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(NASA-TN-82364) ENERGY: AN ANNOTATED  
SELECTED BIBLIOGRAPHY (NASA) 599 P  
HC A99/MF A01

CSSL 10A

N81-25504

Unclas  
G3/44 27804

ENERGY:  
AN ANNOTATED SELECTED BIBLIOGRAPHY  
COMPILED BY SANDRA J. BLOW  
RICHARD W. PEACOCK, AND  
JOSEPH J. SHOLY  
LANGLEY RESEARCH CENTER  
TECHNICAL LIBRARY  
DECEMBER 1979



## PREFACE

This bibliography is an update on three previous energy bibliographies dated August 1974 (N74-27577), February 1975 (N75-27558) and July (N77-28577, N77-28578). These three bibliographies were compiled by Ms Sandra J. Blow. The completion of this bibliography was performed by Dr. Peacock and Mr. Sholy after the untimely death of Ms Blow.

This update contains approximately 7,000 selected references on energy and energy related topics from bibliographic and other sources date June 1977 through subject headings and numerous minor headings. Under each heading the entries have been arranged by the date, with the latest works first. There are some minor changes in subject headings from the previous bibliographies.

The following sources were used:

- NASA RECON - A Computerized, online interactive information system
- NASA Langley Research Center book and Document card files
- Scientific and Technical Aerospace Abstracts
- International Aerospace Abstracts
- Energy Research Abstracts
- Selected Weekly and Monthly Journals

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## GENERAL - BIBLIOGRAPHIES

80N10668# ISSUE 1 PAGE 92 CATEGORY 44 RPT#:  
NTIS/PS-79/0764/5 79/07/00 43 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Aircraft fuel. Citations from the International  
Aerospace Abstracts Data Base TLSP: Progress Report.  
1974 - Jul. 1979

AUTH: A/ZOLLARS, G. F.

CORP: New Mexico Univ., Albuquerque. CSS: (Technology  
Application Center.) AVAIL:NTIS SAP: HC \$28.00/MF  
\$28.00

Sponsored in part by NTIS, Springfield, Va.

MAJS: /\*AIRCRAFT FUELS/\*BIBLIOGRAPHIES/\*ENERGY CONSERVATION  
MINS: / AIR TRANSPORTATION/ AIRCRAFT ENGINES/ COMBUSTION  
EFFICIENCY/ ENGINE DESIGN/ FUEL CONSUMPTION

ABA: GRA

ABS: These 160 citations concern means to conserve fuel in  
airline operations. Articles dealing with aircraft  
design, fuels, engine design, propulsion efficiency,  
and operating procedures which conserve fuel are

included.

79N27547\* ISSUE 18 PAGE 2430 CATEGORY 44 RPT#:  
NASA-SP-7043(21) 79/04/00 503 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Energy: A continuing bibliography with indexes. Issue  
21

CORP: National Aeronautics and Space Administration,  
Washington, D. C. AVAIL:NTIS SAP: HC E07

MAJS: /\*BIBLIOGRAPHIES/\*ENERGY POLICY/\*ENERGY TECHNOLOGY

MINS: / ENERGY CONVERSION/ SOLAR ENERGY/ WINDPOWER  
UTILIZATION

ABA: Author

ABS: This bibliography lists 1873 reports, articles, and  
other documents introduced into the NASA scientific  
and technical information system from January 1, 1979  
through March 31, 1979.

N77-28577\* National Aeronautics and Space Administration,  
Langley Research Center, Langley Station, Va.

AN ANNOTATED BIBLIOGRAPHY, VOLUME 1,  
APPENDIX 2

Sandra J. Blow Jul. 1977 848 p  
(NASA-TM-74765; BIB.74-01-Vol-1-App-2) Avail: NTIS  
HC A99 CSCL 05B

Abstracts of reports concerning energy are presented. The  
topics reported conclude: energy and power, hydrogen and other  
fuels, waste heat utilization, nuclear, solar, and energy storage.  
F.O.S.

N77-28578\* National Aeronautics and Space Administration,  
Langley Research Center, Langley Station, Va.

AN ANNOTATED BIBLIOGRAPHY, VOLUME 2,  
APPENDIX 2

Sandra J. Blow Jul. 1977 874 p  
(NASA-TM-74764; BIB.74-01-Vol-2-App-2) Avail: NTIS  
HC A99 CSCL 05B

For abstract, see N77-28577.

N78-33808# National Technical Information Service, Springfield,  
Va.

STATE-OF-THE-ART REVIEWS AND BIBLIOGRAPHIES ON  
ENERGY. A BIBLIOGRAPHY WITH ABSTRACTS Progress  
Report, 1964 - May 1979

Audrey S. Hundeman Jul. 1979 316 p Supersedes NTIS/PS-  
78/0586 and NTIS/PS-77/0520

(NTIS/PS-79/0639/3; NTIS/PS-78/0586; NTIS/PS-77/0520)  
Avail: NTIS HC \$28.00/MF \$28.00 CSCL 10A

Citations to bibliographies, state-of-the-art reviews, and  
literature surveys on various aspects of fossil fuels, wind, solar  
energy, hydrogen, geothermal energy, nuclear energy, and batteries  
are presented. A few citations pertain to electric power. (This  
updated bibliography contains 310 abstracts, 96 of which are  
new entries to the previous edition.)  
GRA

**NTIS-33006# National Technical Information Service, Springfield, Va.**

**ENERGY SUPPLY AND DEMAND MODELING. A BIBLIOGRAPHY WITH ABSTRACTS Report, 1964 - May 1979**

Audrey S. Hundemann Jul. 1979 151 p Supersedes NTIS/PS-78/0599

NTIS/PS-79/0865; NTIS/PS-78/0599) Avail: NTIS HC \$28.00/MF \$28.00 CSCL 10A

The use of energy models to estimate the supply and demand of electricity, oil, natural gas, coal, and petroleum products on national, regional, and state levels is discussed. The models cover residential, commercial, and industrial supply and demand; the impact of economic conditions on demand; energy use alternatives; and optimal allocation of regionally produced energy resources. Abstracts pertaining to design and development of energy models are included. GRA

78N32585# ISSUE 23 PAGE 3104 CATEGORY 44 RPT#: NTIS/PS-78/0570/B NTIS/PS-77/0505 NTIS/PS-76/0404 78/06/00 229 PAGES UNCLASSIFIED DOCUMENT Supersedes NTIS/PS-77/0505; NTIS/PS-76/0404;

UTTL: Energy conservation: Industry. A bibliography with abstracts TLSP: Final Report, 1964 - May 1978

AUTH: A/HUNDEMANN, A. S.

CORP: National Technical Information Service, Springfield, Va. AVAIL. NTIS SAP: HC \$28.00/MF \$28.00

MAJS: /\*BIBLIOGRAPHIES/\*ENERGY CONSERVATION; /\*BIBLIOGRAPHIES  
MINS: / ENERGY CONSUMPTION/ FUEL CONSUMPTION/ INDUSTRIAL ENERGY/ MANUFACTURING/ THERMODYNAMIC EFFICIENCY

ABA: GRA

ABS: Potential methods of conserving energy, including fuel and materials substitutions, are considered for various industries. Many abstracts deal with reports that also cover processes used, amount of energy consumed, and environmental considerations of energy conserving options. Industries covered include food, paper, chemical, cement, metals, petroleum refining, contract construction, synthetic rubber, plastic, drug manufacturing, and stone, clay, and glass. Energy conservation through the use of waste heat is covered in a related published search entitled Waste Heat Utilization.

78N32586# ISSUE 23 PAGE 3105 CATEGORY 44 RPT#: NTIS/PS-78/0599/7 78/06/00 99 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy supply and demand modeling. A bibliography with abstracts TLSP: Final Report, 1964 - May 1978

AUTH: A/HUNDEMANN, A. S.

CORP: National Technical Information Service, Springfield, Va. AVAIL. NTIS SAP: HC \$28.00/MF \$28.00

MAJS: /\*BIBLIOGRAPHIES/\*DEMAND (ECONOMICS)/\*ENERGY CONSUMPTION/\*MATHEMATICAL MODELS

MINS: / COAL/ ELECTRICITY/ ENERGY TECHNOLOGY/ NATURAL GAS/ PETROLEUM PRODUCTS/ TECHNOLOGICAL FORECASTING

ABA: GRA

ABS: This bibliography contains 94 abstracts. The use of energy models to estimate the supply and demand of electricity, oil, natural gas, coal, and petroleum products on national, regional, and state levels is discussed. The models cover residential, commercial, and industrial supply and demand; the impact of economic conditions on demand; energy use alternatives; and optimal allocation of regionally produced energy resources. Abstracts pertaining to design and development of energy models are included.

77N14592# ISSUE 5 PAGE 639 CATEGORY 44 RPT#: LBL-4458 ERG-76-04 76/01/00 75 PAGES UNCLASSIFIED DOCUMENT

UTTL: Explaining energy: A manual of non-style for the energy outsider who wants in

AUTH: A/SCHIPPER, L. PAA: A/(Calif. Univ., Berkeley)

CORP: Argonne National Lab., Ill. AVAIL. NTIS SAP: HC A04/MF A01

Sponsored by ERDA

MAJS: /\*DEMAND (ECONOMICS)/\*ENERGY TECHNOLOGY/\*GEOTHERMAL RESOURCES/\*SOLAR ENERGY

MINS: / BIBLIOGRAPHIES/ ENERGY CONSERVATION/ FOSSIL FUELS/ NUCLEAR FISSION

ABA: Author (ERA)

ABS: A guide or outline of the most asked about, controversial, and basic characteristics of energy systems was assembled. The parameters of supply, demand, environmental impact, growth, conservation, future energy sources, research and development, and certain socio-political issues form the basis of all discussions of energy. Nuclear fission and fusion, fossil fuels, solar energy, and geothermal energy are the most promising sources that are receiving attention at present. Information is included on obtaining material at little or no cost from Congressional committees, government bureaus, the Government Printing Office, industry and lobby groups, environmental organizations, and research institutions. References in the bibliography citing 834 items emphasize the use of energy choices, through many of the general references form the framework of standard energy forecasts and methodology.

✓ 78V20976 1975 ISS: 45 Z5853.P83H37 016.333  
AUTH: A/Harrah, Barbara K.; B/Harrah, David F.. 8/1949 PAT:  
B/joint-author.

UTTL: Alternate sources of energy. TLSP: a bibliography of  
solar, geothermal, wind, and tidal energy, and  
environmental architecture. with a foreword by Brent  
M. Porter.  
The Scarecrow Press, Inc., Metuchen, N. J. xv, 201 p.  
23 cm.

Includes index.

LC: Power resources--Bibliography. Architecture and  
climate--Bibliography.

NASA: / BIBLIOGRAPHIES/ ENERGY SOURCES/ GEOTHERMAL  
ENERGY CONVERSION/ SOLAR ENERGY/ TIDE POWERED  
GENERATORS/ WINDPOWERED GENERATORS

MAIN-AUTH TRACE-TITL-AUTH\* CATLG BY-FACILITY  
76/11/02 AVAIL: / LANGLEY

✓ 78N14626 ISSUE 5 PAGE 645 CATEGORY 44 RPT#:  
NCWTD-CNDST-BIB-6 74/02/00 64 PAGES UNCLASSIFIED  
DOCUMENT OCAF E090881

UTTL: Unconventional energy sources. A select bibliography

AUTH: A/LAPEYSEN, E. H. PAT: A/comp.

CORP: National Center for Scientific and Technical  
Documentation, Brussels (Belgium). AVAIL.NTIS  
SAP: HC A04

MAJS: /\*BIBLIOGRAPHIES/\*ENERGY POLICY/\*GEOTHERMAL RESOURCES  
/\*SOLAR ENERGY/\*TIDEPower/\*WINDPOWER UTILIZATION

MINS: / ECONOMICS/ ENERGY SOURCES

ABA: ESA

ABS: A total of 680 references to articles covering  
economics, statistics, and prospects; geothermal  
energy; prospects towards new policies; solar energy;  
and tidal energy and wind power are listed. There are  
no subject or author indexes.

✓ 77V16062 1971 ISS: 01 Z5853.P83D4 016.3339 LC-  
70-616330

UTTL: A bibliography of non-technical literature on energy.  
Prepared at the request of Henry M. Jackson,  
chairman...pursuant to S. Res. 45. A national fuels  
and energy policy study, serial no. 92-7.

U.S. Congress, Committee on Interior and Insular  
Affairs.

U. S. Govt. Print. Off., Washington. 99 p.  
S. 45

LC: Power resources--Bibliography. Power  
resources--Laws and legislation-Bibliography.

NASA: / BIBLIOGRAPHIES/ ENERGY SOURCES/ LAW  
(JURISPRUDENCE)

MAIN-CORP TRACE-SERS\*FITL\* CATLG BY-JPL  
76/12/17 AVAIL: / JPL

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GENERAL - BOOKS

**A79-31401** Renewable alternatives; Proceedings of the Fourth Annual Conference, University of Western Ontario, London, Canada, August 20-24, 1978. Volumes 1 & 2. Conference sponsored by the Solar Energy Society of Canada, Ministry of Energy, Mines and Resources, National Research Council of Canada, et al. Winnipeg, Solar Energy Society of Canada, Inc., 1978. Vol. 1, 731 p.; vol. 2, 277 p. In English and French. Price of two volumes, \$29.47. (For individual items see A79-31402 to A79-31458)

Flat plate collectors are discussed, taking into account new approaches regarding the ranking and evaluation of flat plate collectors, the optimization of the flow passage geometry for air heating solar collectors, the performance analysis of a flat plate solar collector using 'forge-fin' tubes, an energy analysis of an aluminum solar collector, the dimensional relations for free convective heat transfer in flat plate collectors, optimization studies on black chrome electroplating variables for solar selective surfaces, and the application of the honeycomb heat trap in flat plate solar collectors. Attention is also given to concentrators, aspects of heat storage, photochemistry and photovoltaics, testing, radiation measurement, the utilization of the ocean temperature difference, monitoring and performance reports, biomass energy, wind energy, economics, energy policy, solar heating, solar domestic hot water, simulation,

**TJ**  
**163.2**  
**.S3** **Hunt, V. Daniel**  
**Energy dictionary / V. Daniel Hunt.**  
**New York : Van Nostrand Reinhold,**  
**©1979.**  
**ix, 518 p. : ill. ; 24 cm. (Van**  
**Nostrand Reinhold environmental**  
**engineering series)**  
**Includes index.**  
**1. Power resources -- Dictionaries.**  
**2. Power (Mechanics) -- Dictionaries.**  
**I. Title.**

**TJ**  
**810**  
**.P53**

**Pierson, Richard E., 1934-**  
**Technician's and experimenter's**  
**guide to using sun, wind, and water**  
**power / Richard E. Pierson. West**  
**Nyack, N.Y. : Parker Pub. Co., ©1978.**  
**270 p. : ill. ; 24 cm. \$9.95**  
**Includes index.**

**1. Solar energy. 2. Wind power. 3.**  
This book is written for experimenters and technicians or anyone interested in building electrical -01-0  
generation units powered by the sun, wind,  
water, exercise and other FREE energy sources.  
Now you can benefit from reduced heating and  
electric bills with the advantage of having a vir-  
tually unlimited supply of fuel. (cover)

Unlike most of the information available on  
the market today, this guidebook gives you clear,  
easy-to-understand explanations of such topics  
as: specific design criteria; materials you need to  
build your own equipment; and inexpensive com-  
ponents that you can build yourself.

What's more, you'll find that all of the design  
problems handled in this guidebook are treated  
from the standpoint of MINIMUM COST so  
that no matter what your budget may be, you  
can join the elite group of solar experimenters.

HD  
9502  
.U52  
N3714  
1979

National Energy Strategies Project.  
Energy in America's future : the choices  
before us : a study / by the staff of the  
RFE National Energy Strategies Project ;  
by Sam H. Schurr, project director ...  
[et al.]. -- Baltimore : Johns Hopkins  
University Press for Resources for the  
Future, c1979.  
xxvi, 555 n. : ill. ; 23 cm.  
Includes index.  
ISBN 0-8019- 2280-7  
1. Energy policy--United States.  
2. Energy consumption--United States.  
(Continued on card 2)

TJ  
163.7  
.I56  
1979

International Conference on Future  
Energy Concepts, London, 1979.  
International conference on future  
energy concepts, 30 January - 1 February  
1979, Savoy Place, London /  
organized by Science, Education and  
Management Division of the Institution  
of Electrical Engineers in association  
with the Institute of Electrical and  
Electronics Engineers. (United Kingdom  
and Republic of Ireland Section)...[et  
al.]. - London ; New York :  
Institution of Electrical Engineers,  
c1979 .  
xvi, 445 p. : ill. - (IEE  
Conference publication ; no. 171)  
Includes bibliographies and index.  
1. Power resources--Congresses. I.  
Institution of Electrical Engineers.  
Science, Education and Management  
Division. II. Title: Future energy  
concepts. III. Series: Institution of  
Electrical Engineers. IEE conference  
publication ; no. 171.  
621.4 79-314963 0-852961-98-7  
79V43541

TJ  
163.3  
.R4  
1979

Reay, David Anthony.  
Industrial energy conservation : a hand-  
book for engineers and managers / David A.  
Reay. -- 2d ed. -- Oxford : New York :  
Pergamon Press, c1979.  
xiv, 371 p. : ill.  
Bibliography: p. 345-354.  
Includes index.  
ISBN 0-08-023273-6  
1. Industry--Energy conservation--Hand-  
books, manuals etc. I. Title.

TD  
195  
.E5

United Nations. Economic Commission for  
Europe.  
Environment and energy : environmental  
aspects of energy production and use, with  
particular reference to new technologies /  
a report of the United Nations Economic  
Commission for Europe. -- Oxford ; New  
York : published for the United Nations by  
Pergamon Press, c1979.  
[iv], 113 p. ; 26 cm.  
Includes bibliographical  
references and index.  
ISBN 0-08- 024468-8  
1. Power resources--Environmental  
aspects--Europe. 2. Technological  
innovations--Europe. I. Title.

QC  
73.8  
.H45

Hemdal, John F.  
The energy center: new alternative for  
effective energy use / by John F. Hemdal.  
-- Ann Arbor, MI. : Ann Arbor Science  
Publishers, c1979.  
xvi, 272 p. : ill.  
ISBN 0-250-40283-1  
1. Energy conservation. 2. Energy  
centers. 3. Power resources. I. Title.

TJ  
163.15  
.W651  
World energy demand : the full report to the Conservation Commission of the World Energy Conference. --- Guildford [Eng.] ; New York : published for the WEC by IPC and Technology Press, c1978.  
x, 109 p. : ill. ; 30 cm. -- (World energy resources, 1985-2020)  
CONTENTS: World energy demand to 2020.  
I. Energy consumption. I. World Energy Conference. Conservation Commission.  
II. Title: World energy demand to 2020.  
III. Series.

333.7

TK  
2896  
.155  
1978  
Intersociety Energy Conversion Engineering Conference, 13th, San Diego, 1978.  
Proceedings of the 13th Intersociety Energy Conversion Engineering Conference, San Diego, California, August 20-25, 1978 / sponsored jointly by the Society of Automotive Engineers ... [et al.]. -- Warrendale, PA : Society of Automotive Engineers, c1978.  
3 v. : ill. ; 28 cm.  
"SAE P-75"  
"IEEE 78-CH 1372-2 Energy."  
I. Direct energy conversion--Congresses.  
2. Energy conservation--Congresses.  
I. Society of Automotive Engineers.

621.3124

TJ  
260  
.P28  
Patterson, G. A.  
Energy analysis with a pocket calculator / by G. A. Patterson. Palos Verdes Estates, Calif. : Basic Science Press, 1978.  
iv, 107 p. : ill. ; 22 cm. \$9.95  
Includes bibliographical references.  
1. Heat -- Transmission -- Measurement -- Data processing. 2. Programmable calculators. I. Title.  
621.4022028 77-88128 0-917410-01-7  
79V32381

TJ  
163.9  
.B34  
Baillie, R. C.  
Energy conversion engineering / Richard C. Baillie. Reading, Mass. : Addison-Wesley, 1978.  
xvii, 537 p. : ill. ; 25 cm.  
(Energy science and technology ; no. 1)  
Includes index.  
1. Power (Mechanics). 2. Power resources. I. Title. II. Series.  
621 78-11969 0-201008-40-8 78V45973

TJ  
163.5  
.B84  
B37  
v.1  
Baron, Stephen L.  
Manual of energy saving in existing buildings and plants. v. 1 : facility operation and maintenance / Stephen L. Baron, editor. -- Englewood Cliffs, N.J. : Prentice-Hall, c1978.  
179 p. : ill. ; 29 cm.  
ISBN 0-13-553578-6  
1. Buildings--Energy conservation. 2. Factories--Energy conservation. I. Title. II. Title: Facility operation and maintenance.

ORIGINAL PAGE IS  
OF POOR QUALITY

TJ  
163.3  
.E3  
1978

Efficient electricity use : a reference book on energy management for engineers, architects, planners, and managers / Craig B. Smith, editor. -- 2d ed. -- New York : Pergamon Press, c1978.

xx, 778 p. : ill. : 29 cm.

"Prepared by Applied Nucleonics Company, inc. (ANCO) as an account of work sponsored by the Electric Power Research Institute, inc. (EPRI)"

Includes bibliographical references and index.

ISBN 0-08-023227-2

1. Energy conservation--Handbooks, manuals, etc. 2. Electric power--Handbooks, manuals, etc. 3. Energy consumption--Handbooks, manuals, etc. I. Smith, Craig B. II. Applied Nucleonics Company. III. Electric Power Research Institute.

333.7

TJ  
163.2  
.W67

World Energy Conference.

World energy resources 1985-2020 : executive summaries of reports on resources, conservation and demand to the Conservation Commission of the World Energy Conference. -- New York : IPC Science and Technology Press, c1978.

xii, 249 p. : ill.

Includes bibliographic references.

ISBN 0-902952-90-6.

1. Power resources. I. Title.

TJ  
163.2  
.L63

Loftness, Robert L.

Energy handbook / Robert L. Loftness. -- New York : Van Nostrand Reinhold Co., c1977.

vii, 741 p. : ill.

Includes bibliographical references and index.

ISBN 0-442-24736-9

1. Power resources--Handbooks, manuals, etc. 2. Power (Mechanics)--Handbooks, manuals, etc. 3. Environmental protection--Handbooks, manuals, etc. I. Title. 333.7

TJ  
163.2  
.A38  
v.1

Advances in energy systems and technology.

v. 1 / [edited by] Peter Auer. -- New York : Academic Press, 1978.

ix, 387 p. : ill. ; 24 cm.

Includes bibliographies and index.

ISBN 0-12-014901-X

1. Energy policy--Addresses, essays, lectures. 2. Power resources--Addresses, essays, lectures. I. Auer, Peter.

TH  
7641  
.L52

Local energy centres : .. [proceedings of the conference organised by the Construction Industry Conference Centre Ltd. ... et al. London, 6-7 July, 1977] / edited by N. J. D. Lucas. London : Applied Science Publishers, 1978.

xiv, 261 p. : ill. ; 23 cm. £15.10

Includes bibliographical references and index.

1. Heating from central stations -- Congresses. 2. Total energy systems (On-site electric power production) -- Congresses. I. Lucas, N. J. D. II. Construction Industry Conference Centre.

621.312132 78-324282 0-853347-82-4  
79V15114

78N29598# ISSUE 20 PAGE 2691 CATEGORY 44 RPT#:  
COO-2865-11 CNT#: EV-76-S-02-2865 77/09/30 17  
PAGES UNCLASSIFIED DOCUMENT

UTTL: ERDA net energy analysis program TLSP: Final Report  
AUTH: A/BULLARD, C. W.

CORP: Illinois Univ., Urbana. CSS: (Center for Advanced  
Computation.) AVAIL.NTIS SAP: HC A02/MF A01

MAJS: /\*ECONOMIC IMPACT/\*ENERGY CONSERVATION/\*ENERGY  
CONVERSION EFFICIENCY/\*ENERGY POLICY

MINS: / COST ANALYSIS/ ENERGY SOURCES/ ENERGY TECHNOLOGY/  
HANDBOOKS/ SYNTHETIC FUELS

ABA: ERA

ABS: Work performed from March 1976 through September 1977  
in support of the net energy analysis program is  
summarized. A handbook was prepared for use by persons  
performing net energy types of goods and services, and  
embodies several methodological advances. Quantitative  
estimates were made for the effects of certain  
deviations from this standard, including  
internalization of R and D expenditures, regulation,  
and capital investment. A method was developed for  
evaluating net energy impacts of energy conservation  
options, and for comparing them to supply development

alternatives.

77N33675# ISSUE 24 PAGE 3244 CATEGORY 44 RPT#:  
PB-269034/5 FEA/B-77/166 77/06/00 64 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Energy interrelationships. A handbook of tables and  
conversions factors for combining and comparing  
international energy data

AUTH: A/GUYOL, N. B.

CORP: National Energy Information Center, Washington, D. C.  
AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /\*DATA CORRELATION/\*ENERGY POLICY/\*ENERGY TECHNOLOGY/\*  
HANDBOOKS/\*INFORMATION DISSEMINATION

MINS: / TABLES (DATA)/ TECHNOLOGY TRANSFER/ THERMODYNAMIC  
EFFICIENCY

ABA: GRA

ABS: Facts about the nature, measurement, comparison, and  
utilization of energy commodities are provided.  
Precise factors for moving from one system of  
measurement to another are described. Particular  
energy commodities and their energy values are  
indicated. A set of tables is given for reducing  
different energy commodities, measured in their  
customary units, to any one of the ten units commonly  
employed in combining or comparing energy data.

77N29624# ISSUE 20 PAGE 2693 CATEGORY 44 RPT#:  
AD-A038802 TETRAT-A-642-77-306 CNT#:  
N00014-76-C-0239 77/04/00 437 PAGES UNCLASSIFIED  
DOCUMENT

Supersedes TETRAT-A-642-76-254

UTTL: Energy fact book, 1977 --- energy sources, technology,  
and conservation

CORP: Tetra Tech, Inc., Arlington, Va. AVAIL.NTIS SAP:  
HC A19/MF A01

MAJS: /\*ENERGY CONSERVATION/\*ENERGY POLICY/\*ENERGY  
TECHNOLOGY/\*FUEL CONSUMPTION/\*FUELS/\*HANDBOOKS/\*  
REGULATIONS

MINS: / GEOTHERMAL ENERGY CONVERSION/ MAGNETOHYDRODYNAMICS/  
NUCLEAR POWER PLANTS/ SOLAR ENERGY CONVERSION/  
THERMOELECTRIC POWER GENERATION

ABA: Author (GRA)

ABS: The Energy Fact Book-1977 summarizes the present U. S.  
Energy situation: Energy R and D Legislation; Federal  
Government Energy R and D; and International Energy R  
and D. It includes a brief description of the various  
processes and developments related to hydrocarbon  
fuels, synthetic fuels, non-hydrocarbon energy sources  
and energy conservation.

TJ  
163.5  
.D96  
H53

Higson, James D.

**Building & remodeling for energy savings**  
/ by James D. Higson. -- Solana Beach,  
Calif. : Craftsman Book Co., c1977.

320 p. ; 28 cm.

Includes index.

ISBN 0-910460-56-6

1. Dwellings--Energy conservation.

I. Title.

TJ  
163.5  
.B84  
K45

Kendrick, Lee

**Energy conservation and management**  
for buildings: / by Lee Kendrick.  
Falls Church, Va. : Kendrick, c1977.

203 p. in various pagings : ill. ;  
28 cm.

1. Buildings -- Energy conservation.

I. Title.

696 77-152508 77V35275

TJ  
163.3  
.S77

**Strategy for energy conservation through tribology /** : sponsored by ASME Research Committee on Lubrication ; prepared by O. Pinkus and D. F. Wilcock, Tribology Department, Mechanical Technology, inc. New York : American Society of Mechanical Engineers, 1977.  
xvi, 174 p. : ill. ; 26 cm.  
Includes bibliographical references.  
1. Energy conservation. 2. Tribology. I. Pinkus, Oscar. II. Wilcock, Donald F., joint author. III. American Society of Mechanical Engineers. Research Committee on Lubrication. IV. Mechanical Technology Incorporated. Tribology Dept. V. Title: Energy conservation through tribology. VI. Title.  
(Continued on card 3)

QC  
866  
.C27

**Campbell, Ian M.**  
**Energy and the atmosphere : a physical-chemical approach /** by Ian M. Campbell. -- London ; New York : Wiley, c1977.  
ix, 398 p. : ill. ; 23 cm.  
Bibliography: p. [383]-384.  
Includes index.  
ISBN-471994-82-0  
1. Atmosphere. 2. Atmospheric chemistry. 3. Fuel. I. Title.

77H11554# ISSUE 2 PAGE 219 CATEGORY 44 RFT#:  
PB-254683/6 FEA/D-76/325 76/03/00 61 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Total energy management: A practical handbook on energy conservation and management  
CORP: National Electrical Manufacturers Association, New York.; Enviro-Management and Research, Inc., Washington, D. C.; National Electrical Contractors Association, Washington, D. C. AVAIL.NTIS SAP: HC  
A04/MF A01

Sponsored in part by FEA and Dept. of Commerce Prepared in cooperation with Natl. Elec. Contractors Assoc., Wash., D. C., and Enviro-Management and Research, Inc., Wash., D. C.

MAUS: /ENERGY CONSERVATION/HANDBOOKS/RESOURCES MANAGEMENT  
MINS: /AIR CONDITIONING/ELECTRICITY/ILLUMINATING/THERMAL INSULATION

ABA: GRA  
ABS: A practical approach for building owners and managers is provided to implement energy conservation procedures and to use energy wisely. It allows businessmen to make knowledgeable judgments on where and how to conserve energy while maintaining optimum business activity. Total energy management (TEM) is an energy conservation approach based on the premise that to effect energy savings in buildings one must make the building's systems as efficient as possible. In this way, they will consume the smallest amount of energy to perform the functions required. By considering all elements of a building's system, one can recognize a great many areas where savings can be achieved. It provides owners and managers the flexibility required to conserve energy and cut costs while meeting the needs of the building's users at the same time.

77N10643# ISSUE 1 PAGE 90 CATEGORY 46 RPT#:  
ORNL-5198 CNT#: W-7405-ENG-26 76, 10, '00 279 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Transportation energy conservation data book  
AUTH: A/LOEBL, A. S.; B/BJORNSTAD, D. J.; C/BURCH, D. F.;  
D/HOWARD, E. B.; E/HULL, J. F.; F/MADEWELL, D. G.;  
G/MALTHOUSE, N. S.; H/OGLE, M. C.

CORP: Oak Ridge National Lab., Tenn. CSS: (Energy Div.)  
AVAIL:NTIS SAP: HC A13/MF A01  
MAJS: /\*ENERGY CONSERVATION/\*ENERGY POLICY/\*INDEXES  
(DOCUMENTATION)/\*TRANSPORTATION ENERGY  
MINS: / EARTH RESOURCES/ ECONOMIC FACTORS/ FUEL CONSUMPTION/  
HANDBOOKS/ TABLES (DATA)  
ABA: Author  
ABS: Statistical data on energy use in the transportation  
sector are presented in the form of tables, graphs,  
and charts. The following topics are covered in six  
chapters: characteristics of transportation modes;  
energy characteristics, including energy consumption  
by source and by sector and energy intensiveness;  
conservation alternatives; government impacts,  
including expenditures, regulations and research,  
development, and demonstration spending; energy  
supply, including domestic petroleum production,  
prices, and projections; and transportation demand,  
including population characteristics and economic  
determinants. A bibliography of data sources is  
provided at the end of each chapter, and a more  
general bibliography is included at the end of the  
book.

TK  
2955  
.H37  
v.1

Hatsopoulos, George N  
Thermionic energy conversion [by] G. N.  
Hatsopoulos and E. P. Gyftopoulos. Cam-  
bridge, Mass., MIT Press [1973]  
xi, 265 p. illus. 24 cm.  
CONTENTS: v. 1. Processes and devices.

1. Thermionic converters. I. Gyfto-  
poulos, E. P., joint author. II. Title.

TU  
163.5  
.H37  
E53

Energy conservation in the built environment  
: proceedings of the 1976 symposium of the  
International Council for Building Re-  
search, Studies and Documentation held at  
the British Building Research Establish-  
ment / editor, Roger G. Courtney. --  
Hornby [Eng.] : Construction Press, 1976.  
603 p. : ill. ; 31 cm.  
English or French; summaries in French.  
Sponsored by CIB W67 Working Commission  
on Energy Conservation in the  
Built Environment.  
Includes bibliographical references  
and index.

ISBN 0-904406-22-8

1. Buildings--Energy conservation--  
Congresses. 2. Dwellings--Energy con-  
servation--Congresses. I. Courtney,  
Roger G. II. International Council for  
Building Research, Studies and Docu-  
mentation. CIP W67 Working Com-  
mission on Energy Conservation in  
the Built Environment. 697

ORIGINAL PAGE IS  
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# Energy Future

REPORT OF  
THE ENERGY PROJECT  
AT THE  
HARVARD BUSINESS SCHOOL

EDITED BY  
ROBERT STOBAUGH AND DANIEL YERGIN

The issue of energy—its price and availability—has dogged our unhealthy economy, even as it has provoked an intense and largely fruitless political controversy. Billions of corporate dollars are at stake, as well as the fundamental security of an industrial society. Here the Energy Project at the Harvard Business School establishes historical perspective, clarifies the terms of the current debate, and advocates a course of action.

As the Project sees it, none of the four conventional sources of domestic energy—oil, coal, natural gas, or nuclear—can supply much more energy than they now do. We are therefore faced with a choice: increased imports of OPEC oil, which can only make a bad situation worse, or a genuinely serious move toward conservation and low-technology solar.

The Energy Project opts for the latter course, which is bound to upset many people. But the beauty of the book is the mode of analysis employed—a managerial mode that assesses priority and potential, cost and risk, incentive, profit, and the marketplace. At the same time, the issue of energy presents far more than a set of technical and economic problems: The resolution of the crisis requires an understanding of the complex interplay of the political and institutional forces involved. The book furnishes that understanding.

*Energy Future* will be both controversial and definitive.

## GENERAL - CONFERENCES

79A46526 ISSUE 20 PAGE 3788 CATEGORY 44  
79/00/00 465 PAGES UNCLASSIFIED DOCUMENT

**UTTL:** Workshop on Economic and Operational Requirements and Status of Large Scale Wind Systems, Monterey, Calif., March 28-30, 1979, Proceedings

**AUTH:** A/CLARK, E. F.; B/DE WINTER, F. PAA: B/(Altas Corp., Santa Cruz, Calif.) PAT: A/(ED.)  
Workshop sponsored by the U.S. Department of Energy and Electric Power Research Institute Santa Cruz, Calif., Altas Corp., 1979, 465 p. (For individual items see A79-46527 to A79-46548)

**MAJS:** /\*CONFERENCES/\*ECONOMIC FACTORS/\*ENERGY TECHNOLOGY/\* WINDPOWER UTILIZATION

**MINS:** / AUTOMATIC CONTROL/ ENVIRONMENT EFFECTS/ INDUSTRIAL MANAGEMENT/ MICROPROCESSORS/ NASA PROGRAMS/ PERFORMANCE PREDICTION/ PERFORMANCE TESTS/ REGIONAL PLANNING/ SYSTEMS ANALYSIS/ SYSTEMS ENGINEERING/ TECHNOLOGY ASSESSMENT/ TOPOGRAPHY/ USER REQUIREMENTS/ UTILITIES/ WIND VELOCITY/ WINDPOWERED GENERATORS

**ABA:** V.T.

**ABS:** The work deals with analytic and experimental studies on the integration of wind generation into electric utility networks. Overviews of major wind program elements are included, covering activities in wind turbine generators (WTG) hardware design and development, wind energy resource assessment and environmental issue assessment. The paper covers the following sessions: (1) wind energy technology overview; (2) wind generation value in electric utility systems; (3) large wind turbine generator operation and status, and (4) network interaction analyses. Consideration is given to economic requirements and value analysis, and operational experience and status.

79A37842 ISSUE 15 PAGE 2788 CATEGORY 44  
79/00/00 460 PAGES UNCLASSIFIED DOCUMENT

**UTTL:** International Conference on Future Energy Concepts, London, England, January 30-February 1, 1979, Proceedings SAP: \$46  
Conference sponsored by the Institution of Electrical Engineers, London, Institution of Electrical Engineers (IEE Conference Publication, No. 171), 1979, 460 p (For individual items see A79-37843 to A79-37918)

**MAJS:** /\*CONFERENCES/\*ENERGY TECHNOLOGY/\*TECHNOLOGICAL FORECASTING

**MINS:** / BIOMASS ENERGY PRODUCTION/ GEOTHERMAL ENERGY CONVERSION/ HYDROGEN-BASED ENERGY/ MAGNETOHYDRODYNAMIC GENERATORS/ SATELLITE SOLAR POWER STATIONS/ SOLAR ENERGY CONVERSION/ TIDE POWERED GENERATORS

**ABA:** B.J.

**ABS:** Papers are presented on solar energy utilization, wave power experiments, geothermal energy, tidal power, MHD power generation, wind energy systems, and hydrogen energy. Particular consideration is given to windpower generation on a large scale, the prospects of a biological-photochemical approach to the utilization of solar energy, tidal and river current energy systems, and satellite solar power stations.

79V42108 1979 ISS: 42 TJ163.2.N36 1979 621.374

**UTTL:** Technology for energy conservation; TLSP: proceedings / affiliated groups: U. S. Department of Energy. - National Conference on Technology for Energy Conservation, Tucson, 1979.  
Information Transfer, Inc., Silver Spring, Md. : 626 p. : ill.  
Held January 23-25, 1979. @Includes bibliographies.  
LC: Energy conservation--Congresses.  
ADDED: United States. Department of Energy.  
NASA: / COMBUSTION/ CONFERENCES/ ECONOMICS/ ENERGY CONSERVATION/ ENERGY STORAGE/ GEOTHERMAL ENERGY CONVERSION/ HEAT PUMPS/ SOLAR ENERGY/ SOLAR HEATING  
MAIN-MEET TRACE-TITL\* CATLG BY-FACILITY  
79/08/20 COPYRIGHT AVAIL: / LANGLEY/ LEWIS

79A40736 ISSUE 17 PAGE 3235 CATEGORY 44  
79/00/00 363 PAGES UNCLASSIFIED DOCUMENT

**UTTL:** Chemistry for energy: Proceedings of the Symposium,  
Winnipeg, Manitoba, Canada, June 5-7, 1978

**AUTH:** A/TOMLINSON, M. PAA: A/(Whiteshell Nuclear Research  
Establishment, Pinawa, Manitoba, Canada) PAT:  
A/(ED.) SAP: \$25

Symposium sponsored by the Chemical Institute of  
Canada, Alberta Energy Co., Department of Energy,  
Mines and Resources of Canada, et al Washington, D.C.,  
American Chemical Society (ACS Symposium Series, No.  
90), 1979, 363 p (For individual items see A79-40737  
to A79-40750)

**MAJS:** /CHEMICAL ENGINEERING/ CONFERENCES/ ENERGY SOURCES/  
ENERGY TECHNOLOGY

**MINS:** / BIOMASS ENERGY PRODUCTION/ CANADA/ CHEMICAL ENERGY/  
COAL GASIFICATION/ COAL UTILIZATION/ ELECTROCHEMISTRY/  
ENERGY CONVERSION EFFICIENCY/ ENERGY POLICY/ ENERGY  
STORAGE/ FOSSIL FUELS/ FUEL CELLS/ HYDROCARBON FUEL  
PRODUCTION/ HYDROGEN PRODUCTION/ ORGANIC WASTES (FUEL  
CONVERSION)/ PHOTOCHEMICAL REACTIONS

**ABA:** S.D.

**ABS:** The chemistry of various sectors of energy production  
from Canadian sources is reviewed, and important R&D  
areas are identified. This 20-chapter book is divided  
into three main sections: fossil fuels, perpetual and  
renewable sources, and electricity production and  
storage. The fossil fuel section covers coal  
conversion, oil sands, sulfurization, peat, and the  
Canadian government's R&D program as well as Canada's  
fossil fuel resources. Under renewable resources, the  
potential of biomass is discussed, with emphasis on  
the most energy-efficient and least costly use of  
biomass, the direct burning of wood. The uses of  
anaerobic bacterial systems for conversion of animal  
manure into methane are examined along with the  
interaction of photosynthetic and sulfate-reducing  
bacteria in a membrane-separated anaerobic culture.  
Some of the chemical problems encountered during  
nuclear generation of electricity are considered.  
Solar energy is related to the thermodynamic and  
kinetic limits on its conversion and storage.

79V43541 1979 ISS: 44 Tj163.7.156 1979 0-852961-93-7  
621.4 LC-79-314963

**UTTL:** International conference on future energy concepts, 30  
January - 1 February 1979, Savoy Place, London /  
organized by Science, Education and Management  
Division of the Institution of Electrical Engineers in  
association with the Institute of Electrical and  
Electronics Engineers. (United Kingdom and Republic of  
Ireland Section)... et al. -  
International Conference on Future Energy Concepts,  
London, 1979.

Institution of Electrical Engineers, London : New York  
: xvi, 445 p. : ill. -

IEEE Conference publication : no. 171 Includes  
bibliographies and index.

LC: Power resources--Congresses.

ADDED: Institution of Electrical Engineers. Science,  
Education and Management Division. Title: Future  
energy concepts. Series: Institution of Electrical  
Engineers. IEEE conference publication : no. 171.

NASA: / CONFERENCES/ ENERGY STORAGE/ GEOTHERMAL ENERGY  
CONVERSION/ HEAT PUMPS/ SOLAR CELLS/ SOLAR ENERGY/  
SOLAR HEATING/ WASTE ENERGY UTILIZATION/ WINDPOWER

#### UTILIZATION

AM-ATL: / Tj163.2.158 1979

MAIN-MEET TRACE- CATLG BY-FACILITY

79/09/17 Publ In UNITED KINGDOM COPYRIGHT AVAIL: /  
AMES-ATL/ LEWIS

79V41240 1979 ISS: 42 Tj153.E53 1979 621

**AUTH:** A/Hill, Richard F.

**UTTL:** Energy technology VI : TLSP: "Achievements in  
perspective" : 1979, Washington, D. C. 1 edited by  
Richard F. Hill. -  
Energy Technology Conference, Washington, D. C., 1979,  
6th.

Government Institutes, Washington : xv, 1152 p. : ill.

LC: Power (Mechanics)--Congresses. Power  
resources--Congresses.

NASA: / CONFERENCES/ ENERGY CONSERVATION/ ENERGY  
POLICY/ ENERGY TECHNOLOGY/ FOSSIL FUELS/ GEOTHERMAL  
RESOURCES/ NUCLEAR ELECTRIC POWER GENERATION/ POWER  
EFFICIENCY

MAIN-MEET TRACE-TITL\*AUTH\* CATLG BY-FACILITY  
79/08/31 AVAIL: / LEWIS

BOA17126 ISSUE 4 CATEGORY 44 79/10/00 321 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Renewable energy prospects; Proceedings of the  
Conference on Non-Fossil Fuel and Non-Nuclear Fuel  
Energy Strategies, Honolulu, Hawaii, January 9-12,  
1979

AUTH: A/BACH, W.; B/MANSHARD, W.; C/MATTHEWS, W. H.;  
D/BROWN, H. PAA: A/(Muenster, Universitaet,  
Muenster, West Germany); B/(United Nations  
University, Tokyo, Japan); D/(East-West Center,  
Honolulu, Hawaii) PAT: A/(ED.)  
Conference sponsored by the United Nations University,  
East-West Center, International Institute for Applied  
Systems Analysis, and University of Hawaii Energy  
(UK), vol. 4, Oct. 1979, 321 p. (For individual items  
see A80-17127 to A80-17140)

MAJS: /\*CLEAN ENERGY/\*CONFERENCES/\*ENERGY POLICY/\*ENERGY  
TECHNOLOGY

MINS: / CHLOROPLASTS/ CLIMATE/ DEVELOPING NATIONS/ ENERGY  
CONSERVATION/ ENERGY POLICY/ GEOTHERMAL RESOURCES/  
OCEAN CURRENTS/ OCEAN THERMAL ENERGY CONVERSION/ RURAL  
AREAS/ SOLAR ARRAYS/ SOLAR COOLING/ SOLAR ENERGY/  
SOLAR HEATING/ TIDES/ WATERWAVE ENERGY CONVERSION/  
WINDPOWER UTILIZATION

ABA: A.L.W.

ABS: Papers are presented on the prospects of renewable  
alternative energy sources, with consideration given  
to the options for short- and long-range energy  
strategies, the potentials and constraints of  
individual renewable energy resources, and energy  
policies and strategies. Specific topics include the  
feasibility of large-scale alternative energy use by  
the year 2000, global perspectives for long- and  
short-range alternative energy strategies and the  
prospects of solar heating and cooling systems,  
satellite power systems, wind energy conversion  
systems, wave, current and tide power, OTEC, hydro  
power, petroleum plantations and geothermal energy  
systems. Attention is also given to the growth in  
energy demand, the implementation of energy  
conservation, the climatic impact of alternative  
energy sources, energy sources for rural development  
and the prospects for renewable energy options in  
developing nations.

ORIGINAL PAGE IS  
OF POOR QUALITY

79A45776 ISSUE 20 PAGE 3776 CATEGORY 44  
79/00/00 733 PAGES UNCLASSIFIED DOCUMENT

UTTL: Ocean thermal energy for the 80's; Ocean Thermal  
Energy Conversion Conference, 6th, Washington, D.C.,  
June 19-22, 1979, Preprints, Volumes 1 & 2

AUTH: A/DUGGER, G. L. PAT: A/(ED.)  
Conference sponsored by the U.S. Department of Energy  
Laurel, Md., Johns Hopkins University, 1979, Vol. 1,  
543 p.; vol. 2, 196 p. (For individual items see  
A79-45777 to A79-45871)

MAJS: /\*CONFERENCES/\*ENERGY TECHNOLOGY/\*OCEAN THERMAL ENERGY  
CONVERSION/\*OFFSHORE ENERGY SOURCES

MINS: / COLD WATER/ COST EFFECTIVENESS/ ELECTRIC POWER  
PLANTS/ HEAT EXCHANGERS/ OCEAN CURRENTS/ OCEAN SURFACE  
/ PILOT PLANTS/ SYSTEMS ENGINEERING

ABA: A.T.

ABS: This volume focuses on the latest OTEC research and  
development work, test results, component design  
information, system integration efforts, and  
application investigations. Specifically, papers are  
presented on the U.S., French, and Japanese OTEC  
developments, waves and salinity gradients as energy  
sources, analysis of OTEC commercialization, heat  
exchanger development, power systems design, design  
and costs of platforms and cold water pipe, biofouling  
and microfouling problems, legal and institutional  
aspects, ammonia as working fluid, studies of oceanic  
environmental parameters, and alternate power systems  
studies.

79V42742 1979 ISS: 44 TJ163.7.E53 1978

UTTL: Energy and aerospace; TLSP: proceedings of an  
Anglo/American conference, held at the Royal  
Aeronautical Society, 4 Hamilton Place, London, 5-7  
December, 1978 / organized by the Royal Aeronautical  
Society and the American Institute of Aeronautics and  
Astronautics. -

s.n., s.l. : 1 v. (various pagings).

LC: Power resources--Congresses.

Aeronautics--Congresses. Astronautics--Congresses.

ADDED: Royal Aeronautical Society, American Institute  
of Aeronautics and Astronautics.

NASA: / AEROSPACE ENGINEERING/ CONFERENCES/ ENERGY  
CONSERVATION/ ENERGY TECHNOLOGY/ SOLAR POWER  
SATELLITES

JSC: / TJ153.E28 MA: / TJ163.E57 1978 MC.1, MC.2 HQ: /  
TL505.J65 1978

MAIN-TITL TRACE- CATLG BY-FACILITY

79/09/17 AVAIL: / JOHNSON/ LANGLEY/ LEWIS/ MARSHALL/  
NASA HQ./ WOLLOPS

**A79-46301** Midwest Energy Conference, Chicago, Ill., November 19-21, 1978. Proceedings. Conference sponsored by the University of Illinois and U.S. Department of Energy. Edited by J. P. Hartnett (Illinois, University, Chicago, Ill.). *Energy* (UK), vol. 4, Apr. 1979. 239 p. (For individual items see A79-46302 to A79-46321)

The conference focused on nuclear energy, energy storage and conservation, alternate energy sources, and coal. Specifically, papers were presented on the characteristics of the high power density tokamak reactor, advanced-fuel pellet approaches to inertial fusion, thermal storage efficiencies, effects of modifying heat transfer properties of indigenous sandstones, design of compressed air energy storage systems, superconductive magnetic energy storage, electro-negative chemical reactors, biomass gasification, fuels and chemicals from biomass, study of a wave energy device, and a steam process for coal gasification. A.T.

✓ **79A16601\*** ISSUE 4 PAGE 654 CATEGORY 44  
78/00/00 687 PAGES UNCLASSIFIED DOCUMENT

**UTTL:** Radiation energy conversion in space; Conference, 3rd. NASA Ames Research Center, Moffett Field, Calif., January 26-28, 1978. Technical Papers

**AUTH:** A/BILLMAN, K. W. PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.) PAT: A/(ED.) SAP: MEMBERS, \$24.; NONMEMBERS, \$45

Conference sponsored by NASA New York, American Institute of Aeronautics and Astronautics, Inc. (Progress in Aeronautics and Astronautics, Volume 61), 1978. 687 p. (For individual items see A79-16602 to A79-16642)

**MAJS:** /\*CONFERENCES/\*ENERGY TECHNOLOGY/\*LASER APPLICATIONS/\*SATELLITE POWER TRANSMISSION (TO EARTH)/\*SATELLITE SOLAR POWER STATIONS/\*SPACECRAFT PROPULSION

**MINS:** / CESIUM ENGINES/ ECONOMIC FACTORS/ ENERGY STORAGE/ EXTRATERRESTRIAL RADIATION/ LASER PUMPING/ MICROWAVE TRANSMISSION/ PHOTONIC PROPULSION/ RADIATION CHEMISTRY / SATELLITE ANTENNAS/ SATELLITE SOLAR ENERGY CONVERSION/ SOLAR ENERGY CONVERSION/ SOLAR GENERATORS

**ABA:** P.T.H.

**ABS:** Concepts for space-based conversion of space radiation energy into useful energy for man's needs are developed and supported by studies of costs, material and size requirements, efficiency, and available technology. Besides the more studied solar power satellite system using microwave transmission, a number of alternative space energy concepts are

considered. Topics covered include orbiting mirrors for terrestrial energy supply, energy conversion at a lunar polar site, ultralightweight structures for space power, radiatively sustained cesium plasmas for solar electric conversion, solar pumped CW CO2 laser, superelastic laser energy conversion, laser-enhanced dynamics in molecular rate processes, and electron beams in space for energy storage.

✓ **79A15879** ISSUE 4 PAGE 644 CATEGORY 44 78/00/00  
1076 PAGES UNCLASSIFIED DOCUMENT

**UTTL:** Energy technology V: Challenges to technology; Proceedings of the Fifth Conference, Washington, D.C., February 27-March 1, 1978

**AUTH:** A/HILL, R. F. PAT: A/(ED.) SAP: \$38  
Conference sponsored by DOE, EPRI, American Gas Association, and National Coal Association Washington, D.C., Government Institutes, Inc., 1978. 1076 p (For individual items see A79-15880 to A79-15925)

**MAJS:** /\*CONFERENCES/\*ENERGY TECHNOLOGY/\*WINDPOWER UTILIZATION

**MINS:** / COMPUTERIZED SIMULATION/ DESULFURIZING/ ECONOMIC ANALYSIS/ ENERGY CONSERVATION/ ENERGY CONVERSION/ ENERGY SOURCES/ INDUSTRIAL ENERGY/ NUCLEAR ENERGY/ SHALE OIL/ SOLAR ENERGY/ UTILITIES/ WASTE ENERGY UTILIZATION

**ABA:** B.J.

**ABS:** Papers are presented on such topics as particulate and sulfur oxide control options for conventional coal combustion, large-scale thermal energy storage for cogeneration and solar systems, an electric utility perspective on solar heating and cooling, the role and status of dispersed electric utility fuel cell power plants, ocean energy, energy from urban waste, and hybrid fossil-geothermal power plants. Also considered

are solar power satellites, SNG production by the Rockgas process, OTEC program status and plans, petroleum plantations, and the fusion-fission energy concept.

✓ **79A34182** ISSUE 13 PAGE 2428 CATEGORY 44  
78/00/00 121 PAGES UNCLASSIFIED DOCUMENT

**UTTL:** Alternative energy sources; Proceedings of the Miami International Conference, Miami Beach, Fla., December 5-7, 1977. Volume 11 - Index

**AUTH:** A/VEZIROGLU, T. N. PAA: A/(Miami, University, Coral Gables, Fla.) PAT: A/(ED.) SAP: PRICE OF ELEVEN VOLUMES, \$495

Conference sponsored by the U.S. Department of Energy and University of Miami Washington, D.C., Hemisphere Publishing Corp., 1978. 121 p.

**MAJS:** /\*CONFERENCES/\*ENERGY TECHNOLOGY/\*INDEXES (DOCUMENTATION)

**MINS:** / CLEAN ENERGY/ COAL UTILIZATION/ ENERGY POLICY/ ENERGY STORAGE/ HYDROGEN-BASED ENERGY/ NUCLEAR REACTORS/ OCEAN THERMAL ENERGY CONVERSION/ SOLAR ENERGY/ SYNTHETIC FUELS/ WINDPOWER UTILIZATION

79N15423# ISSUE 6 PAGE 745 CATEGORY 44 RPTA:  
PB-286246/4 IMMR38-PD21-78 ISBN-0-89779-006-5  
78/08/00 119 PAGES UNCLASSIFIED DOCUMENT

UTTL: Proceedings of Energy Resource 5th Conference  
CORP: Kentucky Univ., Lexington. CSS: (Inst. for Mining  
and Minerals Research.) AVAIL:NTIS SAP: HC A06/MF  
A01  
Conf. held at Lexington, Ky., 10-11 Jan. 1978

MAJS: /\*COAL/\*CONFERENCES/\*CRUDE OIL/\*ENERGY TECHNOLOGY/\*  
NATURAL GAS

MINS: / COAL GASIFICATION/ COAL LIQUEFACTION/ ECONOMIC  
ANALYSIS/ ENERGY POLICY/ FLUIDIZED BED PROCESSORS/  
MINING/ PLANNING/ REGULATIONS

ABA: GRA

ABS: The most recent information available on the rapidly  
changing energy resource picture fuel policies,  
economics, and technical advances is presented. The  
theme of the conference was Gas from Coal for  
Industry: Direct Utilization of Coal Problems and  
Solutions. Topics covered include facilities siting,  
an update of energy resources, state and federal  
regulations, economics, coal utilization, and  
environmental and social considerations.

78V51159 1978 ISS: 51 TJ163.9.154 1978 621.3124 LC-  
78-66386

UTTL: Proceedings of the 13th Intersociety Energy Conversion  
Engineering Conference, San Diego, California, August  
20-25, 1978 / sponsored jointly by the Society of  
Automotive Engineers ... et al. ...  
Society of Automotive Engineers, 13th, Intersociety  
Energy Conversion Engineering Conference, San Diego,  
1978.

Society of Automotive Engineers, Warrendale, Pa. : 3  
v. : ill. : 28 cm.

\*\*SAE p-75'@'''' IEEE 78-CH1372-2 Energy.\*\*

LC: Direct energy conversion--Congresses. Energy  
conservation--Congresses.

NASA: / BIOENGINEERING/ COAL UTILIZATION/ CONFERENCES/  
ELECTRIC PROPULSION/ ELECTROCHEMICAL CELLS/ ENERGY  
CONSERVATION/ ENERGY CONVERSION/ ENERGY TECHNOLOGY/  
GEOTHERMAL RESOURCES/ MAGNETOHYDRODYNAMICS/ NUCLEAR  
REACTORS/ SHALE OIL

AM-ATL: / TK2896.161 1978 JSC: / TJ163.2.161 1978 LA:  
/ TK2896.155 1978 V.1/ TK2896.155 1978 V.2/ TK2896.155  
1978 V.3/ TK2896.155 1978 LE: / TK2896.155 1978 HQ: /  
TKS.175 1978

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78/09/29 COPYRIGHT AVAIL: / AMES-ATL/ JOHNSON/  
LANGLEY/ LEWIS/ NASA HQ.

79A14760 ISSUE 3 PAGE 423 CATEGORY 44 78/00/00  
954 PAGES UNCLASSIFIED DOCUMENT

UTTL: Miami International Conference on Alternative Energy  
Sources, Miami Beach, Fla., December 5-7, 1977.  
Proceedings of Condensed Papers

AUTH: A/VEZIROGLU, T. N. PAA: A/(Miami, University, Coral  
Gables, Fla.) PAT: A/(ED.) SAP: \$50  
Conference sponsored by the U.S. Department of Energy  
and University of Miami Coral Gables, Fla., University  
of Miami, 1978. 954 p (for individual items see  
A79-14761 to A79-14773)

MAJS: /\*CONFERENCES/\*ENERGY TECHNOLOGY

MINS: / BIOMASS ENERGY PRODUCTION/ BREEDER REACTORS/ COAL  
UTILIZATION/ ECONOMIC ANALYSIS/ ENERGY CONSERVATION/  
ENERGY POLICY/ ENERGY TRANSFER/ GEOTHERMAL ENERGY  
CONVERSION/ HEAT STORAGE/ HYDROGEN-BASED ENERGY/

NUCLEAR ENERGY/ NUCLEAR FUSION/ OCEAN THERMAL ENERGY  
CONVERSION/ OFFSHORE ENERGY SOURCES/ PHOTOVOLTAIC  
CONVERSION/ SOLAR COLLECTORS/ SOLAR ENERGY CONVERSION/  
THERMOELECTRIC POWER GENERATION/ WINDPOWER UTILIZATION

AEA: B.J.

ABS: Consideration is given to such areas as solar energy  
economics, solar collectors, ocean thermal energy  
conversion, coal conversion, geothermal energy,  
nuclear breeders, and fusion power. Papers are also  
presented in such fields as power generation and  
transportation, hydrogen energy, solar heating and  
cooling, energy transmission, bioconversion, energy  
conservation, photovoltaics, heat storage and  
transfer, wind energy, and synthetic fuels.

79V19734 1978 ISS: 18 TJ163.15.W651 333.7

UTTL: World energy demand : TLSP: the full report to the  
Conservation Commission of the World Energy  
Conference.

World Energy Conference, Conservation Commission,  
by IPC and Technology Press, Guildford Eng. : New  
York : published for the WEC x. 109 p. : ill. : 30  
cm.

World energy resources, 1985-2020 CONTENTS : World  
energy demand to 2020

LC: Energy consumption.

ADDED: Title: World energy demand to 2020

NASA: / CONFERENCES/ DEMAND (ECONOMICS)/ ENERGY  
CONSUMPTION/ ENERGY SOURCES

JSC: / TJ153.W94

MAIN-TITL TRACE-SERS-CORP\* CATLG BY-FACILITY  
79/03/02 Publ In UNITED KINGDOM COPYRIGHT AVAIL: /  
JOHNSON/ LANGLEY/ LEWIS/ NASA HQ.

78V54373 1978 ISS: 00 TJ163.15.W67 0-902852-90-6;  
0-902852-91-4 333.7 LC-78-317633

**UTTL:** World energy resources, 1985-2020 : TLSP: executive summaries of reports on resources, conservation and demand to the Conservation Commission of the World Energy Conference.  
Published for the WEC by IPC and Technology Press.  
Guilford (Eng.) ; New York : xii, 249 p. : ill. : 30 cm.

pbk "First released at the tenth World Energy Conference in Istanbul, in September 1977." Includes bibliographical references.

LC: Power resources -- Congresses. Energy conservation -- Congresses. Energy consumption -- Congresses.

ADDED: World Energy Conference. Conservation Commission. World Energy Conference, 10th, Istanbul, Turkey, 1977.

NASA: / CONFERENCES/ ENERGY CONSERVATION/ ENERGY SOURCES/ POWER SUPPLIES

LA: / TJ163.2.W67

MAIN-TITL TRACE-MEET\*CORP\* CATLG BY-LC  
/ / Publ In UNITED KINGDOM AVAIL: / LANGLEY

79A16726 ISSUE 4 PAGE 655 CATEGORY 44 78/00/00  
286 PAGES UNCLASSIFIED DOCUMENT

**UTTL:** Energy '78: Annual Conference, Tulsa, Okla., April 16-18, 1978. Record of Conference Papers SAP: MEMBERS, \$18.75; NONMEMBERS, \$25  
Conference sponsored by the Institute of Electrical and Electronics Engineers, New York. Institute of Electrical and Electronics Engineers, Inc., 1978. 286 p. (For individual items see A79-16727 to A79-16744)

**MAJS:** /\*CONFERENCES/\*ENERGY STORAGE/\*ENERGY TECHNOLOGY

**MINS:** / COST EFFECTIVENESS/ ECONOMIC ANALYSIS/ ENERGY CONSERVATION/ ENERGY CONVERSION EFFICIENCY/ ENERGY SOURCES/ SATELLITE SOLAR POWER STATIONS/ SOLAR COLLECTORS/ TOKAMAK DEVICES/ WINDPOWERED GENERATORS B.J.

**ABA:**

**ABS:** Consideration is given to such topics as energy storage for tokamak devices, solar-thermal-electric energy conversion, energy economics, energy management, and the control of energy systems. Papers are also presented on energy saving technologies, energy conservation, renewable energy sources, energy systems planning, electric utility technology, solar power satellites, energy systems modeling, computers and energy, and wind energy systems.

78V54106 1978 ISS: 00 TJ163.15.154 1978 333.7 LC-77-94200 C 78-022605C.2: S 78-022597C.1: 782703

**UTTL:** Energy '78 : TLSP: 1978 IEEE Region Five annual conference, April 16-18, 1978, Tulsa Oklahoma / (co-sponsors IEEE Tulsa Section, et al.)  
Institute of Electrical and Electronics Engineers, Region 5.  
Institute of Electrical and Electronics Engineers, New York : 274 p. : ill. : 28 cm.

On cover: Record of conference papers. Includes bibliographies.

LC: Power resources -- Congresses. Power (Mechanics) -- Congresses.

ADDED: Institute of Electrical and Electronics Engineers, Tulsa Section. Institute of Electrical and Electronics Engineers, Region 5. IEEE Power Engineering Society.

NASA: / CONFERENCES/ ENERGY TECHNOLOGY

GD: / TK5.I13 1978 LA: / TK7800.1256 1978

MAIN-CORP TRACE-TITL\* CATLG BY-LC  
/ / AVAIL: / AMES-ATL/ GODDARD/ LANGLEY/ LEWIS

79V30275 1978 ISS: 29 TJ163.15.M5 1977 V.11  
0-89116-089-2 333.7 LC-78-16383

**AUTH:** A/Veziroglu, T. Nejat.

**UTTL:** Alternative energy sources: TLSP: an international compendium. v. 11. Index / edited by T. Nejat Veziroglu. -

Miami, University of, Coral Gables, Fla. Clean Energy Research Institute. United States. Dept. of Energy. Miami, University of, Coral Gables, Fla. School of Continuing Studies, Miami International Conference on Alternative Energy Sources, Miami Beach, Fla., 1977.

Hemisphere Pub. Corp., Washington, xix, 5065-5170 p.  
"Presented by the Clean Energy Research Institute, University of Miami, Coral Gables, Florida, sponsored by the United States Department of Energy and the School of Continuing Studies, University of Miami." Includes bibliographical references.

LC: Renewable energy sources--Congresses.

NASA: / CONFERENCES/ ENERGY SOURCES

MAIN-MEET TRACE-CORP\*TITL\*AUTH\* CATLG BY-FACILITY  
79/05/21 AVAIL: / LANGLEY

78A53326 ISSUE 24 PAGE 4385 CATEGORY 44  
77/00/00 380 PAGES UNCLASSIFIED DOCUMENT

UTTL: Solid state chemistry of energy conversion and storage; Proceedings of the Symposium, New York, N.Y., April 5-8, 1976

AUTH: A/GOODENOUGH, J. B.; B/WHITTINGHAM, M. S. PAA: A/(Oxford University, Oxford, England); B/(Exxon Research and Engineering Co., Linden, N.J.) PAT: A/(ED.) SAP: \$38.50

Symposium sponsored by the American Chemical Society Washington, D.C., American Chemical Society (Advances in Chemistry Series, No. 163), 1977, 380 p (For individual items see A78-53327 to A78-53344)

MAJS: /\*CONFERENCES/\*ENERGY CONVERSION/\*ENERGY STORAGE/\*ENERGY TECHNOLOGY/\*SOLID STATE

MINS: / CATALYSIS/ CERMETS/ ELECTRIC BATTERIES/ ELECTRODES/ ELECTROLYTES/ FLUORITE/ FUEL CELLS/ HYDROCARBON FUEL PRODUCTION/ HYDROGEN ISOTOPES/ HYDROGEN-BASED ENERGY/ INTERMETALLICS/ ION CURRENTS/ METAL HYDRIDES/ PHOTOVOLTAIC CONVERSION/ SEMICONDUCTING FILMS/ SOLAR CELLS/ SOLAR ENERGY CONVERSION

ABA: G.R.

ABS: Hydrogen as an energy carrier is considered along with the catalytic synthesis of hydrocarbons from carbon monoxide and hydrogen, the photoelectrochemical production of hydrogen, the conversion of visible light to electrical energy, solar energy conversion through photosynthesis, photovoltaic solar cells, the recrystallization of semiconducting polycrystalline ribbons using the Peltier effect, wavelength-selective surfaces, thermodynamic studies of some electrode materials, and new solid electrolytes. Attention is given to the sodium-sulfur battery, the chemistry of hot corrosion, nonstoichiometry and disorder in fluorite-related materials for energy conversion,

properties relating to the application of solid metal hydrides in solar heating and cooling, the storage of hydrogen isotopes in intermetallic compounds, chemical conversion using sheet-silicate intercalates, and material problems with respect to high temperature electrolysis/fuel cells.

78A24751 ISSUE 8 PAGE 1418 CATEGORY 44  
77/00/00 493 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy technology IV; Proceedings of the Fourth Conference, Washington, D.C., March 14-16, 1977

AUTH: A/HILL, R. F. PAT: A/(ED.) SAP: \$25  
Washington, D.C., Government Institutes, Inc., 1977, 493 p (For individual items see A78-24752 to A78-24764)

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*CONFERENCES/\*ENERGY TECHNOLOGY/\*NATURAL GAS/\*NUCLEAR ELECTRIC POWER GENERATION/\*SOLAR ENERGY CONVERSION

MINS: / COAL UTILIZATION/ COST EFFECTIVENESS/ DESULFURIZING/ DOMESTIC ENERGY/ ENERGY SOURCES/ SOLAR COOLING/ SOLAR HEATING/ SOLAR HOUSES/ WASTE ENERGY UTILIZATION

ABA: J.M.B.

ABS: Solar heating and cooling, natural gas and petroleum technology, nuclear power development, and the conversion of biomass and municipal solid waste to energy are discussed. Topics of the papers include the solar energy research sponsored by ERDA, economic and environmental constraints on coal-burning power plants, magnetic fusion power plant schemes, builders' and developers' reactions to the solar energy industry, solar heating and/or cooling for residences, schools and offices, flue gas desulfurization to limit SO2 emissions from coal-burning power plants, and the production of methane from cattle feedlot residues.

78A27776 ISSUE 10 PAGE 1789 CATEGORY 44  
77/09/00 218 PAGES UNCLASSIFIED DOCUMENT

UTTL: World Energy Conference, 10th, Istanbul, Turkey, September 19-23, 1977, Proceedings  
Revue de l'Energie, vol. 28, Aug.-Sept. 1977, 218 p. In French and English. (For individual items see A78-27777 to A78-27790)

MAJS: /\*CONFERENCES/\*ENERGY POLICY/\*ENERGY SOURCES

MINS: / COAL GASIFICATION/ CRUDE OIL/ DOMESTIC ENERGY/ ENERGY TECHNOLOGY/ HEAT PUMPS/ INTERNATIONAL COOPERATION/ NATURAL GAS/ OFFSHORE ENERGY SOURCES/ PHOTOSYNTHESIS/ SHALE OIL

ABA: S.C.S.

ABS: A series of articles concerning perspectives for energy production is presented. Several aspects of developing national and international energy policies are outlined, with reference to Europe, U.S., Japan, USSR, India, and Algeria. Prospects for developing new energy sources from oil shale, heavy oil, petroleum reserves, deep sea oil, coal gasification, heat pumps, and natural photosynthesis are reviewed

ORIGINAL PAGE IS  
OF POOR QUALITY

77A48701 ISSUE 23 PAGE 3979 CATEGORY 44  
77/00/00 1993 PAGES UNCLASSIFIED DOCUMENT

UTTL: Intersociety Energy Conversion Engineering Conference,  
12th, Washington, D.C., August 28-September 2, 1977.  
Proceedings, Volumes 1 & 2 SAP: PRICE OF TWO  
VOLUMES, MEMBERS, \$45.; NONMEMBERS, \$100  
Conference sponsored by ANS, SAE, ACS, ASME, AIAA,  
IEEE, and AIChE. La Grange Park, Ill., American  
Nuclear Society, Inc., 1977. Vol. 1. 1007 p.; vol. 2.  
986 p. (For individual items see A77-48702 to  
A77-48909)

MAJS: / \* CONFERENCES / \* ENERGY CONVERSION / \* ENERGY TECHNOLOGY  
MINS: / BRAYTON CYCLE / COAL UTILIZATION / ELECTRIC PROPULSION  
/ ENERGY CONSERVATION / FLUIDIZED BED PROCESSORS /  
GEOTHERMAL RESOURCES / MAGNETOHYDRODYNAMIC GENERATORS /  
NUCLEAR ENERGY / RANKINE CYCLE / STIRLING CYCLE /  
SYNTHETIC FUELS

ABA: P.T.H.

ABS: The papers in this collection deal with continuing  
advances in the search for and development of new  
sources of energy and more efficient processes that  
consume energy. The topics cover a wide range,  
including advanced auto propulsion, alternative fuels,  
Brayton cycle engines, fluid bed combustion,  
geothermal and solar power systems, Rankine cycle  
engines, thermionics, and wind power.

78V32054 1977 ISS: 26 Tj153.E4783 Pt.3 621.4

UTTL: Energy development III / sponsored by the IEEE Energy  
Development Subcommittee of the IEEE Power Generation  
Committee of the IEEE Power Engineering Society. -  
IEEE Power Engineering Society. IEEE Power Generation  
Committee. Energy Development Subcommittee.  
Institute of Electrical and Electronics Engineers. New  
York ; 178 p. : ill. ; 28 cm. -  
IEEE Power Engineering Society Papers ; 3  
"77CH1215-3-PWR" "6" "Papers presented at the National  
Power Engineering Society meetings." Includes  
bibliographic references.

LC: Power resources--Congresses. Electric  
power--Congresses.

NASA: / COAL UTILIZATION / CONFERENCES / ECONOMIC  
FACTORS / ELECTRIC GENERATORS / ENERGY CONVERSION /  
ENERGY SOURCES / ENERGY STORAGE / ENERGY TECHNOLOGY /  
FUEL CELLS / GAS TURBINES / NUCLEAR FUSION / OILS / SOLAR  
ARRAYS / SOLAR COLLECTORS / SOLAR ENERGY / THERMAL ENERGY  
/ WASTE ENERGY UTILIZATION / WINDPOWERED GENERATORS  
LA: / Tj153.E4783 Pt.3 LE: / Tj153.E4783 Pt.3  
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78/04/11 COPYRIGHT AVAIL: / JOHNSON / LANGLEY / LEWIS

77A42854 ISSUE 20 PAGE 3448 CATEGORY 44  
77/02/00 139 PAGES UNCLASSIFIED DOCUMENT

UTTL: Environmental Pollution Symposium on Practical  
Alternatives to Present Urban Life. 5th, Menlo Park,  
Calif., May 12, 13, 1976. Proceedings  
Symposium sponsored by the Peninsula Professional  
Societies. Water, Air, and Soil Pollution, vol. 7,  
Feb. 1977. 139 p. (For individual items see A77-42855  
to A77-42862)

MAJS: / \* CONFERENCES / \* ENERGY POLICY / \* POLLUTION CONTROL / \*  
RESOURCES MANAGEMENT

MINS: / AIR POLLUTION / AUTOMOBILES / CLEAN ENERGY / ENERGY  
CONSERVATION / FIRE PREVENTION / LANDSLIDES / URBAN  
PLANNING / URBAN RESEARCH / URBAN TRANSPORTATION

ABA: B.J.

ABS: Attention is given to possible solutions to the United  
States energy dilemma, the effects of restricting the  
availability of nuclear energy, the prospects of  
renewable energy sources, and a methodology for the  
implementation of energy saving technologies. Also  
considered are the alternative roles of transportation  
in urban planning, the augmented ingestion of carbon  
monoxide and sulfur oxides by occupants of vehicles  
while idling in drive-up facility lines, and the  
Modular Integrated Utility System as a potential  
influence on community development.

78V33755 1977 ISS: 00 Tj163.15.F87 O-930780-01-9 333.7  
LC-77-87589

AUTH: A/Kiefer, Irene.

UTTL: Future strategies for energy development : TLSP: a  
question of scale : proceedings of a conference at Oak  
Ridge, Tennessee, October 20 and 21, 1976 / sponsored  
by Oak Ridge Associated Universities : (manuscript  
editor, Irene Kiefer).

ORAU, Oak Ridge, Tenn. : 1x, 297 p. : ill. ; 23 cm.  
ORAU : 130 Includes bibliographical references.

LC: Power resources -- Congresses. Energy policy --  
Congresses.

ADDED: Oak Ridge Associated Universities. Oak Ridge  
Associated Universities. ORAU : 130.

NASA: / CONFERENCES / ECONOMIC FACTORS / ENERGY  
CONSERVATION / ENERGY POLICY / TECHNOLOGY ASSESSMENT /  
TRANSPORTATION

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/ / COPYRIGHT AVAIL: / LANGLEY

78A20524 ISSUE 6 PAGE 1012 CATEGORY 44

77/00/00 352 PAGES UNCLASSIFIED DOCUMENT

**UTTL:** Fuels and energy from renewable resources: Proceeding of the Symposium, Chicago, Ill., August 29-September 2, 1977

**AUTH:** A/TILLMAN, D. A.; B/SARKANEN, K. V.; C/ANDERSON, L. L. PAA: A/(Materials Associates, Inc., Washington, D.C.); B/(Washington, University, Seattle, Wash.); C/(Utah, University, Salt Lake City, Utah) PAT: A/(ED.) SAP: \$17.50  
Symposium sponsored by the American Chemical Society New York, Academic Press, Inc., 1977. 352 p

**ABA:** G.R.

**ABS:** Quantitative estimates of energy requirements for the longer term are considered, taking into account the rationale for estimating energy requirements, the approaches used for obtaining energy targets, and the relation of conservation to employment. Attention is given to the present contribution of renewable resources, the anticipated competition for available wood fuels in the U.S., a thermal analysis of forest fuels, the conversion of stagnated timber stands to productive sites and use of noncommercial material for fuel, industrial wood energy conversion, and the pyrolysis-gasification-combustion process. Prospects for cogeneration of steam and power from the forest products industry are discussed along with the feasibility of utilizing crop and forestry residues to produce energy, the use of wood oil from pyrolysis of pine bark-sawdust mixture, the logistics of energy resources and residues, bagasse as a renewable energy source, the use of ginning waste as an energy source, the design of a large-scale manure/methane facility, and energy recovery from municipal wastes.

78V36713 1977 ISS: 33 TJ153.124 1977B 333.8

**UTTL:** Text of "A" papers from the Summer meeting, Mexico City, Mexico, July 17-22, 1977

IEEE Power Engineering Society  
Institute of Electrical and Electronics Engineers, New York : 1 v. in various pagings : ill.

IEEE cat. no. 77CH1194-0-PAR. This publication contains the full text of all the papers published in abstract "A" form in PA & S.

LC: Power resources--United States--Congresses. Energy policy--United States--Congresses.

NASA: / CONFERENCES/ ENERGY POLICY/ ENERGY SOURCES/ UNITED STATES OF AMERICA

LE: / TJ153.124 1977B

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78/05/26 COPYRIGHT AVAIL: / LEWIS

78A20425 ISSUE 6 PAGE 1011 CATEGORY 44

77/00/00 149 PAGES UNCLASSIFIED DOCUMENT

**UTTL:** Conference on National Energy Policy, Washington, D.C., May 17, 1977. Proceedings SAP: \$6.00  
Conference sponsored by the American Association for the Advancement of Science, Carnegie Institution of Washington, and Mitre Corp, Washington, D.C., American Association for the Advancement of Science, 1977. 149 p

**MAJS:** / CONFERENCES/ ENERGY POLICY

**MINS:** / COAL UTILIZATION/ ECONOMIC FACTORS/ ENVIRONMENT PROTECTION/ GASEOUS FUELS/ GOVERNMENT/INDUSTRY RELATIONS/ NUCLEAR POWER PLANTS/ OFFSHORE ENERGY SOURCES/ SHALE OIL

**ABA:** J.M.B.

**ABS:** Technological and economic problems involved in implementing the U.S. National Energy Plan announced by President Carter in April, 1977 are discussed. Topics considered include shale oil development, coal gasification, off-shore oil development, the decontrol of natural gas prices prevailing in interstate commerce, tax credits for improved fuel conservation measures adopted by business, import restrictions on petroleum, a cost-benefit analysis of nuclear power plants, off-gas scrubber systems and emissions control for electrical generating plants, cogeneration of electricity and process steam, and coal conversion regulatory policy.

77V21863 1977 ISS: 00 TJ163.2.W653 1977 0-070718-78-4: 0-070718-79-2 333.7 LC-77-4700 C 78-009172C.2: S 78-008604C.1: 780500: 780583

**AUTH:** A/Wilson, Carroll L.

**UTTL:** Energy : TLSP: global prospects, 1985-2000 / Workshop on Alternative Energy Strategies (WAES), Carroll L. Wilson, project director.

Workshop on Alternative Energy Strategies.

McGraw-Hill, New York : xxv, 291 p. : ill. : 24 cm.

pbk Includes bibliographical references.

LC: Power resources. Energy policy.

NASA: / COAL/ CONFERENCES/ CRUDE OIL/ DEMAND (ECONOMICS)/ ENERGY CONSERVATION/ ENERGY POLICY/ ENERGY SOURCES/ NATURAL GAS/ NUCLEAR ENERGY

MAIN-CORP TRACE-TITL' AUTH' CATLG BY- LC

/ / AVAIL: / GODDARD/ LANGLEY/ LEWIS/ NASA HQ.

77A26076 ISSUE 10 PAGE 1671 CATEGORY 44  
76/00/00 256 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy LA: Tackling the crisis; Proceedings of the  
Second Greater Los Angeles Area Energy Symposium, Los  
Angeles, Calif., May 19, 1976

AUTH: A/ROBINSON, J. W. PAA: A/(McDonnell Douglas  
Aeronautics Co., Huntington Beach, Calif.) PAT:  
A/(ED.) SAP: \$35

Symposium sponsored by the LACES, ANS, AIAA, AICHE,  
AAEE, ISGE, ASCE, IEEE, PMI, WESA, and AIME North  
Hollywood, Calif., Western Periodicals Co. (Los  
Angeles Council of Engineers Scientists Proceedings  
Series, Volume 2), 1976, 256 p (For individual items  
see A77-26077 to A77-26091)

MAJS: /\*CONFERENCES/\*ENERGY SOURCES/\*ENERGY TECHNOLOGY

MINS: / ECONOMIC ANALYSIS/ ENERGY CONSERVATION/ ENERGY  
POLICY/ ENVIRONMENT EFFECTS/ FUEL OILS/ GEOTHERMAL  
ENERGY CONVERSION/ METHANE/ NUCLEAR FUELS/ NUCLEAR  
POWER PLANTS/ SOLAR ENERGY CONVERSION/ SOLID WASTES/  
SOUTHERN CALIFORNIA/ WATERWAVE ENERGY CONVERSION/  
WINDPOWER UTILIZATION/ WINDPOWERED GENERATORS

ABA: B.J.

ABS: Attention is given to alternate fuels (such as  
methane, solid waste, oil shale, etc.), conservation  
and the environment, wind power,  
geothermal/solar/hydraulic/wave energy, and energy  
economics. Particular papers are on electrical energy  
as a sulfur dioxide air pollution control strategy,  
economic considerations in selecting a nuclear vs coal  
plant, windmill optimization, power production from  
high salinity geothermal waters, and harnessing the  
ocean waters, swells and tides.

77N19604# ISSUE 10 PAGE 1338 CATEGORY 44 RPT#:  
CONF-760212-SUMM 76/00/00 60 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Energy storage: User needs and technology  
applications

CORP: Electric Power Research Inst., Palo Alto, Calif.;  
Energy Research and Development Administration,  
Washington, D. C. AVAIL.NTIS SAP: HC A04/MF A01  
Prepared in cooperation with ERDA Presented at the  
Eng. Found. Conf., Pacific Grove, Calif., 8-13 Feb.  
1976

MAJS: /\*CONFERENCES/\*ENERGY STORAGE/\*FOUNDATIONS/\*TECHNOLOGY  
UTILIZATION

MINS: / INFORMATION SYSTEMS/ TECHNOLOGY TRANSFER/ USER  
REQUIREMENTS

ABA: ERA

ABS: Brief summaries of nine papers and topics of seven  
working groups are presented.

78V11106 1976 ISS: 05 TP360.W67 1976 535.84

AUTH: A/Veziroglu, T. Nejat, PAT: A/ed.

UTTL: Conference proceedings: 1st World Hydrogen Energy  
Conference, 1-3 March 1976, Miami Beach, Florida;  
TLSP: presented by International Association for  
Hydrogen Energy, Clean Energy Research Institute,  
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and Development Administration, the School of  
Continuing Studies, University of Miami edited by T.  
Nejat Veziroglu. -  
International Association for Hydrogen Energy, Miami,  
University of Coral Gables, Fla. Clean Energy  
Research Institute, 1st. World Hydrogen Energy  
Conference, Miami, Beach, 1976.  
University of Miami, Coral Gables, Fla. : 3 v. : ill.  
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NASA: / CLEAN ENERGY/ CONFERENCES/ ECONOMICS/ ENERGY  
CONSERVATION/ ENERGY SOURCES/ HYDROGEN PRODUCTION/  
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LA: / TP360.W67 1976 HQ: / TP360.W67 1976

MAIN-MEET TRACE-CORP\*AUTH\* CATLG BY-FACILITY  
77/11/09 AVAIL: / LANGLEY/ NASA HQ.

77N79820 CATEGORY 85 76/00/00 142 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Proceedings: Year 2000 Alternative Transportation  
Futures Conference

CORP: Chicago Area Transportation Study, III. AVAIL.NTIS  
Conf. proc. held at Chicago, 10 Mar. 1976; sponsored  
jointly by the Chicago Area Transportation Study and  
Northwestern Univ.

MAJS: /\*CONFERENCES/\*PROCEEDINGS/\*TRANSPORTATION

MINS: / ECONOMIC FACTORS/ REGIONAL PLANNING/ TRANSPORTATION  
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78V16139 1976 ISS: 08 TK7801.I59 1976 LC-72-92043

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212 p. illus.

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LC: Power resources--Congresses. Energy  
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MAIN-CORP TRACE-TITL\* CATLG BY-KENNEDY

77/02/22 REFERENCE AVAIL: / KENNEDY

✓ 77N80200# CATEGORY 44 RPT#: PB-263800/5  
IMMR24-M3-76 76/12/00 32 PAGES UNCLASSIFIED  
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UTTL: Selected papers from a conference entitled focusing on  
energy. January 22-23, 1976.

CORP: Kentucky Univ., Lexington. CSS: (Inst. for Mining  
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Sponsored in part by Dept. of Energy. Frankfurt.  
Kentucky

MAJS: /\*CONFERENCES/\*ENERGY CONSERVATION/\*SOLAR SIMULATION  
MINS: / COOLING/ ENERGY CONSUMPTION/ HEATING/ INSULATION

✓ 77N79405# CATEGORY 44 RPT#: CONF-7509143  
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UTTL: Proceedings of the Regional Professional Energy  
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CORP: Vermont Energy Resources. Waitsfield. AVAIL.NTIS  
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MAJS: /\*CONFERENCES/\*ENERGY POLICY  
MINS: / ENERGY SOURCES/ VERMONT

77V31961 1975 ISS: 41 TJ163.2.588 1975

AUTH: A/Duggan, Jerome L.; B/Cloutier, Roger J.

UTTL: Energy sources for the future. conducted by Special  
Training Division of Oak Ridge Associated  
Universities. sponsored by the U.S. Energy Research  
and Development Administration Division of Biomedical  
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Research. Oak Ridge Associated Universities. Special  
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the Future. Oak Ridge, Tenn., 1975.  
Springfield, Va.. Distributed by NTIS. 303 p.

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77N10646# ISSUE 1 PAGE 91 CATEGORY 44 RPT#:  
CONF-751228-P2 75/00/00 227 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Creating energy choices for the future. Public  
meeting on A National Plan for Energy Research,  
Development, and Demonstration

CORP: Energy Research and Development Administration.  
Washington, D. C. AVAIL.NTIS SAP: HC A11/MF A01  
Aa

MAJS: /\*CONFERENCES/\*ENERGY POLICY/\*RESEARCH MANAGEMENT

MINS: / ELECTRIC POWER PLANTS/ ENERGY TECHNOLOGY/  
ENVIRONMENT EFFECTS/ NATURAL GAS/ OIL RECOVERY/  
PROJECT PLANNING

ABA: J.M.S.

ABS: Papers are presented dealing with a national plan for  
energy research and development. State, University,  
and private sectors are represented.

✓ 79V17560 1962 ISS: 71 JX1977.A2 LC-63-2456

UTTL: New sources of energy and energy development: TLSP:  
report on the United Nations Conference on New Sources  
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energy. Rome, 21 to 31 August, 1961.

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United Nations. New York, v. 65 p. 28 cm.

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Social Affairs.@"List of conference papers" :  
p.55-60.

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Energy. Rome, 1961. Power (Mechanics)--Congresses.  
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ADDED: Series: United Nations. Document E/3577/rev.1  
etc.

NASA: / CONFERENCES/ ENERGY SOURCES/ RESOURCES  
MANAGEMENT

JPL: / JX1977.U58 1961

MAIN-CORP TRACE-CORP\*TITL\* CATLG BY-LC

79/01/05 AVAIL: / JPL

## II. RESOURCES, SUPPLY/DEMAND, AND FORECASTING

## RESOURCES, SUPPLY/DEMAND, AND FORECASTING

ENERGY RESOURCES AVAILABLE TO THE UNITED STATES, 1985 to 2000, by Earl T. Hayes. Science, vol. 203, no. 4377, January 1979, p. 233-239.

*Summary.* Energy and the gross national product have grown hand in hand at 3 to 3½ percent a year for almost 40 years. Our energy growth is slowing down and will essentially level off in the 1990's. Our production of oil and gas passed a peak in the early 1970's, and there is no resource base to justify predictions of increased yields. Coal is the only fossil fuel capable of increased production. There are serious doubts that our uranium resources can support a large light-water reactor program. Finding rates for petroleum, natural gas, and uranium are less than half of what they were 20 years ago.

Energy: How Dwindling Supplies Will Change our Lives  
by W.J. Davis

The Futurist, Vol. 13, No. 4, August 1979, p. 258-261, 263-267

Will the big city decline inexorably in the years ahead?  
Will the post-industrial society turn out to be an  
*agricultural* society? Here are some provocative answers  
from a biologist who teaches a course on the past,  
present, and future of industrial civilization.

RENEWABLE ENERGY FOR THE WORLD'S POOR. J. Ashworth.  
Technology Review, vol 82, no 2, November 1979, p.  
42-49.

The back lots of communities  
all over the Third World  
are littered with the rusted remains  
of what development experts  
considered "best" for the people.

Energy resources 1979

Measurement of energy resources.

Transaction of the ASME. v. 101, no. 1, March 1979,  
p. 17-30.

COMMITTEE E-38 ON RESOURCE RECOVERY. D. L. Mihelich.

ASTM Standardization News., vol 7, no 11, November  
1979, p. 8-10.

ORIGINAL PAGE IS  
OF POOR QUALITY

**A79-44276 // Future energy alternatives.** J. Grey (Long Island University, Brookville; American Institute of Aeronautics and Astronautics, Inc., New York, N.Y.). *AIAA Student Journal*, vol. 17, Summer 1979, p. 28-31.

Future energy sources such as photovoltaic arrays, solar thermal electric systems, biomass energy, gasohol, wind energy, water power and geothermal energy are discussed. It is noted that the energy problems do not lie in federal R&D, but in the implementation of nationwide and worldwide systems and it is suggested that massive implementation of building and appliance efficiency standards, industrial and commercial cogeneration of electrical power and heat, and capital-intensive options such as district heating via power plant waste, be developed to reduce our expanding energy requirements.  
C.F.W.

**A79-44958 Renewable energy sources (Regenerative Energiequellen).** M. Meliss (Kernforschungsanlage Jülich GmbH, Jülich, West Germany). *Brennstoff-Wärme-Kraft*, vol. 31, Apr. 1979, p. 147-154. 73 refs. In German.

A survey of renewable energy sources is presented with consideration given to the significance of such sources for West Germany. Discussion includes the use of low temperature collectors and heat pumps for household use, since over 80% of the energy used in this area is for heating and hot water production. Heat pumps powered by Volkswagen engines are also covered with data presented showing the number of such units in use and operating costs. Further attention is given to high temperature collectors and solar cells for general power supply, with solar farms and solar towers mentioned in particular. Other topics discussed include wind power and geothermal energy. Finally, research in other nations is examined, noting that the emphasis is also on solar energy.  
M.E.P.

**REVIEW PAPER CANADIAN RENEWABLE ENERGY PROSPECTS.**  
H. Swain, R. Overend and T. A. Ledwell.

*Solar Energy*, vol 23, no 6, 1979, p. 459-470.

**NEEDED: STANDARDS FOR RESOURCE RECOVERY**  
Harvey Alter

*Standardization News*, vol. 7, no. 11, Nov. 1979,  
pp. 11-13.

**EARTH RESOURCES CONCEPTS PROPOSED, Aviation Week & Space Technology**, vol. 110, no. 13, March 1979, p.46-53

Principal objective of the Goddard/GE post-Landsat D advanced concept evaluation (PLACE) study is the identification of key technology requirements of earth resources satellites toward the end of the century.

**NSO-10610/ Booz-Allen and Hamilton, Inc., Bethesda, Md.**  
**EPRI NEW ENERGY RESOURCES DEPARTMENT STRATEGY PAPER Final Report, Jan. 1979**  
Michael Lotker 1979 114 p  
(EPRI-ER-979) Avail NTIS HC A06/MF A01

The rationale for national and utility industry involvement in new energy resources (NER) technology is presented. The procedures currently being used to formulate programs in each of the NER technologies are described.  
DOE

**OIL AND GAS RESOURCES - WELCOME TO UNCERTAINTY.**  
John J Schantz, Jr.  
Resources (Special Issue)  
No. 58 March 1978.

The undercurrent of concern during the 1960s over declining exploratory activity in the United States elicited little real attention outside of the oil and gas industry itself and a small circle of petroleum specialists. It was easy for others to treat these worries as merely the customary background noises that accompany an industry's efforts to encourage favorable treatment by Congress on taxation, incentives, or protection from foreign competition. However, the major disturbance caused by the Organization of Petroleum Exporting Countries (OPEC) oil embargo in 1973 brought an immediate end to this lack of public attention.

In 1975, a report by the Committee on Resources and the Environment (COMRATE) of the National Academy of Sciences, based on a review of contemporary estimates, stated that, of the original stock of crude oil and natural gas liquids (249 billion barrels), only 113 remained to be discovered. For natural gas 530 trillion cubic feet (of an original 1,227 trillion) remained. This marked the end of general optimism both in industry and government about the future U.S. oil and gas resource position. For the public and Congress, whose ears are normally more receptive to good news, it was a shocking revelation to learn that instead of over 400 billion barrels of liquid hydrocarbons there might be much less. To have this unwelcome news appear in the midst of the oil and gas industries' post-embargo clamoring for high prices resulted in both public confusion and distrust.

## RESOURCE AND ENERGY SUBSTITUTION

Thomas Veach Long, II

Energy

Vol. 3, no. 1, February 1978,

p. 63-82.

**Abstract**—Natural resource conservation through economic substitution mechanisms is an important response to constraints on the supplies of energy goods and materials that permits continued economic growth. "Conservation" is distinguished from "preservation" and connotes the rational adaptations of producers and consumers to a change in the social costs and benefits associated with the use of a unit of resources or to better information regarding these benefits and costs. Here, the possibilities of energy-material, energy-labor and energy-capital substitutions are explored using quantitative examples, and the concept, new to economics, of an energy-time tradeoff is introduced. The necessity of evaluating a product's total life-cycle consumption of energy and materials is stressed, encompassing the production technique, the consumer technology and the eventual discard and recycling options as well. Finally, we note that major substitutions require long times—twenty-five to thirty years—for invention, innovation, information diffusion, commercialization and market penetration. Governmental initiatives can play a positive role in reducing such lag

A78-44451 # Energy resources - Revisited 1977. W. B. Haidler (Southwestern Michigan College, Dowagiac, Mich.). *Air University Review*, vol. 29, May-June 1978, p. 39-50. 23 refs.

The energy crisis is presented as being real and immediate. Attention is given to the problem of dwindling reserves of oil and natural gas (especially in the United States), coupled with energy consumption at or above pre-crisis levels (before 1973). It is emphasized that America must rely increasingly on imported oil from politically unstable areas, i.e., the Middle East, and that for the short term, conservation is essential to hold down imports. Alternative sources of energy, e.g., wind, solar, tar sands, and nuclear fusion, are expected to make substantial contributions to the total energy supply beginning only in the period around the turn of the century. Until then, coal and its derivatives (in solid, liquid, and gaseous form) can make up the shortfall if steps are taken now to develop the required technology. D.M.W.

CN-142,869

1978

WORLD ENERGY OUTLOOK. (Exxon Background Series).

Apr. 1978. 47p.

Exxon Corp.,  
(New York)

Energy - Resources  
Energy consumption

NASA CP-2042 Energy - Resources

1978

EMERGING ENERGY ALTERNATIVES FOR THE SOUTHEASTERN STATES. Elias K. Stafsnakos, ed. (Symposium sponsored by DOE, LaRC and NCA&TSU. Held NCA&TSU, Mar. 31, 1978) June 1978. 152p.

Department of Energy,  
Washington, D.C.

NASA,

Langley Research Center

North Carolina Agricultural and Technical

State Univ., Greensboro, N.C.

AN OVERVIEW OF THE ENERGY SITUATION . P:7. 1978

Donald R. Pitts

A79-33256 # New energy sources - An option for the energy crisis (Novas fontes de energia - Uma opção para crise energética). M. A. Vasconcelos Nunes (ELETROBRAS, Rio de Janeiro, Brazil). In: Brazilian Conference on Energy, 1st, Rio de Janeiro, Brazil, December 12-14, 1978, Proceedings. Volume C. (A79-33212 13-44) Rio de Janeiro, Universidade Federal do Rio de Janeiro, 1979, p. 846-858. In Portuguese.

The author discusses several aspects of the earth's energy budget. It is pointed out that at each instant the sources of solar energy, geothermal energy, and gravitational energy are pouring out 174,000, 32, and 10 TW, respectively. The direct solar radiation available for energy conversion at the earth's surface ranges from zero to 1390 W/sq m. The diffusion and discontinuity of solar irradiation are problems in harnessing solar energy. Thermosolar and photovoltaic conversion are currently the most developed forms of solar conversion. The solar power satellite concept is being studied, and solar energy can be used in the production of hydrogen. Wind energy and wave energy are indirect solar energy sources. A program for Brazilian efforts in new energy source exploration is outlined. P.T.H.

ENERGY RESOURCES: REVISITED 1977.

W.B. Haidler.

*Air University Rev.*, May-June 1978, p.39-50.

**STUDY FORECASTS NO BIG SWITCH TO COAL.**

Wilma Price

Chemical Engineering, Vol. 85, No. 17, July  
31, 1978, p. 48.

There will be only modest growth in coal production,  
as the availability of gas and oil, plus a multitude  
of problems inherent to the use of coal, weigh against  
a massive switch to this fuel.

A78-53438 World energy resources 1985-2020: World  
energy demand. I. J. Bloodworth, E. Bossanyi, D. S. Bowers, E. A. C.  
Crouch, R. J. Eden, C. W. Hope, W. S. Humphrey, J. V. Mitchell, D.  
J. Pullin, and J. A. Stanislaw. (Cambridge University, Cambridge,  
England). Guildford, Surrey, England, IPC Science and Technology  
Press, 1978. 115 p. \$31.20.

It is concluded that world energy demand in the year 2020 will  
be between three and four times present consumption if average  
economic growth is between 3.0 and 4.1 percent per year and if the  
efficiency of energy use is improved. Various scenarios of world  
energy demand are examined with reference to regional energy  
balances. The future roles of several energy sources such as oil and  
nuclear energy are considered, and assumptions, methodology, and  
uncertainties are discussed. M.L.

QD Chemistry of the environment / P. A. Bailey  
31,2 ... [et al.]. -- New York : Academic Press,  
.C4313 1978.

x, 575 p. : ill. ; 24 cm.

Includes bibliographies and index.

ISBN 0-12-073050-2

1. Environmental chemistry. I. Bailey,  
Ronald Albert, 1933-

P. 6-39

**RENEWABLE ENERGY SOURCES AND STORAGE**

R.J. Leicester, V. G. Newman and J. K. Wright  
Nature, vol., 272, no. 5653, April 6, 1978  
p.519-521

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Naill, Roger F

Managing the energy transition : a system  
dynamics search for alternatives to oil and  
gas / Roger F. Naill. -- Cambridge, Mass. :  
Ballinger Pub. Co., c1977.

xxii, 248 p. : ill. ; 24 cm.

Originally presented as the author's  
thesis, Dartmouth.

Bibliography: p. 235-243.

Includes index.

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Perspectives on the energy crisis : technical,  
regulatory, environmental, economic, pro-  
spective, v. 1 / advisory editors, Howard  
Gordon, Roy Meador. -- Ann Arbor, Mich. .  
ENERGY RESOURCES OF THE UNITED STATES:

A Bibliography . . . . . 495

(By Anatole Scaun, Science Reference Librarian, City  
College, The City University of New York, prepared for the  
Department of Geography, Columbia University, New York)

This bibliography, one of the most comprehensive available, is divided  
into nine categories, and is the outgrowth of studies on world energy  
at Columbia University. In his preface, the Chairman of Geography  
at Columbia writes, "We hope that this bibliography will provide  
some useful guidelines to the fundamental quest for solutions to the  
worldwide energy problems."

Physics in Technology, v.8, no.4, July 1977.

138 Energy resources available to man  
Sir SAMUEL CURRAN

An appraisal of the potential options  
and dilemmas in harnessing the world's  
energy resources

TJ  
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.P48  
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RR

**Perspectives on the energy crisis : technical, regulatory, environmental, economic, prospective.** v. 1 / advisory editors, Howard Gordon, Roy Meador. -- Ann Arbor, Mich. : Ann Arbor Science Publishers, c1977. xvi, 517 p. : ill. ; 29 cm.

**SELECTED INFORMATION RESOURCES**

**ON ENERGY . . . . . 483**

(From the National Referral Center, Science and Technology Division, Library of Congress)

Whom to contact and where (names, addresses, telephones) for specific information on all phases and aspects of energy. Both government and private sources are included.

**ENERGY RESOURCES IN THE WORLD, U.S. AND CANADA: Coal, Oil, Natural Gas, Uranium, Fusion Energy, Hydrogen Energy; Energy Consumption and Projections for Future Requirements; Energy Problems; Specific Recommendations . . . . . 257**

(By R.W. Sullivan, et al., *A Brief Overview of the Energy Requirements of the Department of Defense*)

The thesis is presented that there is no overall shortage of energy through the end of the century, though significant trends in distribution, implementation, and types of energy must occur to make this prediction true. short-range (1970-1985) and long-range (1990 and beyond) prospects are examined for individual energy resources.

**ENERGY AND AEROSPACE**  
Robert C. Seamans, Jr.

*Aeronautical Journal*, april 1977, vol. 81,  
no. 796, p. 147-169

Section 4 on remote sensing of energy resources.

TJ  
163.2  
.W653  
1977

**Workshop on Alternative Energy Strategies.**

**Energy : global prospects, 1985-2000 / Workshop on Alternative Energy Strategies (WAES), Carroll L. Wilson, project director. New York : McGraw-Hill, 1977.**

This report is an extensive analysis of the world's energy prospects to the year 2000. An ad hoc international project sponsored by the Massachusetts Institute of Technology, the Workshop on Alternative Energy Strategies (WAES) involved approximately seventy-five individuals from fifteen countries. For more than two years they studied energy supply and demand for the rest of this century.

Here are some of their major conclusions:

1. The supply of oil will cease to meet existing demand before the year 2000, most probably between 1985 and 1995.
2. Demand for energy will continue to grow even taking into account vigorous government policies for the conservation of energy. This growth must increasingly be satisfied by energy resources other than oil.
3. The continued growth of energy demand requires that energy resources be developed with the utmost vigor.
4. The critical interdependence of nations in the energy field requires an unprecedented degree of international collaboration in the future. In addition, it requires the will to mobilize finance, labor, research, and ingenuity with a common purpose never before attained in time of peace; and it requires it now.

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163.2  
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Perspectives on the energy crisis : technical, regulatory, environmental, economic, prospective. / advisory editors, Howard Gordon, Roy Meador. — Ann Arbor, Mich. : Ann Arbor Science Publishers, c1977.  
2 v. : ill. ; 29 cm.  
Includes bibliographies and index.

**A PERSPECTIVE ON THE ENERGY FUTURE OF THE NORTHEAST UNITED STATES . . . . . 351**

(By Joel Brainard, Harry Davitian, Richard Goettle IV, and Philip F. Palmado. Sections from the June 1976 publication of the Policy Analysis Division, National Center for Analysis of Energy Systems, Brookhaven National Laboratory)

This is a comprehensive energy profile for an area with ramifications nationally. The energy consumption patterns of the Northeast affect costs and supplies throughout the U.S. and even worldwide. The relationship between historical trends and mankind's current energy position is explained. Energy supply realities are analyzed. The necessity of increased conservation is documented. After the year 2000, what? This question is raised in connection with energy. Finding the answer looms as our paramount human concern.

**THE ELECTRIC ENERGY PICTURE OF THE PACIFIC NORTHWEST . . . . . 391**

(Report from the Bonneville Power Administration, U.S. Department of the Interior, May 1976)

The Pacific Northwest of the U.S. is noted as one of the world's outstanding hydroelectric development areas. This report considers electric usage in the Pacific Northwest in the context of worldwide energy demands and use. A pattern of growth in both demand and output is seen for the future. Achieving necessary output to meet the demand has introduced the need for thermal generation of energy to supplement hydroelectric sources, now near capacity.

**WHEN WE'LL START RUNNING OUT OF OIL**

Peter Nulty  
Fortune

Vol. XCVI, no. 4, October 1977,  
246-250.

Don't be fooled by the current glut of oil. The experts say supplies will fall short of our needs in fifteen to thirty years.

TU  
163.2  
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Perspectives on the energy crisis : technical, regulatory, environmental, economic, prospective. / advisory editors, Howard Gordon, Roy Meador. — Ann Arbor, Mich. : Ann Arbor Science Publishers, c1977.  
2 v. : ill. ; 29 cm.

**ENERGY AND RESOURCES: THERE IS NO CORNUCOPIA . . . . . 3**

(By C. B. Reed, Exploration Consultant, Former Consultant on Radioactive Waste Management to NAS-NRC)

This original essay seeks to pinpoint current energy realities. Written especially for this volume, here is a frank analysis of mankind's position and prospects regarding critical energy and material resources. Statistical evidence is given why conservation seems imperative. The author discusses specific needs and difficult, but essential programs. Man's fortitude and courage will be challenged, he believes, but identifies steps and concerted efforts that would prolong some beneficial aspects of the present era.

**ENERGY RESOURCES COORDINATOR . . . . . 375**

(Report by Hawaii Department of Planning and Economic Development)

Hawaiian energy research and development concentrates on three alternate energies for which the islands are especially well-equipped to make progress: geothermal, wind, bioconversion. Solar radiation is already contributing, and descriptions are given of solar projects in Hawaii. Ocean Thermal Energy Conversion (OTEC) is a fifth alternate with promising technology being developed.

**BIBLIOGRAPHY OF ENERGY RESOURCES . . . . . 455**

(By Anatole Scaun, Assistant Science and Technology Librarian, Virginia Polytechnic Institute and State University)

Energy concerns are global and the citations gathered here reflect this. This bibliography contains writings on all aspects of energy and energy resources including both conventional and nonconventional, renewable and nonrenewable. Much of the material included reflects social, economic, environmental, legislative, political and technical concerns. It represents a cross-section of selected materials that may be found in a research library and is suitable for a wide range of readers.

ORIGINAL PAGE  
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TJ 163.2  
.P4P Perspectives on the energy crisis : technical, regulatory, environmental, economic, prospective. / advisory editors, Howard Gordon, Roy Meador. — Ann Arbor, Mich. : Ann Arbor Science Publishers, c1977.

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MINERALS AND ENERGY FROM THE PUBLIC LANDS—  
AN ASSESSMENT OF CURRENT CONDITIONS . . . . . 11

(Papers from the Rocky Mountain Energy-Minerals Conference, October 15-16, 1975, Billings, Montana)

"America's Energy Dilemma: A Failure to Act" by Donald B. Craven. In a probing statement, the author regrets delays in establishing a coherent U.S. energy policy, and he stresses the necessity of compromise and cooperation in areas of conflict between energy and environmental concerns.

"Good and Bad Gambles in the Search for Energy Independence" by Arlen R. Tussing. Consulting Economist to Senate Interior Committee. The author summarizes prevailing energy assumptions, challenging their validity. Emphasis is placed on the need to expedite new energy development, such as electricity from coal, to improve our chance of winning long-range energy gambles. Energy industries are advised to avoid public backlash.

THE MINERAL SHORTAGE AND WHAT CAN BE DONE  
ABOUT IT . . . . . 447

(By Elbert F. Osborn, Distinguished Professor, Carnegie Institution, Washington, D. C., the Thirteenth Hugh Exton McKinstry Memorial Lecture, Harvard University, April 19, 1977)

A former director of the Bureau of Mines, the author is qualified to report authoritatively on the growing mineral shortages that inevitably follow rapid growth in mineral and energy use. The status and prospect for gas, oil, coal are given, with emphasis on the need for expanded coal use and research. Author's conclusion: "It certainly is time that we stopped listening to dreamers." The necessity for long-range planning is noted.

REGIONAL ENERGY AVAILABILITY FROM CONVERSION  
OF SOLID WASTES.

Donald Garofalo and Kenneth R. Martin

Photogrammetric Engineering and Remote Sensing,  
vol. 43, no. 6, June 1977, pp. 727-738

Remote sensing can be used to delineate urban and rural solid organic wastes, which can be used to generate electricity.

TJ 163.25  
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Dix, Samuel M.

Energy : a critical decision for the United States economy / by Samuel M. Dix. —

Grand Rapids : Energy Education Publishers, 1977,

xii, 256 p. : ill. ; 29 cm.

Previous ed. (c1977) published under title: Energy, last report to President Ford. Bibliography: p. 234-253.

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Karcher symposium / co-editors and co-chairman of the symposium, S. D. Christian and J. J. Zuckerman. — Oxford : New York ; Pergamon Press, 1979.

xiv, 144 p. : ill.

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1. Power resources—Congresses. 2. Chemical engineering—Congresses. I. Christian, Sherril Duane, 1931- II. Zuckerman, Jerold J., 1936- 621.4

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— Alphen aan den Rijn, The Netherlands : Sijthoff & Noordhoff, c1977.  
2 v. (xxx, 1615 p.) : ill.  
Held at the Convention Centre, Hong Kong, March 21-25, 1977.

Outlook of energy source and supply  
by Y. Ando 2,745

**N77-29815/** Brookhaven National Lab., Upton, N. Y.  
**ENERGETICS OF THE UNITED STATES OF AMERICA: AN ATLAS**

F. R. Drysdale and C. E. Calef Sep. 1976 444 p  
(Contract EY-76-C-02-0016)

(BNL-50501) Avail: NTIS HC A19/MF A01

A description of the United States' energy system is presented in the form of thirty-one maps and eight major tables. The country has been chosen as the basic unit for reporting estimations of many energy, demographic, and economic variables. The variables include production of all fuels (including hydroelectricity), use of fuels and electricity broken down by sector and end use, existing and planned electricity generation capacity, refinery capacities, and emissions of air pollutants from fuel use. Calculations and assumptions used to make county-level energy estimates are described in detail. ERA

**N78-23578/** Brookhaven National Lab., Upton, N. Y.  
**ENERGETICS OF THE UNITED STATES OF AMERICA: AN ATLAS**

F. R. Drysdale and C. E. Calef Oct. 1977 447 p refs  
(Contract EY-76-C-02-0016)

(BNL-50501-R) Avail: NTIS HC A19/MF A01

A description of the United States' energy system is presented in the form of maps and major tables. The country was chosen as the basic unit for reporting estimations of many energy, demographic and economic variables. The variables include production of all fuels (including hydroelectricity), uses of fuels and electricity broken down by sector and end-use, existing and planned electricity generation capacity, refinery capacities, and emissions of air pollutants from fuel use. ERA

AICHE Symposium Series, v.73, no.170. 1977

**INTERMATERIALS COMPETITION IN THE MANAGEMENT OF SPENDING RESOURCES.** W.R. Schaal, ed.

American Inst. of Chemical  
Engineers

**IMPACT OF ENERGY SHORTAGE ON INTERMATERIALS COMPETITION**  
**SUMMARY OF PANEL DISCUSSION** P.88

**A79-34170** Energy resources for tomorrow - The possible role of non-nuclear and non-fossil energy resources. M. Meliss (Kernforschungsanlage Jülich GmbH, Jülich, West Germany). In: Alternative energy sources; Proceedings of the Miami International Conference, Miami Beach, Fla., December 5-7, 1977. Volume 10. (A79-34158 13-83) Washington, D.C., Hemisphere Publishing Corp., 1978, p. 4759-4777. Research supported by the Ministry of Research and Development.

The paper presents the results of a study of the theoretical, technical, and economic potential of self-renewing energy sources, such as solar energy, wind, the energy of the sea, geothermal energy, and hydro power, on the world scale and more particularly in the context of the F.R.G. Main conclusions are as follows: (1) geothermal - application will be restricted to areas with exceptionally high temperature gradients; (2) solar cell power production - may provide high grade energy but will not be economical in near future; (3) wind energy - will probably remain unimportant for energy supply system as a whole, and large scale wind energy conversion will depend on the solution of the energy storage problem; (4) heat pump systems - can lead to significant fuel savings, with disadvantage of need for additional high-grade energy; and (5) solar thermal collectors - application in the F.R.G. will be restricted to low temperature heat supply. P.T.H.

**A79-34167** Survey and appraisal of primary future energy sources. D. H. Root (U.S. Geological Survey, Reston, Va.). In: Alternative energy sources; Proceedings of the Miami International Conference, Miami Beach, Fla., December 5-7, 1977. Volume 10. (A79-34158 13-83) Washington, D.C., Hemisphere Publishing Corp., 1978, p. 4667-4695. 38 refs.

Some rough estimates of the potential size of the following domestic alternative energy sources are calculated: Group 1 - wind power, water power, low-temperature solar energy, solar power through photosynthesis, tidal power, geothermal energy, and nuclear fission without breeders; Group 2 - nuclear fission with breeders, solar electric generation, and coal. The major conclusion is that the energy sources of Group 1 could supply only about 50% of the 1973 U.S. consumption rate, so that without oil and gas, half the U.S. energy would have to come from Group 2 sources. P.T.H.

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270  
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Remote-sensing applications for mineral exploration / edited by William L. Smith. — Stroudsburg, Pa. : Dowden, Hutchinson & Ross ; [New York] : exclusive distributor Halsted Press, c1977.

xiv, 391 p., [8] leaves of plates : ill. ; 24 cm.

Includes bibliographical references and index.

ISBN 0-87933-230-1

1. Prospecting--Remote sensing. I. Smith, William L.

Energy, v.2, 1977, p.293-316.

## PRODUCTION-HISTORY PROJECTIONS OF FUELS AND SOME CRUCIAL METALS IN THE UNITED STATES

RICHARD A. ARNDT and L. DAVID ROPER

Department of Physics, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061, U.S.A.

(Received 23 November 1976)

**Abstract**—The production-history projection method of the authors is refined to determine the earliest date at which reasonably well determined depletion parameters can be ascertained. The method is applied to the United States production data for silver, crude oil, natural gas, coal, iron ore and uranium ore.

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Holum, John R.

Topics and terms in environmental problems / John R. Holum. — New York : Wiley, c1977.  
x, 729 p. : ill. ; 24 cm.

"A Wiley-Interscience publication."

Includes bibliographical references and index.

ENERGY RESOURCES. p.235-247.

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I. Title.

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Workshop on Alternative Energy Strategies.

Energy : global prospects, 1985-2000 / Workshop on Alternative Energy Strategies (WAES), Carroll L. Wilson, project director. New York : McGraw-Hill, 1977.

xxv, 291 p. : ill. ; 24 cm. pbk

Includes bibliographical references.

1. Power resources. 2. Energy policy. I. Wilson, Carroll L. II.

N77-29806/ Committee on Science and Technology (U. S. House).

**POLAR ENERGY RESOURCES POTENTIAL**

Washington: GPO 1976 192 p refs Rept. for Subcomm. on Energy Res., Development and Demonstration and the Subcomm. on Energy Res., Development and Demonstration Fossil Fuels of the Comm. on Sci and Technol., 94th Congr., 2d Sess., Sep. 1976 Prepared by Library of Congr., Congressional Res. Service

(GPO:76-187) Avail: Subcomm. on Energy Res., Development and Demonstration

Of the vast known resources contained in the Arctic, only the oil and gas deposits are undergoing, and are expected to continue to undergo, large scale exploitation. This activity will provide incentives for continued development and refinement of polar oil and gas exploration, production, and transportation technology. Other polar energy resources such as coal, hydro-power, uranium, and geothermal energy while often present in enormous quantity will be utilized only locally and on a small scale. Ultimate utilization of polar energy resources will be determined by the economic and energy supply conditions in temperate areas and by the degree of success of the technological advancement needed to develop resources in such remote and inhospitable regions.

Author

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Workshop on Alternative Energy Strategies.

Energy supply-demand integrations to the year 2000 : global and national studies : third technical report of the Workshop on Alternative Energy Strategies (WAES) / Paul S. Pasile, editor ; Carroll L. Wilson, WAES project director. — Cambridge, Mass. : MIT Press, c1977.

xiv, 706 p. : ill. ; 29 cm.

Includes bibliographical references.

TJ McMullan, John T.  
 153 Energy resources and supply / J. T.  
 .M183 McMullan, R. Morgan, and R. B. Murray.  
 London ; New York : Wiley, c1976.  
 xii, 508 p. : ill. ; 24 cm.  
 "A Wiley-Interscience publication."  
 1. Power resources. 2. Power  
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 333.7 75-6973 75V36473

HD Hayes, Denis, 1944-  
 9502 Days of hope : the transition to a post-  
 .A2 petroleum world / Denis Hayes. -- 1st ed. --  
 H37 New York : Norton, c1977.  
 1977 240 p. ; 21 cm.  
 "A Worldwatch Institute book."

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### III. POLICY, LEGISLATION, AND REGULATION

POLICY, LEGISLATION, AND REGULATION

**Public Utilities Fortnightly,**  
v. 104, no. 7.

**Sept. 27,**  
**1979**

**NATIONAL ENERGY POLICY REVIEW. Special Issue.**

**Nuclear Waste: A Problem That Must  
Be Solved** ..... *Hon. John H. Glenn, Jr.* 23

Background and description of proposed legislation, the Nuclear Waste  
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**The Situation at West Valley** ..... *Bernard L. Cohen* 26

Alternatives for ultimate disposition of an abandoned nuclear fuel  
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**The Role of Coal: Neglected but  
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An appraisal of Interstate Commerce Commission procedures for set-  
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utilities which make or expect to make heavy use of that fuel.

**Can We Afford Not to Develop the  
High Tower Windmill Now? ...** *Howard E. Wahrenbruck* 42

An exposition of neglected findings concerning the potential of high  
tower wind turbines for a significant contribution to the nation's electric  
power generating capacity.

**EFFICIENCY OF ENERGY DELIVERY SYSTEMS: II.  
ESTIMATING ENERGY COSTS OF CAPITAL EQUIPMENT**  
Charles Hall, Elizabeth Kaufman, Sharon Walker,  
and Doreen Yen

**Environmental Management, vol. 3, no. 6, November  
1979, p. 505-510.**

ABSTRACT / Procedures are developed and summarized that al-  
low the calculation of the energy required to manufacture and in-  
stall capital equipment, such as the material needed for a coal-  
fired power plant. Three methods are available, each with certain  
strengths and weaknesses. The first uses both literature value  
and national manufacturing statistics, the second uses a pre-  
viously developed technique that disaggregates energy use ac-  
cording to how much each industry buys from all other industries,  
and the third technique is based on the average national relation  
between energy use and dollar flow. The most important differ-  
ences between estimates of energy use by the different tech-  
niques relates to the inclusion or exclusion of labor and indirect  
expenditures rather than to differences in the data bases of the  
three techniques.

**NOO-10610/** Massachusetts Inst. of Tech., Cambridge  
**INDEPENDENT ASSESSMENT OF ENERGY POLICY  
MODELS Final Report**  
E. Kuh and D. O. Wood May 1979 273 p refs Sponsored  
by EPRI

(EPRI Proj. 1015-1)

(EPRI-EA-1071) Avail: NTIS HC A12/MF A01

Energy policy models are reviewed and analyzed. Two energy  
system models, the Baughman-Joskow regionalized electricity  
model and the Wharton annual energy model are assessed and  
the organizational and procedural issues in the model assessment  
process are identified.

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OF POOR QUALITY

**RENEWABLE ENERGY PROSPECTS. (Special issue).**  
**(Proceedings of a Conference on Non-Fossil Fuel**  
**and Non-Nuclear Fuel Energy Strategies.**  
**Held in Honolulu, Hawaii, Jan.9-12,1979.**  
**Sponsored by the United Nations University at**  
**Tokyo, Japan).Wilfrid Bach, et al, eds.**

**Conference on Non-Fossil Fuel and Jan.9-12,**  
**Non-nuclear Fuel Energy Strategies 1979**

**Broad Energy Perspectives**

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<b>TJ 163.2 .A6 v.4</b>	<b>Annual review of energy. v. 4 / Jack M. Hollander, editor, Melvin K. Simmons, David O. Wood, associate editors. -- Palo Alto, Calif. : Annual Reviews, 1979.</b>	
	<b>UNITED STATES ENERGY ALTERNATIVES TO 2010 AND BEYOND: THE CONAES STUDY, Harvey Brooks and Jack M. Hollander</b>	<b>1</b>
	<b>PERSPECTIVES ON NORTH SEA OIL, Paul Leo Eckbo</b>	<b>71</b>
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	<b>CANADIAN ENERGY POLICY, John F. Helliwell</b>	<b>175</b>
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	<b>REVIEW OF SCENARIOS OF FUTURE U.S. ENERGY USE, James Just and Lester Lave</b>	<b>501</b>

**EFFICIENCY OF ENERGY DELIVERY SYSTEMS: III.  
ASSESSING POTENTIAL ENERGY SAVINGS OF A COMPREHENSIVE  
INSULATION PROGRAM**

Joanna Sloane, Charles Hall, and Linda Fisher

Environmental Management, vol. 3, no. 6, Nov. 1979,  
p. 511-515.

This paper develops a computer model for examining the quantity of energy that may be saved in a region if such a program is undertaken. The program requires data on: number of houses, type of houses and present degree of insulation. The results indicate that in the region under consideration it is possible to make available more energy, far cheaper, through insulation than by the alternative of constructing a large power plant.

ABO-11827 United States energy alternatives to 2010 and beyond - The CONAES study. H. Brooks (Harvard University, Cambridge, Mass.) and J. M. Hollander (California, University, Berkeley, Calif.). In: Annual review of energy. Volume 4. (ABO-11826 02-44) Palo Alto, Calif., Annual Reviews, Inc., 1979, p. 1-70. 56 refs.

The CONAES (Committee on Nuclear and Alternative Energy Systems) study examined contextual relationships among the many factors likely to be involved in determining United States energy policy, and, in particular, emphasized the importance of energy demand considerations in planning future U.S. energy supplies. It is concluded that there is a great deal of scope for reducing energy growth without appreciably sacrificing GNP growth or changing nonenergy consumption patterns. Although there is some uncertainty in this conclusion, it is likely that E/GNP one half of today's and conceivably one third of today's could be reached before significant impact on GNP growth is felt. It is recommended that reduction of energy demand growth be accorded the highest priority in United States energy policy. B.J.

**GOVERNMENT CAN HELP MORE BY DOING LESS.**  
Tom Alexander.

Fortune, vol 100, no 6, September 24, 1979.  
p. 84- 86, 88, 90

A federally financed crash program could leave us with a lot of uneconomical plants.

**THE POLITICS OF ENERGY PLANNING.**

Building Systems Design, vol 76, no 3, April/May  
1979, p. 21-27.

Our nation today is at a critical watershed in our history, a time when energy policy decisions of enduring significance are being reached. The measure of our success will be whether the next generation is proud of or regrets the decisions we reach today. These long-range decisions carry serious implications about our energy future, and how that future relates to our economy, our livelihoods, and our sense of democracy. Most seriously, perhaps, is that these energy directions may be irreversible and could take the decision-making process away from individuals and communities most affected by it.

MSO-12688 Oak Ridge National Lab., Tenn.  
**REGIONAL ECONOMIC/DEMOGRAPHIC PROJECTIONS  
FOR ENERGY POLICY ANALYSIS**  
D. J. Bjornstad Jan. 1979 37 p refs  
(Contract W-7406-eng-26)  
(ORNL/TM-8668) Avail: NTIS HC A03/MF A01

The importance of adequate population and employment projections for regional policy analysis related to energy, and whether energy policy may significantly modify existing trends is studied. It is concluded that energy is less likely to create new subnational socio-economic tendencies than to enhance or retard existing trends, but that to analyze these circumstances a growth-policy format is desirable. It is emphasized that a lack of past experience with many new energy technologies will make impact analysis difficult. For this reason, attempts should be made to anticipate possible impacts well in advance of technology deployment. DOE

**A SELF-REGULATING ENERGY POLICY.**

Astronautics and Aeronautics, vol 17, no 7, 8, July-  
August 1979, p. 40-45.

A heavy tax on all uses of oil and gas offset by other tax reductions would spur alternative energy technologies and improve our living standard.

**ENERGY POLICY, THE DOLLAR AND THE US POLITICAL SYSTEM**  
R. J. Friedland

Energy Policy, vol. 7, no. 4, Dec. 1979, pp. 295-306.

What has prevented the USA from formulating an effective long-term energy policy? In this article R.J. Friedland provides an explanation in terms of the interaction of two decisive factors: the dollar's position as the main reserve currency within the international

monetary system; and certain distinctive features of the US political system which bias it towards responding to difficult issues on a short-term basis.

**A79-47071** The race for unlimited energy. G. N. Patterson (Toronto, University, Downsview, Ontario, Canada). Research sponsored by the University of Toronto. Downsview, Ontario, Canada, University of Toronto, 1979. 158 p. 15 refs. \$6.50.

The conversion of national economies from those based on fossil fuels to those based on renewable or unlimited sources of energy is examined, with emphasis given to the position of Canada. The predicted demand for energy, which defines the future requirements to be met, is outlined, and the technical feasibility, environmental protection requirements, economic viability, domestic Canadian resources and necessary research and development activities are assessed for fossil fuels, nuclear fission, nuclear fusion, geothermal energy, solar energy, biomass energy, hydropower, wind energy and tidal power. Consideration is given to electrical power transmission systems and the depletion dates for fossil fuels and the lead times necessary to bring new energy sources on line are discussed, along with specific recommendations. The roles and interrelationships of government, industry and universities in Canada's pluralistic energy system are described and improved coordination is recommended.

A.L.W.

**CRITICAL OBSERVATIONS ON THE U.S. NATIONAL ENERGY PLAN (NEP).**

S. S. Penner.  
Energy, vol 4, no 1, February 1979, p. 33-45.

**Abstract**—Important assumptions implicit in the design of the U.S. NEP are examined. There are pervasive reasons for the conclusion that more effective use should be made of the potential of the free-market system. Near-term constraints on energy-supply options do not appear to be justified in view of environmental and economic uncertainties.

**Energy Policy, v.7, no.2,**  
p.170-171.

**June**  
**1979**

**NUCLEAR PROBLEMS - UNCLEAR SOLUTIONS.** (Repts. on Colloquium on Nuclear Power - Implications for Society organized by the Groupe de Bellerive. Held Geneva, Switzerland, Feb.15-17,1979).

**Groupe de Bellerive**  
**Colloquium on Nuclear Power**  
**- Implications for Society**

**Feb.15-17,**  
**1979**

**A79-42458** Energy on the horizon. M. Wayne. *EPRI Journal*, vol. 4, May 1979, p. 6-12.

The energy outlook for the remainder of the 20th century and into the 21st century, is surveyed, noting that conservation has affected domestic energy sources (coal) more than foreign sources (oil). Reasons for conservation, such as higher prices and government policy are cited together with reduced energy demand in home and industrial uses and also reduced auto use and electric cars. With an energy growth rate of less than 3.3% but over 2%, it is predicted that coal use will triple over its 1976 level by 2000, oil use will double and natural gas consumption will also expand. Attention is given to such factors as oil production, the coal outlook, nuclear power, hydroelectric and new energy sources such as wind and solar power. It is concluded that while energy needs can be met for 2000, it will not be possible to meet them only with domestic sources. M.E.P.

**Energy Policy, v.7, no.2,**  
p.169-170.

**June**  
**1979**

**FROM BLISSFUL IGNORANCE TO INTELLIGENT FOREBODING.** (Rept. on Conf. on Future Energy Concepts organized by IEE in association with other UK engineering institutions. Held London, UK, Jan.30-Feb.1,1979).

**Institution of Electrical**  
**Engineers (Gt. Brit.)**  
**Conference on Future Energy**

**Jan.30-Feb.1,**  
**1979**

**US ENERGY POLICY-THE CONTINUING FAILURE**  
Walter Goldstein

Energy Policy, vol. 7, no. 4, Dec. 1979, pp. 275-294.

The author analyzes the failure of the USA to deal effectively with three related problems: OPEC's increasing political influence; continuing reliance on Middle East crude; and a mounting deficit on the USA's external account. The discussion centres on the serious problems facing President Carter's July 1979 energy plan. The various components of the plan are examined in terms of US domestic politics and in terms of the international oil supply-demand position. An explanation is offered as to why Mr Carter has failed and will continue to fail to reduce the USA's dependence on oil. It is concluded that in the present political climate Congress is unable to support long-term solutions to the oil supply problems which the author envisages for the late 1980s.

**ND0-13634/** Los Alamos Scientific Lab., N. Mex.  
**ENERGY POLICY AND DECISION ANALYSIS: NEW CONCEPTS AND MECHANISMS**

E. L. Kaufman and R. W. Vogel Jul. 1979 52 p refs  
(Contract W-7405-eng-36)  
(LA-7905-MS) Avail: NTIS HC A04/MF A01

Relevant portions of the energy-management problem and a technique wherein objective energy policy analysis can be performed in a short time frame are described. A precept for decision criteria is proposed and a set of fundamental concepts are described that allow quantitative assessment of policy and decision consequences for the total energy system. A decision conferencing is described wherein the technical assessment is combined with the political acumen of experienced decision makers to allow the best public-interest choice to be made. A rationale is also presented for the organizational placement of the analysis function, outside of government or industry. This placement provides a much needed level of credibility, higher than that which presently exists, and reduces bias and equitably balance the needs of the public, government, and industry. DOE

**ND0-10678/** General Accounting Office, Washington, D. C.  
Energy and Minerals Div.  
**ENERGY SAVING STRATEGIES FOR FEDERAL PROCUREMENT**

19 Jun. 1979 14 p  
(PB-296969/9; EMD-79-68) Avail: NTIS HC A02/MF A01  
CSCL 10A

Federal energy conservation measures are evaluated, and what Federal agencies have done to develop and implement procurement techniques which result in reduced energy consumption is reviewed. GRA

**EFFICIENCY OF ENERGY DELIVERY SYSTEMS: I. AN ECONOMIC AND ENERGY ANALYSIS**  
Charles Hall, Mitchell Lavine, Joanna Sloane

Environmental Management, vol. 3, no. 6, Nov 1979  
493-504.

Abstract / Energy-return-on-investment (ERI) analysis is a variation of more traditional cost-benefit analyses, a variation that is particularly important in times of diminishing fuel resources. We present a simple set of procedures for ERI analysis and apply those procedures to central New York State, where there is a proposal for a new 870 MW<sub>e</sub> coal-fired generating station. We compared the energy and dollar costs of building that facility with the costs of an alternative comprehensive regional program of insulation. The analysis showed that regional insulation was more efficient in conserving energy than the plant was in providing it by at least a factor of 4 in economic terms and by a factor of more than 15 when viewed as energy returned on energy invested.

**AS0-11400** Soft and hard energy paths - The roads not taken. M. Stiefel, *Technology Review*, vol. 82, Oct. 1979, p. 56-66, 27 refs.

The paper considers political, technical, and philosophical aspects of the energy problem. The "hard" energy path which relies on the continued expansion of centralized technologies to increase energy supply, will use oil, coal, and nuclear fission. The "soft" path technologies use renewable energy flows, such as from the sun or wind, and require solar collectors, hydroelectric plants and wind for electric power. Cost estimates of energy technologies including nuclear power, coal and solar are discussed, and energy demand forecasts for U.S. are summarized. Comparison of hard and soft options indicates that the hard-path will collapse due to massive energy waste, but a single energy path is not likely. A.T.

**N78-31821/** Oak Ridge Associated Universities, Tenn. Inst. for Energy Analysis.

**ENERGY POLICY AND MATHEMATICS**

A. M. Weinburg Mar. 1979 22 p refs  
(Contract EY-75-C-05-0033)  
(ORAU/IEA-79-5(0)) Avail: NTIS HC A02/MF A01

Mathematics as it applies to the energy policy and energy policy analysis is discussed. The author suggests that the undecidability of energy estimates of the future may to some degree be finessed by the development of technological options whose feasibility can be established through the help of deterministic mathematics. DOE

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- Intersociety Energy Conversion Engineering Conference, 14th, Boston, 1979.**  
**Proceedings of the 14th Intersociety Energy Conversion Engineering Conference, Boston, Massachusetts, August 5-10, 1979.**  
 -- Washington, D. C. : American Chemical Society, c1979.  
 799380  
**Energy Research and Development at the Canada Centre for Mineral and Energy Technology (CANMET), G. Taylor ..... 1788**
- 799382  
**Novel Approaches to Industrial Energy Conservation in Georgia, J.D. Muzzy and J.T. Sommerfield ..... 1793**
- 799383  
**Reference Energy Systems as Applied to Regional Energy Policy, A.L. Hermelee ..... 1799**
- 799384  
**Feasibility of Energy Self-Sufficiency through Decentralized Use of Renewable Resources in Iran, M. Sanai ..... 1804**

**N80-10829/** Mitre Corp., McLean, Va. Metrek Div.  
**ENVIRONMENTAL DATA FOR ENERGY TECHNOLOGY POLICY ANALYSIS. VOLUME 1: SUMMARY**  
 Joke Verhoeff, Robert Kline, William L. Parker, Thomas F. Wolfinger, David Adler (CONSAD Research Corp.), Gabriel Sucher (CONSAD Research Corp.), Marc Narkus-Kramer (International Research and Technology, Inc.), Nicklaus E. Leggett (International Research and Technology, Inc.), and Tyrone Williams (International Research and Technology, Inc.) Jan. 1979 106 p refs  
 (Contract EE-77-C-01-6119)  
 (HCP/EV6119-1) Avail: NTIS HC A06/MF A01

Qualitative and quantitative information on the environmental aspects of different energy technologies is provided. Data are given on nuclear energy, coal, synthetic fuels, oil shale, solar energy, geothermal energy, and hydroelectricity. Each category of technology is broken down into individual technology phases or base units for which environmental effects could reasonably be specified. Each base unit is described in terms of a typical unit or plant size and configuration. DOE

**DEBATE OVER FUEL-USE RULES.** Larry J. Ricci

Chemical Engineering, vol 86, no 16, July 30, 1979, p. 34-36.

President Carter's energy legislation, passed last year, was supported by industry. But rules on fuel use, which are part of the energy package, are causing dissension between industry and the Department of Energy.

**N80-10820/** Department of Energy, Washington, D. C.  
**ENERGY SUPPLY AND DEMAND IN THE MIDTERM: 1986, 1990, AND 1995 Analysis Report**  
 Apr. 1979 223 p

(DOE/EIA-0102/52) Avail: NTIS HC A10/MF A01  
 To account for the uncertainty inherent in projecting future energy production, consumption, prices, and associated variables, five basic projection series (A-E) are presented. These series constitute variations in assumptions influencing energy supply and demand curves. High demand is assumed for Series A and B, and low demand is assumed for D and E. High supply is assumed for Series A and D, and low supply is assumed for Series B and E. Series C assumes medium supply and demand. Two additional scenarios, C High and C Low, evaluate the sensitivity of the Series C forecasts to variations in the projected world of oil price. A computer model, called the 'midterm energy forecasting system', simulates the interactions of energy suppliers and consumers in the marketplace. DOE

**N80-10563/** National Technical Information Service, Springfield, Va.  
**ENERGY POLICY AND RESEARCH PLANNING. VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Oct. 1977 - Sep. 1979**  
 Andrey S. Hundemann Sep. 1979 184 p Supersedes NTIS/PS-78/0962; NTIS/PS-77/0839; NTIS/PS-76/0710  
 (NTIS/PS-79/1069/8; NTIS/PS-78/0962; NTIS/PS-77/0839; NTIS/PS-76/0710) Avail: NTIS HC \$28.00/MF \$28.00 CSCL 10A

Citations relative to planning for future U.S. energy needs on both national and state government levels are presented. The history and development of national and state legislation and regulations, Project Independence studies, and assessment of the effects of deregulation are included. Technical, economic, and environmental considerations in energy planning are also covered. GRA

Public Administration Review, v.39, Mar./Apr.  
no.2, p.111-147. 1979

MANAGING NATIONAL SCIENCE POLICY. Barry  
Bozeman and Ian Mitroff, eds.

Symposium on Managing National Science Policy 1979

Policy Innovation in Federal R & D: The Case of Energy ...

..... W. Henry Lambright and Albert H. Teich 140

N79-31797/ Department of Energy, Washington, D. C.  
DOMESTIC POLICY REVIEW OF SOLAR ENERGY

Feb 1979 146 p  
(TID-28834) Avail: NTIS HC A07/MF A01

Solar technologies and government policy towards competing fuels were assessed and existing Federal solar energy programs were evaluated. Solar energy's potential contributions to national and international needs are identified. Three options for future government policy are presented and specific initiatives which could be adopted to implement each are described. DOE

HD 9502 .U52 E44P 1978  
Energy analysis: a new public policy tool / edited by Martha W. Gilliland. — Boulder, Colo. : Published by Westview Press for the American Association for the Advancement of Science, 1978.

xvii, 110 p. : ill. : 24 cm. — (AAAS selected symposia ; 9)

Includes bibliographical references.

ISBN 0-89158-437-4

1. Energy policy—United States—  
Congresses. 2. Power resources—  
United States—  
Gilliland, Martha W. (Continued on card 2)

TJ U 163.25 .U6 N383 1978  
National Research Council. Committee on Private Sector Participation in Government Energy R&D Planning. Private sector participation in Federal energy R&D planning ; a report / prepared by the Committee on Private Sector Participation in Government Energy R&D Planning, Commission on Natural Resources, National Research Council. Washington : National Academy of Sciences (Continued on card 2)

N80-10807/ Department of Energy, Washington, D. C. Energy Information Administration.

ECONOMIC STRUCTURE, AGGREGATE PRODUCTION FUNCTIONS AND THE DEMAND FOR ENERGY AS AN INTERMEDIATE PRODUCT: A PRELIMINARY ANALYSIS

G. M. Lady Dec. 1978 57 p refs  
(DOE/EIA-0103/8) Avail: NTIS HC A04/MF A01

The relationship between the price elasticity of demand for energy as a factor of production and differences in economic structure was investigated. A model of general economic equilibrium is constructed utilizing a constant-elasticity-of-substitution production function. Using this model the price elasticity of demand for an intermediate product (energy) is determined under alternative structural assumptions (i.e., the degree to which the production process for the intermediate product directly utilizes primary factors of production). For an open economy and the case of energy, these assumptions could concern the degree to which the economy utilizes its own versus imported energy resources. DOE

N80-12805/ Institute for Energy Analysis, Oak Ridge, Tenn. FUNDAMENTAL ASPECTS OF ENERGY CONSERVATION POLICY

W. VanGool Nov. 1978 39 p refs  
(Contract EY-76-C-05-0033)

(ORAU/IEA-78-20(M)) Avail: NTIS HC A03/MF A01

The 'technological fix' approach to energy conservation is discussed. Higher capital investment can lead to a decrease in direct use of energy. Both the cost and the energy involved in these investments were analyzed along a conservation path, and a limited number of constants were used to direct the changes along this path. It was found that an increase in the price of energy will lead to higher capital investments in accordance with the economic lifecycles in the different sectors. For applications with a short lifetime, such as in the transport sector, energy conservation will mainly take place through the construction of new equipment. In sectors with long-lifetime investments (e.g., buildings), retrofitting will be important. DOE

**TJ American Power Conference, 40th, Illinois  
S Institute of Technology, 1978.  
.A55 Proceedings ...c1978  
1978 (Card 2)**

Realities of the Energy Problems Today and Options for Tomorrow .....	3
THE HONORABLE JOHN F. O'LEARY, United States Department of Energy, Washington, D.C.	
Energy—The Challenges and the Realities .....	13
HARRY O. REINSCHE, Bechtel Power Corporation, San Francisco	
The Role of the Federal Energy Regulatory Commission .....	23
THE HONORABLE GEORGINA SHIELDON, Federal Energy Regulatory Commission, Washington, D.C.	
The Energy Scene—One Man's Perspective .....	29
RICHARD E. BALZHEISER, Electric Power Research Institute, Palo Alto, California	
Energy Used and Energy Lost—How Electricity Compares With Other Energy Forms in Efficiency and Cost .....	670
WILFRED H. COMTOIS, Westinghouse Electric Corporation, Pittsburgh WILLIAM H. STINSON, Westinghouse Electric Corporation, Philadelphia	
Federal Environmental Policies and Their Effect on the Electric Utility Industry .....	679
J. A. RASILE, M. S. FERTEL, P. C. RICHIE, and T. A. CARNEY; EnviroSphere Company, A Division of Ebasco Services Incorporated, New York	

**N79-30722/** Hittman Associates, Inc., Columbia, Md.  
**COMPREHENSIVE COMMUNITY ENERGY PLANNING.  
VOLUME 1: A WORKBOOK**  
Nov. 1978 147 p refs 2 Vol.  
(Contract EC-77-C-10-0023)  
(HCP/M0023-01-Vol-1) Avail: NTIS HC A07/MF A01

The project resulted in the development of a methodology and workbook which enables community officials and staff to develop and evaluate energy conservation programs for their community. This methodology is a pioneering effort in the field of community energy planning. As such, many of the procedures generated were not subjected to test and evaluation in actual communities. In an effort to validate the procedures presented, the U.S. DOE is sponsoring a test and demonstration of this methodology in various selected communities. Based upon

the results of these demonstrations, the procedures may require refinement to more accurately reflect actual community needs. G.Y.

**N00 12667/** Franklin Inst Research Labs., Philadelphia, Pa  
**THE GREAT ADVENTURE: A REPORT ON THE  
10 REGIONAL PUBLIC HEARINGS ON SOLAR ENERGY  
FOR THE DOMESTIC POLICY REVIEW**  
Oct. 1978 52 p refs Prepared by the Inst. for Local Self Reliance  
(Contract EU-78-C-01-6354)  
(HCP/U6354-01) Avail: NTIS HC A04/MF A01

A report on the public hearings is presented along with policy recommendations. The recommendations are as follows: (1) the Federal government should move aggressively from research to commercialization, marketing, and public education; (2) decentralization both in program process and in context should be pursued vigorously; (3) the government should emphasize small scale systems, small businesses, individual inventors, community organizations, and small research groups in its funding programs; (4) solar energy systems that are decentralist are preferred over the more central-oriented; (5) passive solar design was the major technology recommended throughout; (6) DOE must streamline its grants process and reduce paperwork that proposals require; (7) the major item required for a successful solar industry is rapid passage of the solar income tax credit, either within, or separate from, the National Energy Act; (8) low interest loans and investment capital are required by small businesses; (9) public information on solar energy should be more available; (10) the budget for solar should be increased substantially; and (11) solar programs should be related to job-creation programs. DOE

**N79-29667/** Brookhaven National Lab., Upton, N. Y. Policy Analysis Div.  
**SYSTEMS APPROACH TO ENERGY PLANNING**  
Philip F. Felmedo and Robert Nathans 18 Nov. 1978 21 p refs Presented at Caribbean Consultation on Energy and Agr., Santo Domingo, 1 Dec. 1978  
(Contract EY-76-C-02-0016)  
(BNL-25523; Conf-781226-1) Avail: NTIS HC A02/MF A01

The criteria of successful energy planning and ways to go about such planning are outlined. Economic, social, and political factors are discussed along with a wide range of geographical scales, from the household and village to the world scene. A reduced reliance on oil imports is emphasized. DOE

**N79-30713/** Hittman Associates, Inc., Columbia, Md.  
**COMPREHENSIVE COMMUNITY ENERGY PLANNING.  
VOLUME 2: APPENDICES**  
Nov. 1978 229 p refs 2 Vol.  
(Contract EC-77-C-10-0023)  
(HCP/M0023-02-Vol-2) Avail: NTIS HC A11/MF A01

Energy saving strategies and components for energy conservation in cities and residential areas are presented. Estimates for alternative energy saving measures are discussed in areas of land use, mass transit, and building modifications. Energy conservation plans in these areas, such as tax credits and loans, are discussed and estimation methods are described. A.W.H.

TK Institute of Electrical and Electronics  
7800 Engineers, Region 5.  
.I256 Energy 78 : 1978 Region Five annual  
1978 conference, April 16-19, 1978, Tulsa,

The Impact of Advanced Technology on the Future Electric Energy  
Supply Problem - T. Gonen, Iowa State University and P. M.  
Anderson, Electric Power Research Institute, Palo Alto, California  
P.117

Input-Output Method Applied to Energy Planning P.122  
Dr. C. Kashkari, University of Akron

Sacramento Energy Efficient Office Building P.127  
J. T. Wood, B. Duke, G. Spragins, Benham Blair & Affiliates, Inc.

A Long Range Energy System Expansion Planning P.130  
S. Kumar, J. Sharma, L. M. Ray, University of Roorkee, India

A Method for Multistage Expansion Planning of Energy Systems P.133  
K. Ramachandran, J. D. Sharma, University of Roorkee, India

TJ Perspectives on the energy crisis : technical,  
163.2 regulatory, environmental, economic, pro-  
.P48 spective, v. 1 / advisory editors, Howard  
v.1 Gordon, Roy Meador. -- Ann Arbor, Mich. :  
RR Ann Arbor Science Publishers, c1977.  
xvi, 517 p. : ill. ; 29 cm.  
Includes bibliographies and index.  
ISBN 0-250401-61-4  
1. Power resources. 2. Energy policy.  
I. Gordon, Howard, II. Meador, Roy.

333.7

## PROJECT INDEPENDENCE EXECUTIVE SUMMARY . . . . . 67

(Executive Summary Prepared by the Federal Energy  
Administration)

In this overview of the U.S. energy problem, assessment is given  
through 1985 in terms of current practices and policies. Energy op-  
tions are discussed and compared with regard to supply, conservation,  
and management. Evaluation of alternate energy contributions  
through 1985. Attention to U.S. energy vulnerabilities. Reference  
tables document positions and predictions.

## PROJECT INDEPENDENCE: An Historical Perspective . . . . . 109

(Final Task Force report prepared by the Federal Energy  
Administration)

Historical background information in conjunction with the U.S.  
energy independence goal. Historical perspectives both internation-  
ally and nationally regarding all significant energy sources, current  
and prospective. Focus on understanding governmental and public  
policies that created the energy situation of the 1970s. The historical  
reasons we are where we are.

N78 28688 Open Univ., Milton (England). Energy Research  
Group  
**ALTERNATIVE ENERGY SOURCES: AN ANALYSIS OF  
THEIR ROLE IN ENERGY POLICY**  
P. F. Chapman 1978 64 p refs  
Aval. NTIS HC A04/MF A01

Combined heat and power, substitute natural gas, solar energy,  
and wave power are examined then compared with traditional  
and nuclear energy sources. The study refers to Great Britain's  
needs and energy policy up to the year 2025. Wave power is  
shown to be the most attractive potential source. Nuclear power  
shows poor performance compare other alternatives. A power  
demand growth rate leveling off at 1 percent per year is assumed.  
Electric car development is considered very probable and beneficial  
to rational use energy. Author (ESA)

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1978

International Symposium-Workshop on Solar  
Energy, Cairo, 1978.  
International Symposium-Workshop on  
Solar Energy : [symposium lectures], 16-  
22 June 1978, Cairo, Egypt / presented by  
Clean Energy Research Institute, University  
of Miami, Florida ; sponsored by National  
Science Foundation ; edited by T. Nejat  
Veziroglu, Homer W. Miser. -- [s.l.:s.n..

ECONOMICS AND POLICY OF ALTERNATIVE ENERGY SOURCES: A REVIEW /

T. Khalil, University of Miami, Coral Gables, Florida, U.S.A.

This paper examines the problems encountered by a growing demand for energy consumption and a dwindling reserves of conventional energy sources. The search for new energy sources have indicated the need for developing approaches to evaluate feasibility and competitiveness of the alternative sources. Comparative economic analysis have lacked completeness and consistency of approach. The need for developing unified objective and realistic methodologies is indicated and discussed. Assessment of some available economic comparison models is made. Emphasis is placed on comparing solar energy systems, a promising alternative energy source, with conventional systems. A unified model is proposed for the feasibility study of utilization of solar energy in certain applications. The model serves as an example illustrating considerations needed for completeness of comparative cost analysis needed for decision making.

#### IV. ENVIRONMENT

ENVIRONMENT

Fuel Conversion and its Environmental effects  
By: H. Gold Walter, J.A. Nardella and C.A. Vogel

Chemical Engineering Progress, Vol. 75, No. 8, Aug. 1979,  
P. 53-64

The objective of the work presented in this article was to determine the feasibility of siting specific conversion plants at given locations in the major U.S. coal and oil shale bearing regions; and the extent of the environmental impacts that could be expected from local water-related site, process and plant design criteria. Of the 90 plant-site combinations studied, 48 were in the central and eastern coal bearing regions and 42 in the western coal and oil shale bearing regions. The plants were assumed to be designed so as not to waste water. Effluent process waters were assumed to be reused, and different cooling options were selected based on the availability and cost of water. Estimates were made of the total net water consumed, wet solid residuals generated, and the cost and energy required for water treatment for each plant-site combination and then generalized to each one of the major U.S. coal and oil shale bearing regions.

In this article the data are summarized for a number of conversion processes without distinguishing between coal rank or coal and oil-shale bearing region. These data have been generalized from individual plant-site results. Details of the complete study are reported by Gold and Goldstein (1) and Probst and Gold. (2)

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Symposium on Turbulence, Diffusion, and Air Pollution, 4th, Reno, Nevada, 1979.

Fourth Symposium on Turbulence, Diffusion and Air Pollution, January 15-18, 1979, Reno, Nevada : preprints / American Meteorological Society. — Boston ; AMS, c1978.

P.117-153 xv, 676 p. : ill.

Includes bibliographies and index.

P.109

1. Air pollution—Congresses. 2. Wind power—Congresses. 3. Turbulent diffusion (Meteorology)—Congresses. I. American Meteorological Society. (Continued on card 2)

TN  
871.3  
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1978

Offshore Technology Conference, 10th, 1978.

Tenth annual Offshore Technology Conference, 1978 : proceedings. — Dallas : Offshore Technology Conference, c1978.  
4 v. : ill.

Sponsors: American Institute of Mining, Metallurgical, and Petroleum Engineers ... [et al.].

1. Petroleum in submerged lands—Congresses. 2. Ocean engineering—Congresses. 3. Marine engineering—Congresses. I. American Institute of Mining, Metallurgical, and Petroleum Engineers. 622.2

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<b>A. General . . . . .</b>	<b>49</b>
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<b>C. Residential, Commercial, and Institutional Energy . . . . .</b>	<b>58</b>
<b>D. Transportation Air . . . . .</b>	<b>81</b>

## CONSUMPTION, CONSERVATION, AND ECONOMICS - GENERAL

### U. S. ENERGY DEMAND BY CONSUMING SECTOR

Exxon Company, U. S. A.'S Energy Outlook 1980-2000, Dec. 1979, pp. 4-5.

### A PRIMER ON CURRENT AUTOMOTIVE FUELS.

Automotive Engineering, vol 87, no 12, December 1979, p. 19-27.

*Here's an overview of factors influencing properties and performance of current petroleum fuels for spark ignited, diesel, and turbine engines.*

**ND0-14976f**—Department of Energy, Bartlesville, Okla. Bartlesville Energy Research Center.  
**AMBIENT TEMPERATURE, FUEL ECONOMY, EMISSIONS, AND TRIP LENGTH Final Report, Feb. - Sep. 1977**  
B. H. Eccleston Aug. 1979 123 p  
(Contract DOT-TSC-RA-76-48)  
(PB-298847/5; DOT-TSC-NHTSA-79-43; DOT-HS-803-668)  
Avail: NTIS HC A06/MF A01 CSCL 13F

The relationship among automotive fuel economy, ambient temperature, cold start trip length, and drive-train component temperatures of four 1977 vehicles is examined. Fuel economy, exhaust emission, and drive-train temperatures were measured at temperatures of 20 F, 45 F, 70 F, and 100 F using the 1975 Federal Test Procedure and EPA highway fuel economy test.  
GRA

### MOTOR VEHICLE EMISSIONS AND FUEL CONSUMPTION MODELLING

J. H. Kent and N. R. Midford

Transportation Research, vol. 13A, no. 6, Dec. 1979, pp. 395-406.

**Abstract**—A preliminary study to predict emissions and fuel consumption of Australian motor vehicles was undertaken. Twenty-eight vehicles were tested on a dynamometer to obtain the modal emission rates of carbon monoxide, carbon dioxide, hydrocarbons and nitrogen oxides. Regression functions of speed and acceleration were fitted to the data and found to be accurate to within about 10% for the group of vehicles. Emissions and fuel consumption predictions were then made for a range of driving pattern data measured in Sydney traffic. The results gave a strong correlation of carbon monoxide, hydrocarbons and fuel consumption with average speed. Nitrogen oxides were almost independent of average speed and showed more scatter.

### AVIATION FUEL: SUPPLY PROSPECTS TO THE YEAR 2000.

ICAO Bulletin, vol 34, no 12, December 1979, p. 11-14.

**In this analysis of the fuel situation over the next 10-20 years, ICAO provides a glimpse of what can be expected by the air transport industry regarding costs and the availability of aviation fuel...**

NASA CP-2096

Fuel Consumption

1979

**IMPLICATIONS OF FUEL-EFFICIENT VEHICLES ON RIDE QUALITY AND PASSENGER ACCEPTANCE: WORKSHOP PROCEEDINGS.** Anna M. Wichansky and A.R. Kuhlthau, UVA, eds. (Final Rept. Sponsored by DOT and NASA. Held Woods Hole, Mass., Sept.6-8,1978). Aug. 1979. 118p.

Department of Transportation, DOT-TSC-RSPA-79-21  
Washington, D.C., Research  
and Space Programs Administration  
Workshop on Implications of Fuel- Sept.6-8,  
Efficient Vehicles on Ride Quality 1978  
and Passenger Acceptance

**DIESEL FUEL: SUPPLY VS. DEMAND.**

Automotive Engineering, vol 87, no 12, December 1979, p. 35-38.

*As demand increases for diesel fuel and jet aircraft fuels, competition increases for the fraction of crude oil on which these two fuels are based.*

**A80-17129** Global options for short-range alternative energy strategies. J. Goldemberg (São Paulo, Universidade, São Paulo, Brazil). *United Nations University, East-West Center, International Institute for Applied Systems Analysis, and University of Hawaii, Conference on Non-Fossil Fuel and Non-Nuclear Fuel Energy Strategies, Honolulu, Hawaii, Jan. 9-12, 1979.* Energy (UK), vol. 4, Oct. 1979, p. 733-744. 13 refs.

A discussion is presented on the possibilities of supplying the energy needs of the world and particularly of the developing countries on the basis of renewable resources: hydro power and biomass. Hydro power is found to be underused in many parts of the developing countries, and, up to the end of the century at least, 25 quads per year could be produced from this source. In addition, the unused annual increment of present-day forests could supply at least another 100 quads/year in developing countries. In industrialized countries only conservation can have a significant impact as an alternative strategy. (Author)

Psychological Strategies to Reduce Energy Consumption:  
Project Summary Report  
by L.J. Becker

Dept of Energy Reptot COO-2789-3, 30 June 1979  
Contract No. EY-76-S-02-2789

**ON THE USE OF ENERGY ELASTICITIES**  
T. Sonnino

Energy, vol. 4, no. 6, Dec. 1979, pp. 1063-1067.

**Abstract**—The change in energy consumption associated with a change in economic activity, i.e. the energy elasticity, has been used as the single most significant parameter in forecasting energy consumption. It has been found that the change in elasticity with time reflects shifts in energy uses in the economy. A detailed analysis for the case of Israel is presented.

The Energy Savings Potential of the Region IX Appropriate Energy Technology Grants Program: An Assessment of Twenty Projects. by F.B. Lucarelli, J. Morris, J.M. Kay, S. Rizer, C.W. Case & H.R. Clark  
Lawrence Berkeley Laboratory Report LBL-9715, October 1979. DOE contract W-7405-ENG-48

**A80-17130** Global perspectives and options for long-range energy strategies. W. Haefele (International Institute for Applied Systems Analysis, Laxenburg, Austria). (*United Nations University, East-West Center, International Institute for Applied Systems Analysis, and University of Hawaii, Conference on Non-Fossil Fuel and Non-Nuclear Fuel Energy Strategies, Honolulu, Hawaii, Jan. 9-12, 1979.*) Energy (UK), vol. 4, Oct. 1979, p. 745-760.

An attempt is made to envisage the evolution of energy supply and demand for the next 50 yr. Seven identified world regions are considered in order to bring out their interrelationships and to provide a background against which national or regional energy strategies can be evaluated. The principal tool for doing this is the elaboration of two detailed and largely internally consistent scenarios. This permits us to make interpolations and extrapolations. The scenarios are only conceptualizations, not predictions. This paper addresses only the technical and substantive aspects of the energy problem and does not look into political, institutional, and societal problems. It is thus meant to serve as a basis for broader policy decision-making. (Author)

SEMICONDUCTOR ALTERNATING-CURRENT MOTOR DRIVES AND ENERGY CONSERVATION. D. J. BenDaniel and E. E. David, Jr.

Science, vol 206, no 4420, November 16, 1979, p. 773-776.

**Summary.** The concentration of electrical energy usage in alternating-current motor drives presents an opportunity for substantial conservation. Emerging advances in power semiconductor transistor systems will support a major commercial effort to this end. An alternating-current synthesizer for this purpose may soon be available. The synthesizer produces electrical power of variable and programmable frequency, voltage, and wave form so that performance can be optimized. This technology provides the additional opportunity for fundamental improvements in electrical distribution and usage systems in the longer term. Power processing with semiconductor a-c motor controls is expected to become widespread in the near future.

A79-38890 # Energy conservation and solar energy - Partners in progress. M. B. McCarley (Tennessee Valley Authority, Chattanooga, Tenn.). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, Orlando, Fla., June 4-6, 1979, Paper 79-0979*. 12 p.

Energy conservation and energy use education programs undertaken by the Tennessee Valley Authority (TVA) are discussed. These include a home insulation program, a commercial and industrial energy audit program designed to help detect areas in which conservation measures can be applied, a program intended to encourage use of electric heat pump units, and a project in which the TVA works with builders to encourage construction of energy-efficient homes. In addition, TVA programs involving installation of solar water heaters with off-peak electrical backup in Memphis, a wood heating demonstration project in North Georgia, and installation of a Rankine Heat/Cool Solar Assist Pump system are described. The importance of implementing both energy conservation measures and research and development related to renewable energy resources is stressed. C.K.D.

N80-18560# National Bureau of Standards, Washington, D.C. National Engineering Lab.  
**AN INVESTIGATION OF PREFERENCES FOR VARIOUS TYPES OF ENERGY COST FEEDBACK** Final Report  
Ann Rammey-Smith and Jennifer L. Gagnon Aug. 1979 73 p  
refs Sponsored by DOE  
(PB-300314/2: NBSIR-79-1771) Avail. NTIS  
HC A04/MF A01 CSCL 10B

The issue of consumer preferences for various types of energy cost feedback for individual consumers is addressed. Recommendations related to the performance characteristics of energy cost feedback devices for use in testing energy cost feedback meters are examined. GRA

MATERIAL OPTIMIZATION IN A TORSIONAL GUIDEWAY TRANSIT SYSTEM. C. E. de Silva and D. N. Wormley.

Journal of Advanced Transportation, vol 13, no 3, Fall 1979, p. 41-61.

A simplistic analytical treatment of the material optimization in a single beam elevated guideway structure for the two-way passage of automated guideway transit vehicles is presented. In the configuration considered, the vehicle is eccentrically supported from the guideway. Using torsional and flexural analyses, the guideway material reduction that is possible for a given bending stiffness is estimated. For a given bending stiffness, material reductions are realized both by decreasing the guideway width and by making cutouts on the guideway. An algorithm to determine the optimal cutout size and location is developed and some design examples are given.

N80-13633# Planco, Inc., Dallas, Tex.  
**SURVEY OF THE RESEARCH INTO ENERGY-ECONOMY INTERACTIONS. VOLUME 1: SURVEY**  
R. Coates, D. Hanson, S. Juenger, and J. Kennington Apr. 1979 248 p refs  
(Contract EI-78-C-01-6346)  
(HCP/16346-01-1-Vol-1) Avail. NTIS HC A11/MF A01

A detailed and comprehensive review of recent (1960 to present) and on-going research into energy-economy interactions is presented. The results form theoretical and empirical analyses of energy-macroeconomics interactions, the different methodologies used, and the conceptual problems in this research are emphasized. The supply of energy, the price of energy, the world price of oil, energy capital requirements, energy R and D, conservation regulations, and stockpiling are among the variables studied. A conceptual framework for analyzing energy-economy models, the general features and methodologies of a large number of models, and the state of the art in modeling energy-economy interactions are included. Six different energy-economy models: Manne's ETA-MACRO and ETA, Hudson-Jorgenson's LITM, PILOT, Wharton Annual Energy, Reister-Edmonds, and Berkeley (Giessey-Benenson) are reviewed. Each review describes the methodology and general features embodied in the model, summarizes the types of energy-economy interactions addressed, and assesses the capabilities of the model. DOE

DOES THE UNITED STATES WASTE ENERGY?

Electric Power Research Institute Journal, vol 4, no 9, November 1979, p. 26-32.

Stepping behind international statistics, researchers find wide differences in the people of modern industrial societies—differences that characterize people's living patterns and determine the way they allocate resources, including energy.

**ENERGY CONSERVATION THROUGH RECYCLING.** D. C. Wilson.  
Energy Research, vol 3, no 4, October-December 1979,  
p. 307-323.

A critical review of the literature is used to suggest best estimates of the energy savings due to recycling one tonne of a number of materials. The use of these estimates is demonstrated by a number of illustrative applications. Substantial energy savings may be made by recycling most metals or paper. The savings from recycling glass cullet are smaller, although there is considerable potential for energy conservation through the substitution of returnable for non-returnable bottles. The recycling of materials already saves some 5 per cent of the U.K. total energy requirement, and this contribution could potentially be doubled. The recovery of fuel products and/or materials from solid waste is also shown to be an attractive and efficient energy source.

Preliminary Conservation Tables From the National  
Interim Energy Consumption Survey  
Office of the Consumption Data System, Office of Program  
Development, Energy Information Administration  
Dept. of Energy Document DOE/EIA-0193/P, 1 August 1979

The focus of this report is the conservation activities performed by households since January 1977, and the status of households with respect to insulation, storm windows, and other energy conserving characteristics. These tables are from preliminary data files. Therefore, the tables are in weighted percentages rather than weighted numbers. The tables will be reissued in final form in the fall of 1979.

Included in the report is a summary, a description of how the survey was conducted, preliminary sampling errors, and a glossary of terms.

**N80-12606#** League of Women Voters, Washington, D C  
**ENERGY CONSERVATION TECHNOLOGY EDUCATION  
PROGRAM Final Report**  
Jan. 1979 106 p refs  
(Contract EC-77-C-01-2165)  
(HCP/M2165) Avail: NTIS HC A06/MF A01

A project on teaching the public how to use energy more efficiently in the home is described. The methodology of the project is discussed and the findings and achievements are highlighted.  
A W H.

**N80-14512#** Brookhaven National Lab., Upton, N. Y.  
**HIGHLIGHTS OF THE ENERGY TECHNOLOGY PROGRAMS  
Annual Report**  
Dec. 1978 49 p  
(Contract EY-76-C-02-0016)  
(BNL-50959) Avail: NTIS HC A03/MF A01

Activities in: electrolysis based hydrogen energy storage systems; an electrochemically regenerative hydrogen-halogen energy storage system; fuel cells (materials and electrolysis); high temperature water electrolysis; and hydrogen energy storage systems for automobile propulsion are summarized. Energy programs reported on include: solar assisted heat pump systems; solar cooling subsystems and systems; solar demonstration projects; hardware simulators for tests of solar cooling/heating systems; fossil energy programs; catalytic process for conversion of synthesis gas to methanol; coal fired heater; coal/oil mixture combustion; rotating fluidized bed containing limestone for removal of sulfur from hot gases; improved oil and gas burners; and residue and waste fuels.  
DOE

**N80-15593#** Department of Energy, Washington, D. C. Energy Information Administration.  
**ENERGY SUPPLY AND DEMAND IN THE SHORT TERM:  
1979 AND 1980**  
Jun. 1979 127 p refs  
(DOE/EIA-0184/4) Avail: NTIS HC A07/MF A01

Overall energy supply and demand balances as well as a detailed discussion of the elements of end-use consumption of coal, natural gas, petroleum products, and electricity are presented. Analyses of the operations of utilities and refineries, the domestic production of coal, natural gas, crude oil, and electricity, and the supply and demand balances for each fuel are provided. Projections of domestic production as well as supply and demand balances, synthetics and imports, and projections for the electric utility sector are included for the short-term.  
DOE

**N80-12550#** Committee on Science and Technology (U. S. House).  
**INVENTORY OF ADVANCED ENERGY TECHNOLOGIES  
AND ENERGY CONSERVATION RESEARCH AND DEVELOP-  
MENT, 1976-1978, VOLUME 1**  
Washington GPO 1979 859 p refs Prepared by ORNL and  
DOE for the Comm. on Sci. and Technol., 96th Congr., 1st  
Sess., Jan. 1979  
(GPO-41-481) Avail: SOD HC

Each of 7,339 research projects is described and listed in one of the following nine sections into which the inventory is divided: solar energy, geothermal energy, hydro energy, basic physical research, biomass production/conversion and alternative fuels, electric power engineering, energy storage, energy conversion, and energy management, policy, and conservation. Each section is organized in a two- and three-level hierarchical arrangement.  
A R H.

**N80-15633# SRI International Corp., Menlo Park, Calif.  
ECONOMIC IMPACTS OF ENERGY CONSERVATION AND  
RENEWABLE ENERGY SOURCES**

R. C. Carlson 1979 21 p refs  
(Contract W-7405-eng-48)

(UCRL-15087) Avail: NTIS HC A02/MF A01

An overall theory of the economic impacts of alternative energy developments is developed. Literature on such impacts is reviewed and economic impacts of alternative energy development scenarios for California are projected. Economic impacts include changes in aggregate employment, unemployment, real income, and real output. Changes in each of these measures are analyzed in circumstances that include incentives or mandates for increased energy conservation or use of renewable energy resources. DOE

TJ Dubin, Fred S.

163.5 Energy conservation standards for  
.B84 building design, construction, and  
D79 operation / Fred S. Dubin and Chalmers  
G. Long, Jr. New York : McGraw-Hill,  
1978.

xi, 413 p. : ill. ; 24 cm.

Includes index.

I. Building -- Energy conservation.

I. Long, Chalmers G., joint author .

II. Title.

Billman, Kenneth W.

NASA Conference on Radiation Energy Conversion,  
3d, Ames Research Center, 1978.

Radiation energy conversion in space :  
technical papers prepared for the third  
NASA Conference on Radiation Energy Conversion  
at NASA Ames Research Center, Moffett  
Field, California, January 26-28, 1978 /  
edited by Kenneth W. Billman. -- New York :  
American Institute of Aeronautics and Astro-  
nautics, c1978.

xviii, 670 p. : ill. -- (Progress in

0 Energy II : use conservation and supply /  
181 edited by Philip H. Abelson, Allen L.  
.A1 Hammond. -- Washington : American Association  
A68 for the Advancement of Science, c1978.  
no. 78-9 201 p. : ill. ; 29 cm. -- (A Special  
Science compendium ; no. 6) (AAAS publica-  
tion ; 78-9)

ISBN 0-87168-300-8

1. Power resources--United States--  
Addresses, essays, lectures. 2. Energy  
policy--United States--Addresses,  
essays, lectures. I. Abelson,  
Philip Hauge. (Continued on card 2)

FUEL CHARACTERISTICS AFFECT ECONOMY.

J. L. Bascunana & R. C. Stahman

Automotive Engineering, Vol. 86, No. 6, June 1978,  
p. 54-55

Fuel economy involves much more than volume and distance.

**N80-10611#** California Univ., Berkeley Lawrence Berkeley  
Lab.

**ANOTHER LOOK AT ENERGY CONSERVATION**

L Schipper 1978 24 p refs Presented at Amer Econ  
Assoc., Chicago, 30 Aug 1978  
(Contract W-7405-eng-48)

(LBL-7893: Conf-7808104-1) Avail: NTIS HC A02/MF A01

The need for energy conservation in U.S. buildings, industry  
and the transportation sector, the effects of the amount and  
cost of energy supplies on energy conservation, and goals of a  
national energy policy are discussed. DOE

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TK Institute of Electrical and Electronics  
7800 Engineers. Region 5.  
.1256 Energy 78 : 1978 Region Five annual  
1978 conference. April 16-19, 1978, Tulsa,  
Energy Conservation by Means of Recycling  
J. A. Savage, Southern Methodist University

Energy Conservation in a Small Manufacturing Plant - An Engineering  
Education Case Study - D. I. Rimmer, University of Kansas  
Energy Conservation & Control in Power Plants  
L. F. Martz, Westinghouse Electric Corp.

Energy Conservation - A Personal & Professional Interaction  
B. L. Capehart, J. K. Watson, University of Florida

Verification of Energy Conservation Savings  
T. Mason, El Paso Natural Gas Company, Texas

The Jersey City Energy Conservation Demonstration  
Program. Final Report. by R.F. Newbold

Dept. of Energy Document COO-2820-1, August 1978  
Contract no. EY-76-C-02-2820

This report shows the benefits of energy saving,  
cost-saving, and added comfort which may be attained by retrofitting old  
buildings for improved energy conservation, noting typical complications  
which arise in doing so. The effectiveness of the conservation methods  
has been presented in terms of costs relative to effective payback  
periods which were calculated from results of their application in Jersey  
City.

**SUPPLYING GASOLINE FOR TOMORROW'S CARS**  
R. M. Ormiston  
Automotive Engineering  
Vol. 85, no. 9, September 1977,  
p. 47-51.

Before 1985, U. S. gasoline consumption is expected to increase  
slightly, level off, and then begin a slow decline. Gasoline short-  
ages are not foreseen, but changing product demands and un-  
certain government regulations will present challenging prob-  
lems to refiners.

TL R&D Planning Workshop, Transportation Systems  
151.6 Center, 1977.  
.R1R Tire rolling losses and fuel economy : an  
1977 R&D Planning Workshop / sponsored by the SAE  
Highway Tire Committee, in cooperation with  
ERDA, DOT, industry, and academia. -- Troy,  
MI. : Society of Automotive Engineers, c1977.  
iii, 202 p. : ill. ; 2<sup>nd</sup> cm. -- (SAE con-  
ference proceedings ; P-74)  
Bibliography: p. 201-202.

TJ Fuel economy of the gasoline engine : fuel,  
789 lubricant, and other effects ...1977.  
.P78 (Card 2)  
1977 1. Internal combustion engines, Spark  
ignition--Fuel consumption. I. Blackmore,  
David Richard, 1938- II. Thomas, Alun,  
1925- III. Affleck, W. S.

621.434

An Energy Efficient Window System. Final Report .

Suntek Research Associates

Lawrence Berkeley Laboratory Report LBL-9307, August 1977  
(also has report numbers: UC-95d; EEB-W-79-10)  
Prepared for the Dept. of Energy under contract  
W-7405-ENG-48

The purpose of this program was development of commercial production plans for a practical and cost effective energy conserving retrofit system for windows based on Suntek's prototype Superpane retrofit window. The original Superpane configuration consisted of a transparent insulation known as Heat Mirror to reduce radiative heat loss, a thermally sensitive optical shutter known as Cloud-gel to reduce summer heat gain, and a contained air space to reduce convection, all related to the prime window by an appropriate edge detail.

TL Canadian Symposium on Energy Conserving  
695.7 Transport Aircraft, Ottawa, 1977.  
.C36 A Canadian Symposium on Energy Conserving  
1977 Transport Aircraft = Symposium Canadien  
sur les Aeronefs de Transport a Faible  
Consommation d'Energie / sponsored by  
National Research Council of Canada,  
Transport Canada, Canadian Aeronautics and  
Space Institute. -- [s.l. : s.n., 197?]  
1 v. in various pagings : ill.  
1. Transport planes--Energy  
conservation-- Congresses.  
I. National Research Council, Canada.  
II. Canadian Aeronautics and Space  
Institute. III. Transport Canada.

N-141,474 Oak Ridge National Lab., ORNL-NSF-EP-68  
Tenn.  
National Science Foundation  
Contract W-7405-eng-26

TOTAL ENERGY USE FOR COMMERCIAL AVIATION IN THE U.S.  
Eric Hirst. Apr.1974. 13p.

L recd 7-7-75 1 copy  
Route: John Witherspoon M.S. 368  
(For R.K. Watson/Summer Design Study)

H74-21624

L

THE GASOLINE AND FUEL OIL SHORTAGE. (Hearings  
before the Subcommittee on Consumer Economics of  
the Joint Economic Committee, Congress of the  
United States, 93rd Congress, 1st Session, May  
1-2 & June 2, 1973). 1973. 290p.

93rd Congress, 1st Session  
Joint Economic Committee

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Electrochemistry, the past three  
and the next thirty years : a volume  
in honor of J. O'K. Bockris / edited  
by Harry Bloom and Velox Gavarna. --  
New York : Plenum Press, 1977  
xiv, 450 p. : ill. ; 26 cm.  
Proceedings of a symposium held at the  
Imperial College, London, in 1975.  
Includes bibliographical references and  
index.

Chapter 1

**The Problems of Energy Conversion—Experience of the Past**

A. R. Despić *p. 9*

Chapter 2

**The Future of Electrochemical Energy Conversion—  
The Next Thirty Years** .....

James McBreen *p. 35*

Chapter 3

**Summary: Energy Conversion—The Past and the Future** ...

A. J. Appleby *p. 53*

INDUSTRIAL AND AGRICULTURAL ENERGY

**N80 10633#** Brookhaven National Lab., Upton, N. Y.  
**DYNAMICS AND CONTROL: ENERGY CONVERSION,  
DELIVERY, AND DEMAND ANALYSIS**

Kenneth C. Hoffman Apr 1979 22 p refs Presented at the  
Workshop on Process and Systems Dyn. Control, Denver, 20 Jun  
1979

(Contract EY-76-C-02-0016)

(BNL 26045; Conf-790636-1) Avail NTIS HC A02/MF A01

Techniques of mathematical modeling and modern control  
theory, using microprocessors and advanced measurement and  
control devices, are extensively applied to components and  
systems for the conversion and delivery of energy. The projection  
of energy demands, as a function of economic growth and  
energy price, is also the subject of active research and analysis.  
This position paper reviews the current state of the art of analysis  
in these areas dealing with the planning and operation of energy  
systems that deliver fuels and electric power. Future research  
directions are also discussed. DOE

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Improvements in fluid machines and systems  
for energy conversion, volume IV. — Milan  
: Ulrico Hoepli, c1976.

xiii, 247 p. : ill. ; 24 cm.

Includes bibliographies.

1. Hydraulic machinery--Addresses, essays,  
lectures. 2. Fluid power technology--  
Addresses, essays, lectures. I. Hoepli,  
firm, Milan.

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National Solid-State Power Conversion Con-  
ference, 4th, Boston, 1977.  
Proceedings of Powercon 4 / Boston :  
fourth National Solid-State Power Conversion  
Conference / Ronald I. Birdsall, chairman.  
— Oxnard, Calif. : Power Concepts, Inc.,  
Consulting Engineers, c1977.  
1 v. in various pagings  
Held in Boston, Mass. May 12-14, 1977.  
1. Electric power distribution--Congres-  
ses. 2. Electric power production--Congres-

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## RESIDENTIAL, COMMERCIAL, & INSTITUTIONAL ENERGY

### EFFECTS OF ENERGY CONSERVATION IN RESIDENTIAL AND COMMERCIAL BUILDINGS, Eric Hirst and Bruce Hannon

Science, v.205, no.4407, Aug. 17, 1979, p.656

*Summary.* In 1977, heating, cooling, lighting, and other operations in residential and commercial buildings used 27 quads (1 quad =  $10^{15}$  British thermal units) of energy. This is more than one-third of the nation's total energy budget. Future trends in energy use in buildings are likely to depend strongly on fuel prices and government policies designed to save energy. Three scenarios are examined: (i) a base line in which fuel prices rise as projected by the Department of Energy; (ii) a conservation case that includes higher gas and oil prices plus the regulatory, financial incentive, and information programs authorized by the 94th Congress and proposed in the April 1977 National Energy Plan; and (iii) another conservation case that also includes new technologies (more efficient equipment, appliances, and structures). These scenarios are analyzed for changes in energy use, costs, and employment by means of detailed engineering-economic models of energy use in residential and commercial buildings developed at the Oak Ridge National Laboratory and input-output analyses developed at the University of Illinois.

SCHOOLS: AIR TIGHTNESS AND INFILTRATION, by C.Y. Shaw and L. Jones.

ASHRAE Journal, vol. 21, no. 4, April 1979, p.40-45.

*The overall air leakage characteristics of eleven elementary schools of the Carleton Board of Education were measured. These results were used to classify the constructions as loose, average and tight. Using the data for average construction, air infiltration rates were calculated for a simple model of a school building under various combinations of wind speed and outside air temperature. A calculation of the annual heating requirement indicates that air infiltration is a significant component of total heat consumption. This paper was presented during the First Technical Session at ASHRAE's 1979 Semiannual Meeting in Philadelphia, PA, and will be published unabridged in ASHRAE Transactions, Vol. 85, Part 1.*

A79-33951 **Designing thermally efficient buildings for the U.S. Midwest.** R. Wright (Hawkweed Group, Ltd., Chicago, Ill.). *Sunworld*, vol. 3, no. 1, 1979, p. 13-17.

The design of thermally efficient buildings utilizing natural energy sources and regionally available materials in the midwestern United States is discussed. Climatic factors necessitate space heating for most of the year in the region, while local topography, vegetation, orientation, soils and microclimate determine the types of heating and construction feasible. To reduce energy losses, buildings should be small, with a north-south to east-west ratio of 1 to 1.1 in cool zones and 1 to 1.6 in temperate zones. The building should also be properly insulated, with minimal internal energy requirements. A solar heating system for a building should be integral with the structure; passive solar heating is achieved by the use of south windows and a thick concrete, masonry or water-containing wall to store the heat while active devices should be designed to use building structures already in use. A.L.W.

DOMES HOMES - DO THEY COST LESS? DO THEY MEET BUILDING CODES? DO THEY SAVE ENERGY?, by Franklynn Peterson and Judi R. Kesselman.  
Popular Science, vol. 214, no. 4, April 1979, p.84-87.

A79-51960 **District heating and cooling with heat pump systems.** J. M. Calm and P. T. Bauer (Argonne National Laboratory, Argonne, Ill.). In: Intersociety Energy Conversion Engineering Conference, 14th, Boston, Mass., August 5-10, 1979, Proceedings, Volume 2. (A79-51726 23-44) Washington, D.C., American Chemical Society, 1979, p. 1681-1686. Research sponsored by the U.S. Department of Energy.

The paper describes basic approaches to district heating and cooling with heat pump systems and the heat-pump-centered integrated community energy systems (HP-ICES) project. HP-ICES are energy systems for communities, which provide heating, cooling and/or other thermal energy services through the use of heat pumps. Since heat pumps primarily transfer energy from existing and otherwise probably unused sources rather than convert it from electrical or chemical to thermal form, HP-ICES offer potential for energy conversion. Furthermore, since conventional building heating and cooling systems would be replaced by this community energy system, nonscarce resources could be used instead of depleting fuels which are in short supply. V.T.

PRE-INSULATED PANELS INCREASE ENERGY EFFICIENCY.  
 Energy Engineering, vol. 76, no. 1, Dec. 1978, Jan. 1979,  
 p. 46-48.

ASHRAE 90-75, mandates stringent performance levels for thermal transmission: in walls,  $U$  of 0.20 to 0.38 is required. Pre-insulated panels — a ready-to-install "sandwich" of steel exterior wall, insulation and steel interior wall — usually exceed the ASHRAE standard. They are said to cut energy usage more than a third compared to insulated masonry construction. For example, pre-insulated steel panel systems attain  $U$  factors as low as 0.048 to 0.062, depending upon insulation thickness. Average  $U$  factors for competitive materials are 0.48 for 4" face brick plus 4" common brick; 0.33 for 4" face brick plus 8" concrete block (cinder); 0.47 for 12" concrete block (gravel aggregate); 0.31 for 6" poured concrete; and 0.55 for two vertical glass sheets with one half inch air space. As a result, prefabricated panels are on the ascendancy. This year, industry sources estimate that pre-insulated panels will account for 15% of the 135 million square feet of metal wall panels to be erected. Within 10 years, the percentage is expected to climb to 40% of a 160 million square foot market.

**N80-11573#** Mechanical Technology, Inc., Latham, N. Y.  
**HIGH COP HEAT PUMP SYSTEM, PHASE 1. RESULTS**  
 Apr. 1979 151 p.  
 (Contract EC-77-C-01-5056)  
 (HCP/M5056-01; TR-1) Avail NTIS HC A08/MF A01

The High COP Heat Pump System described is a device for recovering heat or energy usually lost in process streams by rejection to once-through cooling systems. The acetone recovers process makes use of river water to cool process streams, with the river water taking on heat in the heat exchange process. Heat or energy is thereby rejected from the process stream and is not recovered for reuse. The MHI Heat Pump System allows reuse of this energy. The estimated cost of a production Heat Pump System is \$625,000 plus installation. The system can deliver 20 million BTU's per hour of latent steam energy. Based on a steam cost of \$1.89 million BTU's for natural gas, the system being in service for 7884 hours per year (90% in-service rate), a 20% investment tax credit and installation costs at 50% of hardware costs, the discounted cash flow rate of return is 29.5%. Breakeven points are 2.6, 3.6, and 4 years for oil, gas and coal respectively. Details are provided about the Heat Pump System operation in the section entitled Process Description. Cycle Optimization is discussed, providing insight on the technique of determining the optimum system configuration. System Sensitivity shows how relatively little the output varies with changes in turbine and compressor efficiencies. Details of System Design are given, in which design objectives, applicable codes, working fluid, general arrangement, and component design features are discussed. Installation at the host site is analyzed, as is System Cost. Under Environmental Effects, it is shown that the Heat Pump System will increase the quality of the environment.

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**Heat pump technology for saving energy /**  
 edited by M. J. Collie. Park Ridge,  
 N.J. : Noyes Data Corp., 1979.  
 xi, 348 p. : ill. ; 25 cm. (Energy  
 technology review ; no. 39) \$39.00  
 Includes bibliographical references.  
 1. Heat pumps. 2. Buildings --  
 Energy conservation. I. Collie, M. J.  
 697.07 79-83902 0-815507-44-5  
 79V30769

ASHRAE Journal, vol. 21, no. 3, March 1979.

Cold Storage Insulation: The Vapor Barrier (Can We Get it Straight?) .....	36
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A Summary By the Authors of the Plan	
Some Problems With Insulation Over Suspended Ceilings .....	46
Donald J. Misselhorn	
New Concepts in Thermal Insulation Heat Flow Measurements — Requirements for Implementation .....	51
Charles M. Pelanne	
Applying a Computer Analysis Program to the Selection of Insulation Materials .....	62
John G. Dixon & Bob W. Dean	

**HEAT PUMP DESIGN: COST-EFFECTIVENESS IN THE COLLECTION,  
 STORAGE AND DISTRIBUTION OF SOLAR ENERGY, by**  
 J.G. Cottingham.

ASHRAE Journal, vol. 21, no. 4, April 1979, p.35-38.

Various solar heat pump configurations are reviewed, and the assisted or series configuration is identified as the concept having the greatest potential for economic acceptance. This study is not limited to consideration of commercially available units, but examines the system impact that would result from the development of vapor compression equipment specially tuned to the collection and distribution of solar energy. Major impacts on the solar collector and energy storage elements are identified and reviewed. This paper was presented at a Symposium, Solar-Assisted Heat Pumps, during ASHRAE's 1979 Semiannual Meeting in Philadelphia and will appear unabridged, in ASHRAE Transactions, Volume 85, Part 1.

Research and Development of an Air-Cycle Heat-Pump Water Heater.

by J.T. Dieckmann, A.J. Erickson, A.C. Harvey & W.M. Toscano

Dept. of Energy Report ORNL/Sub-7226/1, L October 1979

A prototype reverse Brayton air cycle heat pump water heater has been designed and built for residential applications. The system consists of a compressor/expander, an air-water heat exchanger, an electric motor, a water circulation pump, a thermostat, and fluid management controls.

OPTIMIZING A HEAT PUMP FOR HEATING PURPOSES. C.G. Carrington.

International Journal of Energy Research, vol 2, no 2, April-June 1978, p. 153-170.

A computer simulation routine is used to analyse the economic effects of varying the heat exchangers and fans of a 3 hp commercial (base-line) air-air heat pump, on the assumption that it is used only for heating purposes. Both long-term (life-cycle costing) and short-term (pay-back time) economic measures are considered. The results indicate that there is economic justification for substantial increases in the capacity of the heat exchangers of the base-line unit. Such an optimized heating-only heat pump has technical and energetic advantages over the base-line unit.

**A80-18595 #** A solar assisted and wind powered heat pump for residential dwellings. E. Spero (Basic Automation, Ltd., Jerusalem, Israel) and A. Dylbs (Case Western Reserve University, Cleveland, Ohio). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/HT-133*. 10 p. 14 refs. Members, \$1.50; nonmembers, \$3.00.

This paper presents a practical and cost-effective design of a residential energy system. The system combines the use of solar collectors and a wind turbine with a water to air heat pump. The wind turbine is directly coupled to the compressor of the heat pump and a thermal energy generator, thus eliminating intermediate stages and improving energy conversion efficiency. Proper matching between collection and conversion elements eliminates the need for complex speed controls. The system was simulated on a digital computer using hourly wind, temperature, and total daily isolation data for the Cleveland, Ohio, area. The results indicate that the collector and storage elements are smaller than expected because of the high degree of matching between the solar and wind energy availability and demand, along with an increased probability that one of these energy sources will be available. (Author)

**A80-18591 #** Residential solar heat pump systems - Thermal and economic performance. J. H. Morehouse and P. J. Hughes (Science Applications, Inc., McLean, Va.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-25*. 9 p. 21 refs. Members, \$1.50; nonmembers, \$3.00. Contract No. DE 8C04-78CS-34261.

This study performed an analysis of series and parallel configured solar heat pump systems for residences. The year-round thermal performance for all the heating, cooling and hot water system configurations were determined by simulation and compared against conventional heating and cooling systems in three geographic locations. The series and parallel combined solar heat pump systems investigated are at best marginally competitive, on a 20-year life-cycle cost basis, with conventional oil and electric furnace systems. The combined solar heat pump systems are not economically competitive with conventional gas furnace or stand-alone heat pump systems for residential space heating, cooling and water heating. (Author)

**A80-18555 #** A simplified procedure for performance of solar systems with heat pumps. F. Osterle, A. Murphy (Carnegie-Mellon University, Pittsburgh, Pa.), A. Salehpour, and P. Vercaemert. *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-23*. 12 p. 11 refs. Members, \$1.50; nonmembers, \$3.00.

A simple procedure is described and assessed for determining the annual heating and cooling energy requirements of a hypothetical small residential building in Pittsburgh, PA by four methods: (1) direct solar plus auxiliary for heating and heat pump for cooling, (2) unassisted heat pump plus auxiliary, (3) and (4) two solar heat pump combinations. The procedure used average daily temperatures and insolation for each month. The emphasis of the paper is on the modeling procedures developed rather than on the specific results presented. The use of the simplified procedure provides good results with great time saving compared to hour-by-hour performance modeling. (Author)

**N80-13680#** California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div. **THERMAL PERFORMANCE OF BUILDINGS AND BUILDING ENVELOPE SYSTEMS: AN ANNOTATED BIBLIOGRAPHY** William L. Carroll Apr. 1979 41 p. Presented at the DOE/ASTM Thermal Insulation Conf., Tampa, Fla., 23-24 Oct. 1978 (Contract W-7405-eng-48) (LBI-8925) Avail. NTIS IC A03/MF A01

A bibliography of published papers describing models, measurement techniques, apparatus, and data for the thermal performance of whole buildings and building envelope systems is presented. Summary descriptions of the content of each citation are provided. Citations on analytical models are selective and concentrate on methodology that forms the basis of computer programs for whole building energy analysis. Approached to dynamic measurements, both in the laboratory and in the field, for envelope systems and for whole buildings are included. DOE

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Intersociety Energy Conversion Engineering Conference, 14th, Boston, 1979.  
Proceedings of the 14th Intersociety Energy Conversion Engineering Conference, Boston, Massachusetts, August 5-10, 1979. -- Washington, D. C. : American Chemical Society, c1979.

799357  
District Heating and Cooling with Heat Pump Systems, J.M. Calm and P.T. Bauer ..... 1681

799358  
Feasibility of a Heat-Actuated Heat-Pump-Centered Integrated to a Community, B. Yudow, R. Tison, N. Baker and P.F. Swenson 1587

799359  
System Performance of a Stirling Engine Powered Heat Activated Heat Pump, W.D. Richards and W.S. Chiu ..... 1693

799360  
Modeling the Performance of Gas-Fired Heat Pump Systems, A. Potani and U. Bonne ..... 1699

799361  
Heat Pump System for Process Steam Generation, R.K. Sakhuja and G.V. Mileris ..... 1708

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Thermodynamic Evaluation of Heat Pumps Working with High Temperatures, I.A. Ekroth 1713

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A New Absorption-Cycle Process for Upgrading Waste Heat, G. Cohen, J. Salvat and A. Rojey ..... 1720

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Technology Impact Study of a High Efficiency Industrial Heat Pump, D. Sullivan ..... 1725

799368  
Storage Assisted Heat Pumps Using Phase Change Material, G.R. Frysinger ..... 1730

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Use Peltier Heat Pumps to Improve Process Separation Availability, M. Meckler ..... 1780

NASA CR-3112 *Heat pumps* 1979

RESULTS OF HEATING MODE PERFORMANCE TESTS OF A SOLAR-ASSISTED HEAT PUMP. Clay B. Jones and Frederick O. Smetana. Apr. 1979. 81p.

North Carolina Science and Technology Research Center, Research Triangle  
NASA NAS1-14208

A MATHEMATICAL SIMULATION OF A SOLAR ASSISTED HEAT PUMP SYSTEM USING THE GROUND FOR ENERGY STORAGE, BY Knud Schlosser and Bjorn Teislev. Energy and Buildings, vol. 2, no. 1, January 1979, p. 37-43.

*A residential heating system utilizing a combination of a solar collector, a heat pump and an energy storage in the ground is described and some simulation results are presented.*

*It is concluded that for ground heat-pump systems without a solar collector the best positioning of the heat absorbing tubes are horizontal, whereas the vertical tube configuration seems to be superior when a solar collector is included in the system.*

*Finally it is observed that the use of a heat storage consisting of vertical tubes buried under the house appears to be a rather attractive solution.*

**N79-32704#** Brookhaven National Lab., Upton, N. Y.  
**EXPERIMENTAL PERFORMANCE STUDY OF A SERIES SOLAR HEAT PUMP**

Edward A. Kush 1979 6 p. refs Presented at the 4th Ann Heat Pump Technol. Conf., Stillwater, Okla., 9-10 Apr. 1979 (Contract EY-76-C-02 0016)

(BNL 25928; Conf-790446-2) Avail: NTIS HC A02/MF A01

A systematic experimental study of heat pump performance at evaporator temperatures typical of series solar input, 50 to 100 F, was conducted using a laboratory assembled heat pump and specially constructed testing simulator. Results which show that coefficients of performance which follow the thermodynamic potential can be achieved are presented and discussed. DOE

CHEMICAL HEAT PUMPS—A BASIC THERMODYNAMIC ANALYSIS.  
W. M. Raldow and W. E. Wentworth.

Solar Energy, vol 23, no 1, 1979, p. 75-79.

Abstract—The concept of a thermodynamically driven chemical heat pumping cycle is discussed. Using Carnot analysis, it is shown that these cycles are closely related to the Carnot cycle and that they offer a means to be used in selection of chemical reaction. For maximum efficiency are formulated.

GROUND-HEAT-ASSISTED HEAT PUMPS, by E. F. Lindsley.  
Popular Science, vol. 214, no. 2, Feb. 1979, p.98-100.

Earth coil makes winter use  
of rejected A/C heat and  
down-the-drain hot water

PERFORMANCE OF COMBINED SOLAR-HEAT PUMP SYSTEMS, by T.L.  
Freeman, J.W. Mitchell and T.E. Audit, Solar Energy, vol.  
22, no. 2, 1979, p.125-137.

Abstract—A comparative study of the performance of combined solar heat pump systems for residential space and domestic hot water heating has been undertaken. Simulations have been made with TRNSYS[1] of three basic combined configurations, as well as conventional solar and conventional heat pump systems, in two different climates, Madison, Wisconsin, and Albuquerque, New Mexico.

The three combined systems are the series system in which the solar storage is used as the source for the heat pump, the parallel system in which ambient air is used as the source for the heat pump, and the dual source system in which the storage or ambient is used as the source depending on which source yields the lowest work input. The influence of collector area, number of glazings, main storage volume to collector area ratio, and heat pump coefficient of performance were determined.

The results indicate that the parallel combined system is probably the most practical solar-heat pump configuration. The thermal performance at a given collector area is consistently superior to both the series or the dual source systems over the heating season. Costs and the extent to which summer cooling is a requirement determine the relative merit of the conventional heat pump, conventional heat pump, conventional solar, and parallel systems.

STRATIFICATION BY DESIGN, by Charles J. Allen.  
ASHRAE Journal, vol. 21, no. 1, April 1979, p.32-34.

*The modernization of two manufacturing buildings resulted in a new roof over two existing buildings while they were in full production. This presented the opportunity to design a new ventilating system capable of exploiting the natural stratification phenomenon by providing low-level cooling and high-level ventilation for the removal of internal heat gains. This paper was presented at a symposium, Environmental Control in Industrial Plants, during ASHRAE's 1979 Semiannual Meeting in Philadelphia and will appear unabridged in ASHRAE Transactions, Vol. 85, Part 1.*

TURBINE-DRIVE HEAT PUMP DOUBLES HEATING/COOLING  
EFFICIENCY. David Scott.

Popular Science, vol 215, no 4, October 1979.  
p. 112-113.

Its heart is a tiny, virtually maintenance-free  
turbine.

THE ENERGY REQUIRMENTS OF BUILDINGS  
B. Steinmuller and R. Bruno

Energy and Buildings, vol. 2, no. 3, August 1979, pp.  
225-235.

*In this study a simple and accurate dynamic one-capacity model is used to investigate systematically the effect and potential of energy conservation measures on the heating requirement of buildings. The value of present and future building codes is studied under various Central European weather conditions. Three building codes are identified. For these building codes, parameter variations of the envelope, the inner part, and the operational mode of the building are performed. Three static parameters (the total heat loss coefficient, the internal capacity and the response time) and one dynamic parameter (the heating period, here defined as the number of hours with a heating requirement) turn out to be central quantities in the characterization of the thermal behaviour of a building.*

PASSIVE COOLING OF BUILDINGS BY NATURAL ENERGIES  
B. Givoni

Energy and Buildings, vol. 2, no. 4, Dec. 1979, pp. 279-285.

*Cooling of buildings by natural energies can be effected either by solar energy, although only with 'active' sophisticated systems, or by the utilization of other natural energies which can also be applied in a passive way.*

*The natural energies which can be utilized for passive cooling are:*

- nocturnal longwave outgoing radiation
- night convection
- water evaporation

*Combinations of these cooling sources are also possible, such as combining convective and evaporative nocturnal cooling or combining nocturnal longwave radiant initial cooling of air with subsequent super-cooling or water evaporation.*

*The applicability of the various natural cooling sources (besides solar energy) depends greatly upon the climatic conditions prevailing in summer at night in a given region, and in particular on the dry and wet bulb temperatures of the nights in summer. This is because the low level to which a thermal storage system can be cooled is close to the dry or wet bulb temperatures at night, for convective or evaporative cooling, respectively.*

*This paper discusses the applicability of various cooling systems utilizing the above-mentioned natural energies and some of the problems involved. Quantitative comments are related to the climatic conditions prevailing in Israel.*

**NBO 11572#** Dubin Bloome Associates, New York  
**HEAT PUMP CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS. SYSTEMS DEVELOPMENT. DUBIN BLOOME ASSOCIATES**

Fred S. Dubin, A. Halfon, and P. Herzog Feb. 1979 242 p  
refs

(Contract W 31-109 eng 38)

(ANL/ICES-TM-29) Avail NTIS HC A11/MF A01

A heat pump centered integrated community energy system (HP-ICES) which provides all the heating, cooling, and other energy requirements to an entire community is investigated. The ice generating HP-ICES which uses the heat of fusion of water as a heat source for the heat pump, thus converting the water into ice, is described. The ice is stored in a bin and used the following summer for cooling. The systems performance and engineering are evaluated and a comparison is made with conventional heating systems. AWH

THE REVERSED BRAYTON CYCLE HEAT PUMP--A NATURAL OPEN CYCLE FOR HVAC APPLICATIONS, by F. Sisto.

F. Sisto.

Transaction of the ASME, vol 101, no 1, January 1979, p. 162-167.

NASA CR-3111

Heat pumps

1979

AN ANALYTICAL INVESTIGATION OF THE PERFORMANCE OF SOLAR COLLECTORS AS NIGHTTIME HEAT RADIATORS IN AIRCONDITIONING CYCLES. Clay B. Jones and Frederick O. Smetana. Mar. 1979. 60p.

North Carolina Science and Technology  
Research Center, Research Triangle Park  
NASA NAS1-14208

**NPO 10662#** Westinghouse Research and Development Center, Pittsburgh, Pa

**PERFORMANCE MONITORING OF AN OFF PEAK HEATING AND COOLING SYSTEM UTILIZING THERMAL STORAGE AND SOLAR AUGMENTED HEAT PUMP**

W C Moreland Apr 1979 39 p

(EPRI-ER 845) Avail NTIS HC A03/MF A01

The instrumentation system (including sensors and data logging equipment) used in the demonstration system are described. A general description is also given of the modes of operation of the main heat pump/storage/solar system, the proposed methodology and format for data reduction, and the present status of the program.

DOE

Case Study of the Brownell Low Energy Requirement House  
by R.F. Jones, R.F. Krajewski & G. Dennehy

B

Brookhaven National Laboratory Document BNL 50968,  
May 1979. Under contract with DOE, contract no.  
EY-76-C-02-0016

An evaluation is made of the design and thermal performance of an innovative house built in 1977 in the Adirondacks area of New York State. The house has a very tight and well-insulated envelope, with the rigid insulation board applied to the outside of the frame. Passive solar gain through south-facing glass, along with internal "free" sources of heat, are shown to provide a substantial part of the building's heating requirements. Effective integral thermal storage, provided by the exposed interior structure, serves to keep interior temperature excursions within acceptable limits.

Estimating Energy Impacts of Residential and  
Commercial Building Development  
A Manual for the Pacific Northwest and Alaska

Dept. of Energy Report CONS-0261-T1, 22 February 1979

This energy impact manual has been prepared in response to the growing need for a practicable procedure for estimating, in a non-engineering context, the energy implications of new building design and operation. It provides a simplified, yet reasonably accurate means of assessing the total energy impact of new construction in the commercial and residential sectors. While developed specifically for the States of Alaska, Idaho, Oregon and Washington, much of the data used are national averages; the procedures described in the text are applicable to other regions of the nation, with appropriate adjustments for climatic differences.

**N80-11586#** Argonne National Lab., Ill.  
**DOE HEAT PUMP CENTERED INTEGRATED COMMUNITY  
ENERGY SYSTEMS PROJECT**  
J. M. Calm 1979 17 p refs Presented at Heat Pump Technol.  
Inform. Exchange Meeting, Gaithersburg, Md., 7 Mar. 1979  
(Contract W-31-109-eng-38)  
(CONF-790352-1) Avail: NTIS HC A02/MF A01

The development of centralized, distributed, and cascaded heat pump centered integrated community energy systems using both waste and natural heat is discussed. These systems show promise for cost reduction, increased reliability, and avoidance of adverse environmental effects in providing process and space heating and cooling.

K.L.

**N80-10651#** Brookhaven National Lab., Upton, N. Y.  
**STATE OF THE ART OF SENSIBLE HEAT STORAGE FOR  
SOLAR HEAT PUMP SYSTEMS**

Philip D. Metz 1979 9 p refs Presented to Solar Energy  
Storage Options Workshop, San Antonio, Tex., 18 Mar 1979  
(Contract EY-76-C-02-0016)

(BNL-25909; Conf-790328-4) Avail: NTIS HC A02/MF A01

Factors which influence the storage characteristics of solar source heat pump systems are discussed including: solar collection devices, the heat pump, and the utility interface. Some of the characteristics of solar source heat pumps storage are specified such as: temperature range and thermal inertia. The storage options which are discussed are: rock beds, water tanks, ground coupled storage, swimming pools, and ponds. DOE

**N80-14637#** Southern California Edison Co., Rosemead  
**COMMERCIAL SOLAR AUGMENTED HEAT PUMP SYS-  
TEM**

J. Wilborn Mar. 1979 79 p refs Sponsored by Elec. Power  
Res. Inst.  
(EPRI-ER-1004) Avail: NTIS HC A05/MF A01

A solar energy augmented water source heat pump system was installed on an administration building located on the campus of the Golden West College in Huntington Beach, California. Testing began in mid-1978 and will continue for two years. Solar energy is collected from 800 square feet of solar collector panels mounted on the administration building roof. Buried tanks having a total capacity of 4,000 gallons store thermal energy. A complete and automated operation control system and instrumentation package are included. The system features flexible operation and operates in multiple modes. These modes of operation allow testing with and without solar collectors and with and without thermal storage. Solar augmentation, thermal storage, and heat pumps are to be evaluated. DOE

**N80-12566#** Lincoln Lab., Mass. Inst. of Tech., Lexington  
**OPTIMIZATION OF PHOTOVOLTAIC/THERMAL COLLEC-  
TOR HEAT PUMP SYSTEMS**

M. C. Russell and E. C. Kern, Jr. 1979 5 p refs Presented  
at the 1979 Intern. Solar Energy Soc., Atlanta, 28 May - 1 Jun.  
1979

(Contract EG-77-S-02-4577)

(COO-4577-7; CONF-790541-20)

HC A02/MF A01

Avail: NTIS

Photovoltaic/thermal (PV/T) collector-heat pump systems were simulated for residences in New York and Fort Worth climates. Analysis of the technical and economic results are discussed. The parallel heat pump configuration with 40 square meters of PV/T collectors was found to be the least-cost system option for the New York residence.

DOE

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**Institute of Electrical and Electronics  
Engineers, Region 6.**

**Electronic Monitors for Residential Energy Conservation . 53**  
Peter O. Lauritzen, Paul Seto, Department of Electrical  
Engineering, Robert Kohlenberg, Department of  
Psychology  
University of Washington, Seattle, WA

Two electronic instruments were designed to give direct information feedback and offer individuals a strong incentive for energy conservation. One instrument, the Shower Monitor, measures the amount of energy used in a single shower and displays this information to the person taking the shower. The instrument fits in a small battery powered box clipped on the end of a shower head.

The second instrument, the Electricity Use Monitor, monitors total electricity use in the home. It is placed in the kitchen where it displays electricity demand in kilowatts and the cumulative energy in kilowatt hours used during each day. Alarms indicate when preset levels of consumption are exceeded. The energy used over each 15 minute interval is stored in a memory to be retrieved every two weeks for later computer analysis.

TJ  
163.3  
.S54

**Shinskey, F.**

**Energy conservation through control /  
Francis G. Shinskey — New York :  
Academic Press, 1978.**

xiv, 321 p. : ill. ; 24 cm. — (Energy  
science and engineering)

Includes bibliographical references and  
index.

ISBN 0-12-641650-8.

1. Energy conservation. 2. Process  
control. I. Title. II, Series.  
621

5-588

**WINDOWS AND INSULATION.** Elaine Hudson.

House Beautiful, Jan.1978, p.66,67,99,100.

Window performance is critical for energy conservation.  
Here are the facts you need to know.

Alternative Energy Sources, no.31, Apr.1978.

Special Window Insulation Section

Make Your Own Insulating Window Shades by Abby Marier . . . . . 4

Variation on a Theme: More Insulated Roman Shades  
by Marilyn McGriff. . . . . 10

Group Designed Insulating Curtains for Thermal and Economic Efficiency  
by Carlotta Collette. . . . . 12

Window Tips from the Experts: Karen Wilson & Darryl Thayer . . . . . 15

Window Winterizing with Wiggly Worms by John Kubricky . . . . . 16

Styrofoam Shutter Systems drawn by Tony Rau . . . . . 17

Effective Window Use Can Save on Fuel Bills . . . . . 20

Every Day -- Sun Day compiled by Dana McDill . . . . . 18

**N79-30779#** California Univ. Berkeley. Lawrence Berkeley  
Lab.

**ENERGY UTILIZATION ANALYSIS OF BUILDINGS**

M. Lokmanhekim Jun. 1978 20 p refs Presented at the  
Symp. on Solar Energy, Cairo, 16 Jun. 1978  
(Contract W-7405-eng-48)

(LBL-7826, Conf-780667-4) Avail. NTIS HC A02/MF A01

The accurate calculation of the energy requirements and heating and cooling equipment sizes for buildings is one of the most important, as well as one of the most difficult problems facing the engineer. The fundamental principles utilized in the procedure developed by American Society of Heating, Refrigeration, and Air-Conditioning Engineers are explained and brief descriptions of the computer programs using these procedures are given. Such computer programs generally are capable of simulating the thermal response of a building to all sources of heat gains and losses, accounting for all nonthermal energy requirements in the building or on the site, translating the building operating schedules into energy demand and consumption, identifying the peak capacity requirements of heating and cooling equipment, and performing an economic analysis that would select the most economical overall owning and operating cost, equipment and energy source that minimize the building's life cycle cost. DOE

**Thermal Insulation for Residential Homes (Citations from the NTIS Data Base).**

Guy E. Habercom, Jr.  
National Technical Information Service, Springfield, Va.  
Apr 78, 105p  
NTIS/PS-78/0353/9WE Price code: PC N01/MF N01

Materials and installation methods for thermal control of residential buildings are investigated in these Federally-funded research reports. The thermal efficiency of window glass, cellular materials, glass wool, fibers, wood, and other insulating materials is reviewed. (Contains 100 abstracts)

**INSULATION AND THE "M" FACTOR.**

Mario J. Catani  
ASHRAE Journal, Vol. 20, No. 6, June 1978,  
p. 50-55.

**ASHRAE Standard 90-75 "Energy Conservation in New Building Design" recommends that in addition to the criteria set forth in the standard, a proposed design should consider thermal mass. In Section 4.4.3, Cooling Criteria, consideration is given to the mass of a wall when the formula given for compliance with the standard is applied. However, no provisions are given for consideration of mass when checking for compliance of a wall or roof system in heating applications. This article presents the development of a simplified correction factor that is intended to be used when checking walls and roofs for compliance with the requirements of 90-75 in heating applications.**

**A NEW AIR SOURCE HEAT PUMP SYSTEM.**

T. atsuda, et al.  
ASHRAE J., v.20, no.8, Aug.1978, p.32-35.

*The authors propose a new heat pump system to solve problems accompanied by traditional air-source heat pump systems. In this paper they report results of a study which examined performance characteristics.*

TJ  
163.5  
.B84  
E528 Energy conservation in heating, cooling, and ventilating buildings : heat and mass transfer techniques and alternatives / Economically Optimal Heat Protection in Buildings

K. Gertis 15

Finite Element Analysis of Heat and Mass Transfer in Buildings

G. Comini and S. del Giudice 25

Thermal Resistance of Structural Members under Unsteady Conditions

Yu. N. Kuznetsov 37

Simultaneous Heat and Moisture Transfer in Porous Wall and Analysis of Internal Condensation

M. Matsumoto 45

Fundamentals of Moisture and Energy Flow in Capillary-Porous Building Materials

J. Claesson 59

Moisture Transfer in Porous Medium under a Temperature Gradient

J. P. Gupta and S. W. Churchill 71

An Engineering System for Determining Thermal and Moisture Transfer Properties of Structural Materials

A. Shaw 83

Effects of Infiltration on Heat Transfer through Vertical Slot Porous Insulation

P. J. Burns and C. L. Tien 93

The Effect of Convective Heat Exchange on Thermal-Insulating Properties of Permeable Porous Interlayers

V. A. Brailovskaya, G. B. Petrazhitsky, and V. I. Polezhaev 107

Radiative Energy Transfer Effects on Fibrous Insulating Materials

E. Özil and R. Birkebak 115

Analysis of Heat Transfer through Walls with Vertical Air Layers and Wall

**HOUSE ON ICE.**

EPIR Journal, v.10, no.3, Dec.1978, p.26-28.

28 House on Ice

DOE is pursuing an unusual concept for heating and cooling that has the potential for big energy savings.

TH Dillon, Joseph B.  
 1715 Thermal insulation : recent developments  
 .D55 / Joseph B. Dillon. — Park Ridge, N.J. :  
 Noyes Data Corp., 1978.  
 xi, 339 p. : ill. ; 24 cm.

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Cast Reinforced Panels .....	7
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HEAT PUMPS: OFF AND RUNNING . . . AGAIN, by Leon R. Glicksman.  
 Technology Review, vol. 80, no. 7, June/July 1978,  
 p. 64-70.

Heat pumps appear to defy the law of energy conservation by producing thermal output two to three times greater than their mechanical input. But public unfamiliarity and the poor performance of some early models hamper their acceptance.

TH Dillon, Joseph B.  
 1715 Thermal insulation : recent developments  
 .D55 / Joseph B. Dillon. — Park Ridge, N.J. :  
 Noyes Data Corp., 1978.

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Energy Conservation in Existing Office Buildings  
 Appendices to Report, Phase I, Volume 2

Dept. of Energy Document C00-2799-T2, June 1977  
 Contract no. EY-76-C-02-2799

SAWING SOLAR COSTS IN HALF, by Al Weinstein, Dick Duncan, Gordon Van Zuiden, Dick Niess and Mike Kaplan.

Solar Heating & Cooling, vol. 3, no. 5, October 1978, p. 48-51.

The Westinghouse Native Sun™ Solar-Assisted-Templifier (S-A-T) hot water system is a combination of a solar energy collection system with a Templifier heat pump. They are piped together physically and operationally.

HOW TO USE TILT WEATHERSTRIP.

Eric Larson

Alternative Sources of Energy, No. 32, June 1978, p. 4-5

Retrofitting existing houses to improve their energy consumption is becoming more important daily. In this article a process developed by staff consultant Darryl Thayer will be described. The materials are available through a local lumber yard, and their incorporation into this application is now becoming common.

Energy Conservation in Existing Office Buildings  
Volume 1 - Phase I

Dept. of Energy Document COO-2799-T1, June 1977  
Contract no, EY-76-C-02-2799

Energy Conservation in Existing Office Buildings  
Phase II

Dept. of Energy Document COO-2799-T5, August 1978,  
Contract no. EY-76-C-02-2799

The major thrust of Phase II deals with establishing the potential value and feasibility of retrofitting conservation measures and determining how best to achieve desired energy savings practically. Other facets of the study dealing with definition and removal of barriers to achieve feasible conservation measures will be reported on with the next phase.

SOLAR-ASSISTED HEAT PUMPS

C. P. Gilmore

Popular Science, vol. 212, no. 5, May 1978, p. 86-90

Link these two systems, engineers say, and they compensate for each other's limitations

GROUND-WATER HEAT PUMPS: HOME HEATING AND COOLING  
FROM YOUR OWN WELL.

R. Gannon.

Popular Science, Feb. 1978, p. 78-82.

If you're building a home or just planning to replace your furnace, a ground-water heat pump may be what you're looking for.

What?

A ground-water heat pump is a device that cools water—usually from a well—and then pumps the extracted heat into your home. In summer, it withdraws heat from the inside air and uses water to carry it away.

**A NEW FENESTRATION MATERIAL FOR HEAT PROTECTION.**

N. C. Varshneya & V. V. Verma

*Energy and Buildings*, Vol. 1, No. 4, June 1978, p. 383-391

*This work applies the Mie scattering theory to the case of polydisperse spherical air bubbles embedded in a transparent medium. It calculates the attenuation through such medium of normally incident solar radiation. The attenuation depends on the size parameter,  $x$ ; where  $x$  is  $2\pi$  times the ratio of bubble radius to the incident wavelength. By proper choice of the bubble size the attenuation can be made skew with respect to the wavelengths of incident solar radiation.*

*A practical application of this theory has been made in the design of fenestration material. The bubble size can be so chosen as to attenuate the larger wavelengths considerably more than the shorter ones. This will suit the fenestration requirements of the tropical climate, insofar as the elimination of heat is desirable.*

*A fenestration material (a Perspex sheet with air bubbles embedded in it) based on these considerations has been prepared and attenuation of normally incident radiation from an artificial source, simulating solar radiation, through it has been measured experimentally. The results are in good agreement with the theoretical calculations obtained for such case. The cut-off is about 14%.*

**PERFORMANCE ANALYSIS AND COST OPTIMIZATION OF A SOLAR - ASSISTED HEAT PUMP SYSTEM.**

J. W. MacArthur, et al.

*Solar Energy*, Vol. 21, No. 1, 1978, p. 1-9.

The study presented here is a performance analysis and cost optimization of a solar-assisted heat pump system for space and domestic hot water heating. Since air conditioning is not generally needed in the New England area, this study did not consider the heat pump as part of an air conditioning system. If air conditioning is required, the competitive position of the solar system would probably be improved[5].

**HEAT-PUMP WATER HEATER**, by Brenda Becker.

*Popular Science*, vol. 213, no. 6, December 1978, p. 132.

**A heat-pump water heater works like any other heat pump—or like an air conditioner in reverse [PS, July]. It uses standard principles of refrigeration to draw heat from the air surrounding the evaporator coil (which sits on top of the water tank). Then it augments that heat in the compressor and releases it through the condenser coil immersed in the water tank, thus heating the water.**

**A HEAT PUMP DRIVEN OPTIMAL HEATING SYSTEM.**

H.E. HARPSTER.

*IEEE Trans. Industry Applications*, v. IA-14, no.4, July/Aug.1978, p.357-363.

*Abstract—Optimizing a heat pump driven forced-air domestic heating system utilizing solar/thermal energy storage and off-peak storage from the electric power network is discussed. The system proposed is modeled and simulated on the digital computer. An optimal controller is then developed to maximize comfort and minimize conventional energy consumption. The controller is then simulated with the heating system for the University of Toledo experimental electric/solar house, Toledo, OH, and shown to be truly optimal and able to control the system in a desirable manner.*

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## THE USE OF HEAT PUMPS IN REDUCING FUEL CONSUMPTION FOR NONSOLAR CLIMATE CONTROL OF BUILDINGS

W. Leidenfrost

Energy

Vol. 3, no. 1, February 1978,

p. 83 - 93.

**Abstract**—Heating and climate control are of world-wide importance since these processes demand a large percentage of the total energy consumption of all nations. Conversion of energy stored in fossil fuels for heating, by direct combustion in a furnace or by electrical resistance heating via power produced in a power plant, exhibits very low efficiency. This implies that our consumption of primary fuels is several fold larger than the amount really needed for accomplishing the desired climate-control function. Large improvements are possible and should be achieved. These improvements can be attained by reversible heating, i.e. by use of optimized heat pumps powered by work produced from fuels with high efficiency. Several systems are described which utilize readily available technology and know-how. Similar improvements are possible by identical means in other low-temperature processes.

## METAL HYDRIDES AS CHEMICAL HEAT PUMPS, by D. M. Gruen

M. H. Mendelsohn and I. Sheft

Solar Energy, vol. 21, no. 2, 1978, p. 153-156

Applications of the "heat pump" concept have been discussed for more than 100 years as a result of the study of refrigerating machines in the 1870's. We wish to distinguish chemical heat pumps from the general class of heat pumps as those which rely on chemical equilibria rather than mechanical compressors for their operation. Interest in solar energy driven heat pumps including chemical heat pumps has recently been shown[1-3]. A two metal hydride chemical heat pump system using solar or any other appropriate energy source for space heating and cooling, refrigeration and power production has been proposed[4]. In this paper, we describe in detail the refrigeration mode of operation for a two metal hydride chemical heat pump system. The derivation of general heat pump equations which may be applied to any pair of compounds, which depend on a linear relationship of  $\ln P$  vs  $1/T$  for their heat pump utility will also be given.

## A HIGH TEMPERATURE ABSORPTION HEAT PUMP AS TOPPING PROCESS FOR POWER GENERATION, by

G. Alefeld

Energy, vol. 3, no. 5, October 1978, p. 649-656

**Abstract**—With a high temperature absorption heat pump as a topping device to the Rankine-water cycle, the efficiency for power generation may be improved by 40-50% above present values. A possible heat pump process working with water as absorbent and CaO as absorber is discussed by using diagrams which are suited to study the combination of a heat pump with the Rankine cycle.

## A SOLAR - ASSISTED HEAT PUMP SYSTEM FOR HEATING AND COOLING RESIDENCES.

B. W. Tlemimat & E. D. Howe

Solar Energy, Vol. 21, No. 1, 1978, p. 45-54.

**Abstract**—A significant impact of solar energy applications on the total energy demand requires systems or devices which can be retrofitted to existing energy users. The all electric residence unit, which includes about 10 per cent of all such units in the U.S.A. and constitutes over half of those completed in 1973, seems particularly suited to a solar modification. It is proposed that heating and cooling of the all-electric residence unit be accomplished by using a solar-assisted heat-pump system. The proposed system makes use of a conventional air-conditioning unit which would be modified by fitting controls to reverse the flow of refrigerant for the heating mode and by changing the outdoor heat exchanger from refrigerant-to-air to refrigerant-to-water. In addition, there would be provided a solar collector and two insulated water-storage tanks. Water from one tank would be circulated through the refrigerant-to-water heat exchanger when needed and then returned to the other tank, so that essentially a source of heat of constant temperature would be maintained, thus decreasing the temperature interval for the heat pump and thereby saving energy. In the cooling mode the stored water would be cooled by exposure of the solar collector to the night sky to decrease the temperature interval for the heat pump, thereby reducing energy consumption. Calculations were made for an existing residence unit for which the total energy input is known and to which the proposed solar-assisted heat-pump system is applied. An estimated cost of equipment and of its operation is compared with the cost of owning and operating fuel and electrically heated systems. It is concluded that the solar-assisted heat-pump system with current fuel prices can provide immediate economic benefit over the all-electric home and is possibly on par with residences using fuel oil or liquefied petroleum gas, but it yields higher cost over systems using natural gas. The effect of a two-phase expander to replace the expansion valve in the refrigerant circuit has been theoretically investigated. It shows a significant energy saving worthy of further economic and practical consideration.

### Heat Pumps (Citations from the Engineering Index Data Base).

National Technical Information Service, Springfield, Va.

Mar 78, 249p

NTIS/PS-78/0166/5WE Price code: PC N01/MF N01

### Heat Pumps (Citations from the NTIS Data Base).

National Technical Information Service, Springfield, Va.

Mar 78, 99p

NTIS/PS-78/0165/7WE Price code: PC N01/MF N01

## HEAT PUMP TECHNOLOGY.

A Survey of Technical Developments, Market Prospects, and Research Needs.

Gordian Assoc, Inc. for DOE.

Contract EX-76-C-01-2121. June 1978. 464p.

N79-13540 #

Energy Conservation in Existing Office Buildings  
Phase III

Dept. of Energy Document COO-2799-T4, August 1978  
Contract no. EY-76-C-02-2799

A significant goal of the study on Energy Conservation in Existing Office Buildings was to determine the constraints and/or the adverse consequences of possible conservation measures and how to overcome any barriers.

Other goals were to develop realistic energy consumption budgets, if it was determined that this was the proper approach; and if not, to propose an alternative approach; and to indicate applicability of recommendations and methodologies for application to other building types and geographical regions of the U.S.

This report, the third in a series, concerns itself with the findings and recommendations with respect to the above.

Also, this report contains a revision of Questionnaire No. 2 (see Phase I report) in the Appendix.

**N80-10624#** Brookhaven National Lab., Upton, N. Y.  
**SOLAR ASSISTED HEAT PUMP OVERVIEW AND SUMMARY OF IN-HOUSE RESEARCH**

John W. Andrews Sep 1978 5 p refs Presented at the 3rd Ann. Solar Heating and Cooling R and D Contractors' Meeting, Washington, D. C. 24 Sep. 1978  
(Contract EY-76-C-02-0016)

(BNL-24911; Conf-780983-2) Avail: NTIS HC A02/MF A01  
The following areas of solar assisted heat pump research and development are overviewed: (1) development of special heat pump tuned to take advantage of the 40 to 100 F source temperature range appropriate for solar assist; (2) identification of low cost, solar energy collection and storage subsystems appropriate for the solar assist function; and (3) analysis of solar assisted heat pump systems to determine what component parameters are required to produce economically competitive systems. DOE

**N80-12613#** Energy Utilization Systems, Inc., Pittsburgh, Pa.  
**RESEARCH AND DEVELOPMENT OF A HEAT AND PUMP WATER HEATER, VOLUME 1 Final Report**  
R. L. Dunning, F. R. Amthor, and E. J. Doyle Aug. 1978 69 p refs

(Contract W-7405-eng-26)  
(ORNL/SUB-7321-1) Avail: NTIS HC A04/MF A01

An electric heat pump water heater with an operating efficiency of 2.5 in average conditions of 70 to 75 F ambient air and 55 to 60 F supply water was designed. Separate heat pump designs are available for new water heaters and for retrofitting of existing ones. The condenser is a dual tube direct immersion type which enters the tank through a special 4-in. hole in the top of new tanks. For retrofit units, the condenser is in the form of a helix and is screwed into the tank through the hole normally used by the lower resistance element. The payback period is dependent on the amount of hot water consumption and the price of electricity. In warm climates, the benefit/cost ratio will be improved by higher efficiency from warmer ambient air and by the value of free air conditioning and dehumidification provided while the unit is operating. In colder climates, the improved efficiency from colder supply water and the higher operating savings from higher kilowatt-hour use because of the cold water tend to offset the effect of the less favorable climate. DOE

**N80-15610#** California Univ., Livermore, Lawrence Livermore Lab.

**ANALYTICAL MODELING OF HEAT PUMP UNITS AS A DESIGN AID AND FOR PERFORMANCE PREDICTION**  
M.S. Thesis - Calif. Univ., Berkeley

Jack Edwin Flower 8 Dec. 1978 149 p refs  
(Contract W-7405-eng-48)

(UCRL-52618) Avail: NTIS HC A07/MF A01

Three computer programs for simulating the operating characteristics of heat pump units are described. Program THERMO calculates heat pump performance coefficients of idealized units based purely on thermodynamic considerations. Program DESIGN computes heat exchanger size requirements and operating information for a desired heat pump cycle based on input saturation temperatures in the evaporator and condenser, and heat exchanger configuration. Program PREDICT enables a model of the operation of an existing or proposed heat pump unit, given certain physical dimensions, to be designed. DOE

79N13540# ISSUE 4 PAGE 482 CATEGORY 44 RPT#:  
HCP/M2121-01 CNT#: EX-76-C-01-2121 78/06/00 562  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Heat pump technology: A survey of technical  
developments, market prospects and research needs  
CORP: Gordian Associates, Inc., New York. AVAIL:NTIS  
SAP: HC A24/MF A01

MAJS: /\*ENERGY TECHNOLOGY/\*HEAT PUMPS/\*MARKET RESEARCH/\*  
TECHNOLOGY ASSESSMENT

MINS: / COMPUTERIZED SIMULATION/ ENERGY CONVERSION  
EFFICIENCY/ HEATING EQUIPMENT/ LIFE CYCLE COSTS

ABA: DOE

ABS: The on-site energy consumption, energy and life cycle  
cost, market prospects, institutional factors and  
primary or resource energy efficiency of heat pumps  
for residential and commercial applications were  
evaluated. Calculations of the on-site and primary  
energy effectiveness, and cost of conventional and  
advanced heat pumps in comparison to electric and  
combustion furnaces and baseboard heat were made by  
means of two hour-by-hour computer simulation  
programs; one for a 2-story frame residential  
building, one for a 2-story masonry office building.  
These buildings were hypothetically moved about to  
nine different locations (cities) selected as  
representative of the various climatic regions of the  
continental United States. Electric heat pumps were  
more efficient than any other all-electric HVAC  
system. The general conclusion is that no residential  
or commercial HVAC system is universally to be  
preferred to any other if energy effectiveness,  
life-cycle cost, building application and other  
pertinent factors are considered.

#### FUNDAMENTALS OF BUILDING HEAT TRANSFER

Tamami Kusuda

Journal of Research Nat. Bur. Stds.,

Vol. 82 no. 2 Sept-Oct. 1977

p. 97-106

Basic problems and unique features of building heat transfer are described in relation to the heating and cooling load calculation, which is a starting point for building energy consumption analysis and equipment sizing. Detailed discussion is given of the relationship between heat loss (heat gain) and heating load (cooling load). Also outlined is a discussion of the multi-space heat transfer problem in which the air and heat exchange equations among adjacent spaces in a building are solved simultaneously with the radiant heat exchange equations for the surfaces of each room.

#### A COMPARISON OF THERMAL REQUIREMENTS OF BUILDINGS

Stephen Jaeger

Energy and Buildings

Vol. 1, no. 2, October 1977,

p. 159-166.

*In the U.S.A., thermal requirements for buildings have the form of resistance, R for U values; in European countries, the weight or mass of the building shell is included as part of the thermal requirement for a building. In this study, these European thermal requirements, which vary substantially, are numerically tested and compared. The comparison is the ratio of heat transmitted during a day by a wall which incorporates the thermal requirements to a wall which has no mass and only thermal resistance. The comparison shows a wide discrepancy in the thermal response of the requirements for different countries. For the purpose of comparison, the physical properties of the thermal requirements are normalized to groups which are part of the solution to the differential equation of heat transfer. Also compared are Givoni's recommended requirements which, in relation to other requirements, show good consistency.*

Energy, v.2, 1977, p.461-64.

#### CHARACTERIZATION OF BUILDING INFILTRATION BY THE TRACER-DILUTION METHOD

P. L. LAGUS

Systems, Science & Software, P.O. Box 1620, La Jolla, CA 92038, U.S.A.

(Received 24 February 1977)

**Abstract**—Air infiltration is an important factor in the total energy budget of a structure. It is also a significant parameter in indoor-outdoor air pollution relationships. Air infiltration cannot be reliably calculated but must be measured in a structure of interest. The tracer-dilution method is a useful technique to determine infiltration rates. This technique entails measurement of the logarithmic dilution rate of a tracer gas concentration with respect to time.

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163.5  
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Lee, Kalman

Encyclopedia of energy-efficient building design : 391 practical case studies / by Kalman Lee. Boston : [Environmental Design and Research Center], 1977.

2 v. (1023 p.) : ill. ; 27 cm.

Includes bibliographical references and indexes.

1. Buildings -- Energy conservation -- Case studies. I. Title.

HARMONIC ANALYSIS OF BUILDING THERMAL RESPONSE APPLIED TO THE OPTIMAL LOCATION OF INSULATION WITHIN THE WALLS  
Robert C. Sonderegger  
Energy and Buildings  
Vol 1, no. 2, October 1977,  
p. 131-140.

*The analysis of heat transfer through building walls using Fourier transforms and the matrix method are briefly reviewed. The formalism is applied to a simple one-room building. By making a few simplifying assumptions and by considering only one- or two-layer walls and roofs, the equations are kept sufficiently short to preserve the insight of the reader into the effects of a few construction features upon the building's thermal response. Such construction features, mainly the placement of insulation inside or outside the main wall mass, are extensively discussed, with an eye on their potential energy savings.*

**Savings in Energy Consumption by Residential Heat Pumps: The Effects of Lower Indoor Temperatures and of Night Setback.**

R. D. Ellison.

Oak Ridge National Lab., Tenn. Jan 77, 32p  
ORNL/CON-4 Price code: PC A03/MF A01

The energy saving potential of reduced indoor temperatures and of night setback is examined for residential heat pumps.

COST-EFFECTIVE THERMAL INSULATION.

M.R. Harrison and C.M. Pelanne.

Chemical Engineering, v.84, no.27, Dec.19,1977, p.62-76

With increasing energy costs, increased insulation can give a greater return on investment than increased plant capacity. Here is what you need to know about insulation selection, thickness calculations and economics.

N79-32732# MITEC G.m.b.H. Ottobrunn (West Germany).  
**THE USE OF THE HEAT PUMPS TO RAISE TEMPERATURES IN AN ECONOMICAL AND ECOLOGICAL WAY Final Report.**  
Jul. 1977

Max Huber and Fritz Bukau Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 295 p refs  
(Contract BMFT 03E-5211-A/ETS-0004-A)  
(BMFT-FB-T-78 35) Avail. NTIS HC A13/MF A01; Fachinformationszentrum. Eggenstein-Leopoldshafen. West Ger. DM 61.75

The use of heat pumps to transfer the cooling water from plant condensers to a hot water district heating system was investigated both from a thermodynamic and economic point of view. A model of the system was derived and evaluated in detail. The specific consumption of primary energy and the expected specific heat costs were determined, depending on different parameters. Results show that if certain marginal conditions are presumed, such district heating system may be equivalent to or even better than conventional hot water district heating performed on the basis of combined power-heat generation. Author (ESA)

54587 (IDO-1570-T17) Heat pumps: primer for use with low temperature geothermal resources. Keller, J.G. (Idaho National Engineering Lab., Idaho Falls (USA)). 16 Nov 1977. Contract EY-76-C-07-1570. 24p. Dep. NTIS, PC A02/MF A01.

Attention is focussed on using heat pumps to obtain heat energy from low temperature geothermal resources. The principles of heat pumps are examined to explore applications in residential and commercial heat requirements. Availability and costs are discussed. This is intended to serve as a primer and user document requiring no background in heat pump technology. (MHR)

TA Institute of Environmental Sciences.  
 1 Environmental technology '77: proceedings.  
 .I39913 — Mt. Prospect, Ill. : The Institute, c1977.  
 1977 xviii, 437 p.  
 23rd annual technical meeting held in Los  
 Angeles, Calif. April 25-27, 1977.  
 ISBN 0-915414-17-1  
 1. Environmental testing. 2.  
 Environmental engineering—Societies, etc.  
 I. Title.

COST EFFECTIVE SOLAR AUGMENTED HEAT PUMP/POWER BUILDING SYSTEMS  
 By Milton Meckler . . . . .

Pg 118

TU International Solar Energy Society. UK Section.  
 R10 Economic & commercial assessment of  
 .I55 solar energy conversion : conference (C12)  
 at the Royal Institution July 1977. —  
 London : UK - ISES, c1977.  
 98 p. : ill. ; 30 cm.  
 Includes bibliographical references.  
 1. Solar energy—Congresses.  
 I. Title.

The Heat Pump in Relation to Solar Energy  
 J. KEABLE p. 43

RESIDENTIAL HEAT PUMP USE: SAVING ELECTRICAL  
 ENERGY  
 Dr. Mark J. Nicolich  
 ASHRAE Journal  
 Vol. 19, no. 2 December 1977  
 p. 22-23.

*The author considers electrical power consumption in a single-family residence over a four-year period—three heating seasons with electric resistance heat and one with a heat pump. He finds that power consumption is related to monthly heating degree days through two least squares regression analyses. Using these results, the relative efficiency, COP and overall dollar values are discussed.*

TK Intersociety Energy Conversion Engineering  
 2996 Conference, 12th, Washington, 1977.  
 .I55 779064 — Development of the HSPF Gas Heat  
 1977 Pump, P. F. Swensen, Cons. Natural Gas Serv.  
 Co., Cleveland, O.; R. K. Rose, Mechanical  
 Technology Inc. . . . . 390  
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 779065 — Development of a Stirling Engine Pow-  
 ered Heat Activated Heat Pump, W. L. Auxer,  
 General Electric Co., Valley Forge, Pa. . . . . 397  
 779066 — A Heat Pump Cycle with an Air-Water  
 Working Fluid, E. C. Hise, J. V. Wilson, Oak  
 Ridge National Lab., Oak Ridge, Tenn. . . . . 402  
 779068 — Free-Piston Heat Pumps, G. M. Benson,  
 Energy Res. & Gen., Inc., Oakland, Calif. . . . . 416

CH-142,668, v.1-3 1977  
 AN INVESTIGATION OF METHODS TO IMPROVE HEAT PUMP  
 PERFORMANCE AND RELIABILITY IN A NORTHERN CLIMATE.  
 VOLUME I, VOLUME 2: APPENDIX A, VOLUME 3: APPENDICES  
 B,C,D. (Final Rept. Research Proj.544-1). Jan.  
 1977.

Electric Power Research Inst., EPRI EM-319  
 Palo Alto, Calif. v.1-3  
 Westinghouse Electric Corp.,  
 Pittsburgh, Penn.

Heat pumps  
 Power sources, Solar - Heating & cooling

N79-33671# National Aeronautics and Space Administration,  
 Langley Research Center, Hampton, Va  
 NASA TECH HOUSE: AN EARLY EVALUATION  
 1977 23 p refs  
 (NASA-TM-80751) Avail: NTIS HC A02/MF A01 CSCL  
 10A

A.; architect-engineering firm, as well as university partici-  
 pants, performed system studies, evaluated construction methods,  
 performed cost effectiveness studies, and prepared construction  
 drawings which incorporated the selected technology features  
 into a final design. A Technology Utilization House (Tech House)  
 based on this design was constructed at the NASA Langley  
 Research Center in Hampton, Virginia. The Tech House is  
 instrumented so that the performance of the design features  
 and energy systems can be evaluated during a planned family  
 live-in period. As such, the house is both a demonstration unit  
 and a research laboratory. The Tech House is to demonstrate  
 the kind of single-family residence that will probably be available  
 within the next five years. G.Y.

THE UNITARY HEAT PUMP INDUSTRY: 25 YEARS OF PROGRESS.  
J.A. Pietsch.  
ASHRAE J., v.19, no.7, July 1977, p.15-18.

*The heat pump industry came up the hard way. It had no government funding or subsidies. The industry did the work and took the risks, made errors and corrected them. After 25 years, the industry is scarred, but strong, with a demonstrated record of responsibility and accomplishment. This paper was presented before the 39th Annual Meeting of the American Power Conference last April, sponsored by Illinois Institute of Technology.*

N78 27583# State Univ of New York, Albany.  
SOLAR ENERGY AND THE HEAT PUMP IN A NORTHERN CLIMATE Final Report  
R. Stewart, J. Healey, B. Murphy, and J. Scott -Dec. 1977  
68 p refs  
(EPRI EA 407) Avail: NTIS HC A04/MF A01

The performance of copper solar panels with a water-to-water heat pump, an air-to-water heat pump, an electric boiler, and two eight thousand gallon storage tanks is reported. The heated building was instrumented to provide data for the time variant electric power demands, the impact of meteorological variables, peak storage capabilities, the efficiency of the solar panels, coefficient of performance of the heat pumps, and heating system performance factor. Computer simulations of the heat budget of the building were prepared and verified. A series of economic analyses were performed comparing the air source heat pump to the solar assisted water-to-water heat pump and using a base case of electric heating peak shaving. Incremental costs were included but the peak shaving capability was not tested. It is indicated that the air source heat pump has a higher coefficient of performance than the solar assisted water-to-water heat pump. The solar system provides 33% of the heating load during peak winter operating conditions. ERA

(AD-A 041024) Demonstration of building heating with a heat pump using thermal effluent. Special report, Sector, P.W. (Cold Regions Research and Engineering Lab., Hanover, NH (USA)) May 1977. 30p. (CRREL-SR-77-11) NTIS PC A03/MF A01.

Efforts made to recover waste heat and to reuse it to heat a building are described. A heat pump, which is a refrigeration device, was operated to provide building heat and to demonstrate both economic benefits and energy savings possible with this type of heating system. Heat pump fundamentals and system design considerations supplement the report of this demonstration project. Operational characteristics were monitored and are reported. A 25% reduction in heating costs was observed compared with an oil-fired system. It is recommended that the minimum coefficient of performance should be 3.4 for a cost effective, energy conservative heat pump heating system.

TAKING ADVANTAGE OF URETHANE FOAM IN THE FAST-GROWING INSULATION MARKET.

R. Martino.

Modern Plastics, v.54, no.10, Oct.1977, p.44-48.

**Tougher regulations coming on flame spread and smoke suppression? Developments in materials and installation systems provide multiple advanced options that do a lot more than simply cope**

**BUILDING TECHNOLOGY: Mechanical & Electrical Systems.**  
by William J. McGuinness and Benjamin Stein. 1977. John Wiley & Sons, 605 Third Ave., New York, NY. 10016, 612 pp., bound, \$19.95.

Richly illustrated, this textbook discusses the basic principles and systems of heating, cooling, ventilation, plumbing, electricity and lighting. It includes an analysis of mechanical and electrical building systems with actual construction drawings, uses residential and nonresidential buildings as working examples, provides details in drafting and layout technology details, and analyzes building types to establish principles which can be applied to most structures for determining equipment type and function.

Economic evaluation of heat pumps. Kernan, G.; Brady, J. *Int. J. Energy Rev.* 1: No. 2, 115-125(1977).

The economics of heat pumps is evaluated by comparing the operating costs and discounted capital costs with those of oil-fired boilers. The study's purpose was to determine the energy utilization efficiency and the technical as well as economic characteristics of heat pumps. The tests, conducted in Ireland, determined the theoretical breakeven coefficient of performance for a range of fuel prices, with consideration given to Irish climatic conditions.

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DR. EDWARD'S AIR CYCLE HEAT PUMP (ROVAC).  
Building System Design, v.74, no.2, Feb./Mar.1977,  
p45-58.

ROVAC, a rotary vane air cycle heat pump may be the answer to fluorocarbon pollution and the need for more efficient automobile cooling and heating and cooling buildings.

HEAT PUMPS WORLDWIDE.  
ASHRAE J., v.19, no.7, July 1977 p.34.

Heat pumps in Australia, German Federal Republic, Great Britain, Japan, and Sweden.

Optimising heat exchangers for air-to-air space-heating heat pumps in the United Kingdom. Blundell, C.J. (Electricity Council Research Centre, Capenhurst, Eng.). *Int. J. Energy Res.*; 1: No. 1, 69-94(1977).

The paper deals with some of the major aspects of heat-exchanger design for electric heat pumps. After a discussion of heat-transfer theory, it describes a method that can be used in the design and sizing of air-to-refrigerant heat exchangers and in calculating temperature distributions. As an illustration, economically optimum sizes for exchanger coils are given for heat pumps of output 13.9 kW, 5.6 kW, and 5 kW at 5°C outside the ambient temperature. At several stages, manufacturer's experimental data have been used, and the final results are compared with the design of heat exchangers used in commercially available models. Some temperature measure-

HEAT PUMP  
Popular Science, v. 211, no. 4, October 1977  
p. 84-86.

Solar assisted heat pump.

MAN, CLIMATE AND ARCHITECTURE—Second Edition. By B. Givoni. 1976. Applied Science Publishers Ltd, Ripple Rd, Barking, IG110SA, Essex, England, 483 pp., bound, \$40.

Equal emphasis is given to the physiological, physical and architectural aspects of the relationship between climate, man and architecture. New data on several biophysical predictive models of various physiological responses to work, the thermal environment and clothing properties are summarized in Chapter 3. Chapter 10 has been re-written with emphasis on the description of the motion of the sun and architectural methods of sun control. A new chapter discusses the use of natural energy for heating and cooling of buildings and analyzes the suitability of different systems to different climatic conditions and building types.

ENERGY CONSERVATION TECHNIQUES: CONVERTING DUAL DUCT HEAT PUMP TO VARIABLE AIR VOLUME.

J.B. Olivieri and T.s.Singh.  
ASHRAE J., v.19, no.7, July 1977, p.28-29.

*The objective of this paper is to analyze the operation of an internal source heat pump in an existing school building and to study the effect of various changes in the energy consumption for this system. This analysis enabled the authors to recommend changes that produce optimum savings.*

THE ANNUAL CYCLE ENERGY SYSTEM: A HYBRID HEAT PUMP CYCLE.

Richard A. Biehl  
ASHRAE J., v.19, no.7, July 1977, p.20-24.

*Suppose there was a hybrid heat pump system that could supply all of a building's heating demands, at any temperature whatsoever, without the use of additional heat: No electric resistance, no oil, no gas, no coal. The Annual Cycle Energy System (ACES) does this and much, much more.*

Controlled environment laboratory for the testing of domestic heat pumps. Buick, F.R.; McMullan, J.T.; Morgan, R.; Murray, R.H. (New Univ. of Ulster, Coleraine, Northern Ireland). *Int. J. Energy Res.*; 1: No. 1, 47-54(1977).

The construction and operation of a controlled-environment laboratory for the testing of domestic heat pumps is described. The operational range of the laboratory is -5°C to 20°C with relative humidity up to 100%. Air-to-water heat pumps of up to 16 kW heating capacity can be tested with the present design but modifications to allow for the testing of larger units or of air-to-air units are also described. The laboratory is stable to within 1°C and 5% relative humidity, and has a recovery time of 12 min to a perturbation of 3 kW. The test procedure for air-to-water heat pumps is described in detail and some preliminary results presented.

WHERE DOES THE HEAT PUMP STAND TODAY?  
Power, v.121, no.4, Apr.1977, p.80-83.

Although the concept of the electric heat pump is not new, its attraction to owners and users has never been more dazzling than today. The attraction is across the board—residential, commercial, industrial, institutional. Unitary shipments for residential and light commercial applications have been the most spectacular, but as fuel oil and natural gas are further restricted for large-scale use, the heat pump should take on a new and hopefully lasting glitter for heating/cooling systems for comfort and process.

10 DESIGN PRINCIPLES FOR AIR-TO-AIR HEAT PUMPS.  
A. Trask.  
ASHRAE J., V.19, no.7, July 1977, p.30-33.

THE current energy crisis has established the need for air-to-air heat pumps as the universal replacement of combustion equipment for comfort heating. These reversible air conditioners have the capability of harnessing solar radiation after it has been collected and stored in the outdoor air, making duplicate collecting and storage unnecessary. Whether or not the heat pump is now able to meet that need, however, is another question.

N78-26600f Oak Ridge National Lab., Tenn.

**UNITARY AIR-TO-AIR HEAT PUMPS**

J. E. Christian Jul. 1977 51 p refs

(Contract W-31-109-eng 38)

(ANL/CES/TE-77-10) Avail: NTIS HC A04/MF A01

Commercially available unitary heat pumps ranging from nominal capacities of 1.5 to 45 tons were evaluated. The nominal COP of the heat pump models, selected as representative, vary from 2.4 to 2.9. Seasonal COPs for heat pump installations and single-family dwellings are reported to vary from 2.5 to 1.1, depending on climate. For cooling performance, the nominal EER's vary from 6.5 to 8.7. Representative part-load performance curves along with cost estimating and reliability data are provided to aid: (1) the systems design engineer to select suitably sized heat pumps based on life-cycle cost analyses, and (2) the computer programmer to develop a simulation code for heat pumps operating in an Integrated Community Energy System. ERA

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1976  
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Solar heating and cooling of buildings :  
joint conference, American Section, Inter-  
national Solar Energy Society and Solar  
Energy Society of Canada, inc., August 15-  
20, 1976, Winnipeg / editor, K. W. Boer. --  
Cape Canaveral, Fla. : American Section of

HEAT PUMP SYSTEMS *International Solar Energy Society*

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LIMITATIONS OF THE ARKLA SOLAIR ABSORP-  
TION COOLING SYSTEM

NA Portman, John Calvin.  
737 The architect as developer / by John  
.P63 Portman and Jonathan Barnett. — New York :  
B37 McGraw-Hill, c1976.  
198 p. : ill. (some col.) ; 29 cm.  
Includes index.  
ISBN 0-07-050536-5  
1. Portman, John Calvin. 2. Architecture  
and society—United States. 3. Cities and  
towns—Planning—United States. 4. Real  
estate investment. I. Barnett, Jonathan,  
joint author. II. Title.

A CASE STUDY: HOW HEAT PUMPS CONDITION AIR IN A DATA  
PROCESSING CENTER.  
W.R. Ratal.  
Power, v.120, no.8, Aug.1976, p.52-54.

Two-phase design of a central heating/cooling system for a  
corporate computer operation combined water-to-water heat pumps  
with heat recovery and storage to meet current and future needs

ORIGINAL PAGE IS  
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TJ Price, Billy L.  
163.3 Homeowner's guide to saving energy /  
-P74 by Billy L. Price & James T. Price.  
Blue Ridge Summit, Pa. : G/L Tab  
Books, 1976.  
288 p. : ill. ; 22 cm. \$8.95. pbk  
Includes index.

It Pays to Know Your Insulation 32 books,  
cker,

Insulation and Heat Transfer—Heat Transfer Factors—Heat  
Conduction Through Walls—Heat Conduction Through Ceil-  
ings—Heat Conduction Through Windows—Types of Insula-  
tion

Insulating Your Home 60

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Insulating the Floor—Insulating the Duct System—Insulating  
Slab Floors—Insulating Mobile Home Floors—Insulating the  
Walls—Insulating Masonry Walls—Insulating the Ceiling—  
Tips on Hiring an Insulation Contractor—Attic Ventilation

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Insulating an Unheated Garage—Insulating a Heated  
Garage—Garage Doors

Weather Stripping Doors 106  
and Windows

Weather-Stripping Windows—Simple Weather Seals—  
Weather-Strip Inserts—Combination Weather Strip and Part-  
ing Stop—Installing New Windows—Installing Storm Win-  
dows—Other Window Tricks—Insulating and Weather-  
Stripping Doors—Storm Doors—Caulking Materials

Critical Evaluation of the Heat Pump for Residential  
Space Heating.

H. P. Kalischer.

Rheinisch-Westfaelisches Elektrizitaetswerk A.G., Essen  
(West Germany). 1976. 38p U.S. Sales Only.

AED-Conf-76-642-001 Price code: PC A03/MF A01

The operating principles of heat pumps are discussed, and  
the significance of heat pumps to energy conservation in  
the space heating of homes is described. Information is in-  
cluded on air-to-air heat pump performance; influence of  
climate conditions; methods for improving the coefficient  
of performance; commercial exploitation; comparative  
cost of oil heating and heat pump heating for single family  
residences; retrofitting oil-fueled central heating systems  
with heat pumps, and possible locations of heat pumps in  
houses. (ERA citation 02:060101)

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7011  
.A5  
v.82  
pt.1

American Society of Heating, Refrigerating and  
Air-Conditioning Engineers.

ASHRAE transactions : proceedings of the  
ASHRAE semiannual meeting February 1-5, 1976,  
Dallas, Texas. -- New York : American So-  
ciety of Heating, Refrigerating and Air-  
Conditioning Engineers, c1976.

1192 p. : ill.

"Including technical papers and discussions,  
symposium papers and comments and society  
(Continued on card 2)

DA-76-2 INNOVATIONS OF THE HEAT PUMP CYCLE

**Operational Experience and Examples of Existing Heat  
Pump Plants.**

K. Vielhaber.

Bosch (R.) G.m.b.H., Wernau/Neckar (West Germany).

1976, 18p CONF-7606121-2 U.S. Sales Only.

AED-Conf-76-285-001 Price code: PC A02/MF A01

The suitability of different heating systems for heat pump  
operation and their influence on the mean thermal efficien-  
cy are discussed. The possible applications of bivalent heat  
pump heatings are illustrated by the example of existing  
plants. The operation of an air-water heat pump with aux-  
iliary liquefied gas heating is explained with the aid of tem-  
perature diagrams and monthly supply measurements. Measure-  
ments on a water-water heat pump with indirectly  
heated water storage device confirm the suitability of heat  
pumps for heating industrial water and their economy as  
compared with oil combination boilers. (ERA citation  
02.054729)

CN-142,403

ACOUSTICAL AND THERMAL PERFORMANCE OF EXTERIOR  
RESIDENTIAL WALLS, DOORS AND WINDOWS. Hale J.  
Sabine and Myron B. Lacher, Owens-Corning Fiber-  
glass Corp. and Daniel R. Flynn and Thomas L.  
Quindry, NBS. Nov.1975. 158p.

National Bureau of Standards,  
Washington, D. C.

BSS-77

Laboratory tests of sound transmission loss,  
thermal transmittance, and rate of air leakage  
were conducted on full scale (9 feet high x 14  
feet wide; 2.7 x 4.3 meters) specimens of  
typical residential exterior wall  
constructions, either unbroken or penetrated by  
a door or window. The walls were of wood frame  
construction with gypsum board drywall interior  
finish and exterior finishes of wood siding,  
stucco, or brick veneer. Additional  
acoustical tests were run on a number of  
individual doors and windows. A total of 109  
acoustical tests and 48 thermal tests are  
reported. The resultant data are compared with  
literature data on similar constructions.  
Correlations developed among the several  
quantities measured will assist more rational  
design where both energy conservation and noise  
isolation must be considered. (130 references)

.77

TRANSPORTATION AIR

AIR TRAFFIC CONTROL AND ENERGY CONSERVATION IN AIR OPERATIONS, by H. R. Merritt.  
Canadian Aeronautics and Space Journal, vol 25, no 1, First Quarter 1979, p. 28-33.

A discussion of the Canadian Air Traffic Control system, its responsiveness to user demand, and a look at future involvements in respect of energy conservation requirements.

MANUFACTURERS DEVELOPING FUEL-EFFICIENT ENGINES.  
Jerry Mayfield.

Aviation Week and Space Technology, vol 110, no 22, May 28, 1979, p. 46-55.

*E<sup>3</sup> Engine*

FUEL PRICE AND SUPPLY OUTLOOK APPEARS GRIM FOR AIRLINES. J. D. Baumgarner.

Air Transport World, vol 16, no 12, 27-28, December 1979.

Availability may be even more of a constraint than cost on future growth of air transportation.

Fuel conservation - Transportation, Air

SQUEEZING THE MOST FROM THOSE GALLONS OF AVGAS,  
Richard L. Taylor

Air Prog., v.41, no.9, Sept. 1979, p.49

SIMULATION STUDY OF THE OPERATIONAL EFFECTS OF FUEL-CONSERVATIVE APPROACHES. L. Tobias, and E. A. Palmer.

Journal of Aircraft, vol 16, no 7, July 1979, p. 498-505.

CN-150,793  
FUTURE AVAILABILITY OF AVIATION FUEL. 1979.  
48p.

International Civil Aviation Organization (Canada)      Circular  
149-AT/52

Fuels, Jet  
Fuels, Alternative  
Fuels - Availability  
Energy consumption

FUEL STATE FINITE, by Bill Sweetman.  
Flight International, vol. 115, no. 3649, February  
1979, p. 548-563.

Continuing rises in the price of fuel, and the prospect of eventual exhaustion of reserves, are problems that won't go away. **BILL SWEETMAN** looks at the way finite fuel stocks will affect the industry, and some of the technical palliatives

**NASA CP-2092** <sup>1979</sup>  
Energy conservation, - Transportation, Air  
**AEROPROPULSION 1979.** (Proceedings of conf. held  
LeRC, May 15-16, 1979). 1979. 467p.

Conference on Aeropropulsion **May 15-16,**  
**1979**

*Energy Conservation - Transportation, Air*  
**NASA CP-2067** <sup>1978</sup>  
**THE ROTARY COMBUSTION ENGINE - A CANDIDATE FOR**  
**GENERAL AVIATION.** (Symposium held LeRC, Feb.  
28, 1978). 1978. 190p.

**Symposium on the Rotary Combustion Feb. 28,**  
**Engine - A Candidate for General 1978**  
**Aviation**

**GENERAL AVIATION ENERGY-CONSERVATION RESEARCH PROGRAMS AT**  
**NASA LEWIS RESEARCH CENTER**  
Edward A. Willis, NASA Lewis Research Center 13 . . .

**EFFORTS CONTINUED IN 1977 TO IMPROVE AVIATION**  
**ENERGY EFFICIENCY, SUPPORT SERVICES, AND FLIGHT**  
**SAFETY.**

ICAO Bulletin, v.33, no.5, May 1978, p.60-65.

*STOL SYSTEM FUEL SAVINGS--GROUND AND AIR*, by  
A. F. Toplis and J. H. Nazareth.

Canadian Aeronautics and Space Journal, vol. 24,  
no. 5, Sept.-Oct. 1978, p. 284-298.

*For intercity travel, a short take-off and landing (STOL) system with STOLports located in the proximity of the major downtown passenger traffic zones can provide a substantial savings in the fuel required for access and egress from the air terminal. Because of the use of propellers, over short haul routes (less than 500 statute miles), a present day STOL aircraft such as the Dash 7 is more fuel efficient than current conventional twin engine jet aircraft.*

*A computerized model for estimating the passenger traffic diverted to STOL from the conventional short haul air system is developed. The associated fuel savings and profitability of a STOL system are calculated.*

*A STOL system centred on the Toronto Island Airport would attract some 1.5 million travellers from conventional take-off and landing (CTOL) by offering time savings and in most cases, cost savings too. In addition to convenience, the STOL system would save almost 5 million gallons of fuel over the alternative of a completely CTOL system, and in so doing, would operate profitably to the tune of \$30 million annually in 1980.*

*A calculation was also made for 1986 when advanced, more fuel efficient, CTOL and STOL aircraft were assumed to be in operation. The model was used to choose the optimum of three STOL aircraft (with cruise speed designs of Mach 0.7, 0.6 and 0.5) from the point of view of fuel savings and profitability. The Mach 0.6 would appear to be an optimum choice by allowing the STOL system fuel savings of close to 7 million gallons when compared with a completely CTOL system and annual profits of \$31 million.*

**PROSPECTS FOR ENERGY CONSERVING STOL TRANSPORTS USING**  
**PROP-FANS**

B. Eggleston

Canadian Aeronautics and Space Journal, vol. 24, no. 4,  
July/August 1978, p. 201-216

CN-150,310 1978  
ADVANCED TURBOFAN ENGINES FOR LOW FUEL CONSUMPTION. William Sans, Pratt & Whitney. (For presentation at Gas Turbines Conf. & Products Show, London, England, Apr.9-13,1978). 1978. 12p.

American Society of Mechanical Engineers  
Conference on Gas Turbines  
Paper  
78-GT-192  
Apr.9-13,  
1978

Engines, Turbofan Fuel consumption, Jet  
Energy conservation - Transportation, Air  
Engines - Pratt & Whitney JT9D-7A  
(Amer.)

NASA - CP - 2036 pt.1

N78-27064\*# General Electric Co., Fairfield, Conn.  
ENERGY EFFICIENT ENGINE PRELIMINARY DESIGN AND INTEGRATION STUDIES a07  
R. P. Johnston and M. C. Hemsworth In NASA Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 111-138 refs (For primary document see N78-27046 18-01)  
Avail: NTIS HC A22/MF A01 CSCL 21E

The characteristics and systems benefits of an energy efficient engine (E3) suitable for use on advanced subsonic transport aircraft were determined. Relative to a current CF6-50C engine, the following benefits were estimated: 14.4% reduction in installed cruise specific fuel consumption, and a reduction in direct operating cost of more than 5%. The advanced technology E3 system would also permit compliance with FAR 36 (1977) noise limits, and compliance with 1981 EPA emission standards. JMS

FUEL EFFICIENCY: NEW DIMENSION IN AIRCRAFT DESIGN.  
EXXON Air World, v.30, no.2, 1978, p.34-38.  
(Reprinted with permission of Automotive Engineering, v.85, no.11, 1977.)

Aircraft design has an important part to play in the drive to reduce petroleum consumption. Here's a look at some fuel-saving measures which could save billions of gallons of increasingly-precious fuel

ENERGY CONSERVING AIRCRAFT FROM THE ENGINE VIEWPOINT.

R. M. Denning  
Canadian Aeronautics and Space Journal, Vol. 24, No. 3, May/June 1978, p. 137-149.

*The increasing cost of hydrocarbon fuel inevitably intensifies the quest for lower engine SFC on the conventional aero gas turbine. This should not obscure the fact that minimizing all aircraft direct operating costs is the ultimate yardstick for the engine designer. Higher fuel prices may change priorities in engine design and justify more complex and expensive engines particularly for longer range operations. Optimum engine design for shorter range can be significantly different because of the implication of cyclic life on air cooled turbine blades. Lower specific thrust engines are worthy of close consideration particularly for short haul operation. More effort should be devoted to comprehensive studies of new powerplant concepts.*

A78-31303 # Prospects for energy conserving STOL transports using prop-fans. B. Eggleston (de Havilland Aircraft of Canada, Ltd., Downsview, Ontario, Canada). In: Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977. Proceedings. (A78-31301 12-05) Ottawa, Canadian Aeronautics and Space Institute, 1978, p. 2-1 to 2-16. 8 refs.

A study has examined the application of the prop-fan type of advanced propeller design to a 1986 technology, 50-passenger STOL transport aircraft cruising at Mach numbers of 0.50, 0.60 and 0.70. Comparisons were made with an equivalent 1977 technology STOL transport (cruising at Mach 0.38) sized to meet the same design requirements. In a 1986 technology aircraft the greatest fuel savings were found at Mach 0.50 and maximum energy efficiencies of 98 passenger miles per Imperial gallon were predicted. At short ranges the direct operating costs of the 1986 technology aircraft at Mach 0.50 and 0.60 were found to be very similar to the 1977 technology STOL transports. The energy efficiencies of a prop-fan aircraft designed for Mach 0.70 were found superior to 1977 technology STOL and jet-CTOL aircraft by 10-20%. B.J.

NASA CP-2067 1978  
*energy conservation - transport*  
THE ROTARY COMBUSTION ENGINE - A CANDIDATE FOR GENERAL AVIATION. (Symposium held LeRC, Feb. 28, 1978). 1978. 190p.

Symposium on the Rotary Combustion Engine - Feb. 28, 1978  
Engine - A Candidate for General Aviation

AGARD Lecture Series No. 96  
Advisory Group for Aerospace Research and  
Development, NATO  
AIRCRAFT ENGINE FUTURE FUELS AND ENERGY  
CONSERVATION

Published September 1978  
194 pages including Bibliography of 61 items

This AGARD Lecture Series No. 96 is sponsored by the  
Propulsion and Energetics Panel of AGARD and is  
implemented by the Consultant and Exchange  
Programme.

Future fuel supplies for aviation is an important matter.  
If the world continues to consume its petroleum  
resources at its current rate of consumption, it will  
essentially run out of these resources by the turn of the  
century. The need for aircraft fuel conservation is most  
urgent, if not mandatory, because the future of aviation  
as we know it today, is at stake. This lecture series is  
designed to provide various interested members of

P.T.O.

**N78-27127\*** # National Aeronautics and Space Administration,  
Lewis Research Center, Cleveland, Ohio.

**FUEL CONSERVATIVE AIRCRAFT ENGINE TECHNOLOGY**

Donald L. Nored 1978 39 p refs Proposed for presentation  
at 11th Congr. of the Intern. Council of Aeronautical Sci., Lisbon,  
Portugal, 10-16 Sep. 1978; sponsored by AIAA

(NASA TM 78962 E 9719) Avail. NTIS HC A03/MF A01  
CSCL 21E

Technology developments for more fuel efficiency subsonic  
transport aircraft are reported. Three major propulsion projects  
were considered: (1) engine component improvement - directed  
at current engines, (2) energy efficient engine - directed at new  
turbofan engines, and (3) advanced turboprops - directed at  
technology for advanced turboprop powered aircraft. Each project  
is reviewed and some of the technologies and recent accomplish-  
ments are described. GG

**AUTOMATED FUEL CONSERVATION AS RELATED TO ADVANCED  
AIRCRAFT SYSTEMS**, by Earl Stephen Smith  
Aviation Research Journal, vol. 3, August 1978, p. 15-  
18

*Automated fuel conservation systems are innovative and timely developments of  
microprocessors and advanced aircraft systems as related to existing and future aircraft.  
As a library study using the most current periodicals as reference sources, this article  
examines the various systems that are available or currently under development.*

AGARD-LS-96 1978

Aviation fuels  
Jet engine fuels  
Fuel consumption  
Refining  
Energy  
Design criteria  
Conservation

Energy conserva-  
tion - transporta-  
tion, Air

**FUEL CONSERVATION FOR HIGH PERFORMANCE AIRCRAFT IN  
TERMINAL AREA.**

S.C. Mohleji.

Navigation, Spring 1978, v.25, no.1, p.19-27.

This paper describes an approach for the ATC  
system in the terminal area to accommodate fuel  
conserving landing approaches.

**A78-45097\*** # Fuel consumption improvement in current  
transport engines. R. W. Hines (United Technologies Corp., Pratt and  
Whitney Aircraft Group, East Hartford, Conn.) and J. A. Ziemanski  
(NASA, Lewis Research Center, Cleveland, Ohio). *American Institute  
of Aeronautics and Astronautics and Society of Automotive Engi-  
neers, Joint Propulsion Conference, 14th, Las Vegas, Nev., July  
25-27, 1978* AIAA Paper 78-930. 7 p. 7 refs. Contracts No.  
NAS3-20630; No. NAS3-20632.

A review is conducted of improvements which can be made with  
respect to the fuel consumption of current engines and new  
production versions of current engines. A description is presented of  
an engine diagnostics program which has the objective to identify  
and quantify the causes and sources of performance deterioration in  
the JT9D turbofan engine and to develop basic data which will be  
applied to minimize performance degradation of current and future  
engines. General areas where performance losses occur are examined,  
taking into account seals, blades and vanes, and cases. Potential  
performance improvement concepts are related to improved compo-  
nent aerodynamics, improved flowpath sealing, blade tip clearance  
control, improved turbine cooling effectiveness, improved turbine  
materials and coatings, duct and nozzle aerodynamic refinements,  
nacelle aerodynamic refinements, forced exhaust mixers, advanced  
nacelle materials, and advanced fuel control. G.R.

**A78-31311** # Thrust computing system applications to in-  
crease engine life and provide fuel conservation. G. B. Mackintosh  
(Computing Devices Co., Ottawa, Canada). In: Canadian Symposium  
on Energy Conserving Transport Aircraft, Ottawa, Canada, October  
3, 4, 1977, Proceedings. (A78 31301 12 05) Ottawa, Canadian  
Aeronautics and Space Institute, 1978, p. 10-1 to 10-20. Research  
supported by the Canadian/United States Defense Production  
Sharing Program.

The paper describes a method of computing the gross thrust  
required by a jet engine based only on measurements of pressure in  
the engine tailpipe and of ambient static pressure.

A78-37114 **Aero engines climb towards better fuel efficiency.** M. Hewish. *New Scientist*, vol. 78, May 11, 1978, p. 380, 381.

The low-bypass-ratio turbofans of the early 1960s had specific fuel consumptions about 15 percent lower than the previous straight turbojets. The introduction of high-bypass turbofans in the early 1970s led to a further 20 percent reduction. Studies financed by NASA have the objective to reduce fuel consumption by another 12 percent. Gains to be made are related to improved components performance, revised maintenance procedures to reduce deterioration in use, reduced sensitivity to factors which cause performance to fall while the engine is in service, and a modified operating cycle, mainly involving changes in bypass ratio, overall pressure ratio, and turbine inlet temperatures. The integrated fan duct, which provides structural strength and damps out fan noise, contributes to performance gains by more efficient mixing of the fan flow and hot gas stream from the engine core. G.R.

A78-30698 # **Aviation fuel usage - Economy and conservation.** V. F. J. Craig and B. G. Smith. (*Roads and Transportation Association of Canada, Annual Conference, 8th, Quebec City, Canada, Sept. 13, 1976.*) *Canadian Aeronautics and Space Journal*, vol. 24, Jan.-Feb. 1978, p. 34-49.

Methods of conserving aircraft fuel are discussed; the emphasis is on short-term operational and procedural measures. Reduction of required fuel reserves for flights operating under excellent weather conditions, minimization of jet-powered taxiing maneuvers, better

#### AVIATION FUEL USAGE - ECONOMY AND CONSERVATION

V.F.J. Craig and B.G. Smith

*Canadian Aeronautics and Space Journal*, v.24, no.1,  
Jan/Feb. 1978, p. 34-49

Historically, the Aviation Industry has accounted for a relatively small proportion of the total national consumption of petroleum-based fuel. The transportation sector in general represents some 40% of the total Canadian consumption, with aviation currently accounting for approximately 12% of that amount, or about 5% of the total consumption. In the relatively near future, the air transport industry is expected to experience an absolute increase in air passenger traffic, and to have to accommodate an increasing proportion of total intercity passenger trips made by all modes. In terms of fuel consumption, this means that Canadian commercial aviation could account for as much as 9% of total Canadian petroleum consumption by 1985, or between 20 and 25 percent of the total petroleum fuel consumed in the transport sector. These forecasts assume an annual growth rate of 7% per year for the next 10 to 15 years, and progressive improvements in aircraft fuel performance, fuel management and passenger load factors.

The figures quoted above suggest that the significance of air transport as an oil consumer is growing. When one considers that Canada is already a net importer of crude oil, it is evident that if oil prices continue to increase as forecast, the air transport industry is going to be confronted with the continuing fuel-cost squeeze.

**ENERGY CONSERVING AIRCRAFT FROM THE ENGINE VIEWPOINT,**  
by R. M. Denning, CEng, FRAeS  
*Aircraft Engineering*, vol. 50, no. 8, August 1978  
p. 27-37

The increasing cost of hydrocarbon fuel inevitably intensifies the quest for lower engine SFC on the conventional aero gas turbine. This should not obscure the fact that minimising all aircraft direct operating costs is the ultimate yardstick for the engine designer. Higher fuel prices may change priorities in engine design and justify more complex and expensive engines particularly for longer range opera-

tions. Optimum engine design for shorter range can be significantly different because of the implication of cyclic life on air cooled turbine blades. Lower specific thrust engines are worthy of close consideration particularly for short haul operation. More effort should be devoted to comprehensive studies of new powerplant concepts.

*NASA-CP-2036, pt. 1*

N78-27063# Pratt and Whitney Aircraft Group, East Hartford, Conn.

**ENERGY EFFICIENT ENGINE: PRELIMINARY DESIGN AND INTEGRATION STUDIES** c07

David E. Gray / In NASA Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p. 89-110 (For primary document see N78-27046 18-01)

Avail: NTIS HC A22/MF A01 CSCL 21E

A mixed exhaust, direct drive fan turbofan configuration was selected from four candidates. This choice was based on its ability to exceed study goals of 12% lower thrust specific fuel consumption and 5% lower direct operating cost by the 1990's with commercially acceptable technical risk and relative mechanical simplicity. The evaluation leading to configuration selection is discussed. Necessary technology advancements are identified and related to the goals. J.M.S.

*Air World*, v.30, no.2, p.34-38. 1978

**FUEL EFFICIENCY: NEW DIMENSION IN AIRCRAFT DESIGN.** (Originally printed in *Automotive Engineering*, v.85, no.11, 1977).

*Automotive Engineering*, v.85, 1977  
no.11.

ORIGINAL PAGE IS  
OF POOR QUALITY

**A78-31310 #** Energy conserving aircraft from the engine viewpoint. R. M. Denning (Rolls-Royce, Ltd., Aero Div., Bristol, England). In: Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977, Proceedings. (A78-31301 12-05) Ottawa, Canadian Aeronautics and Space Institute, 1978, p. 9-1 to 9-35. 5 refs.

The paper is mainly concerned with fuel-efficiency improvement in conventional gas turbine propulsion systems for airline operation; a broad philosophy of engine improvements for short, medium and long-haul aircraft is reviewed. It is stressed that minimizing all aircraft direct operating costs is the ultimate yardstick for the engine designer. Higher fuel prices may change priorities in engine design and justify more complex and expensive engines particularly for longer-range operations. Optimum engine design for shorter range can be significantly different because of the implication of cyclic life on air-cooled turbine blades. Lower-specific-thrust engines are worthy of close consideration particularly for short-haul operation.

B.J.

**A78-31309 #** Aircraft fuel economy - The propulsion system contribution. R. A. Harvey, R. E. Morris, and B. J. Palfreman (Pratt and Whitney Aircraft of Canada, Ltd., Longueuil, Canada). In: Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977, Proceedings. (A78-31301 12-05) Ottawa, Canadian Aeronautics and Space Institute, 1978, p. 8-1 to 8-20.

Results are presented of some engine performance and design studies intended to determine the potential improvements in fuel efficiency that can be made over a 10 year period by advances in engine technology. The study is confined to 'small' gas turbine engines of the type used for executive and commuter aircraft i.e., turboprops up to 2500 SHP and turbofans up to 6000 lb thrust. Using projections of technology improvements, equivalent 1987 production engines were synthesized; this showed that a 15-19% reduction in cruise specific fuel consumption could be expected for this class of engine over the next 10 years. Two pairs of aircraft were designed - turboprop and turbofan powered using 1977 and 1987 engines but constant 1977 airframe technology. Reduction in specific fuel consumption and specific weight results in reduction in aircraft weight for the same mission with further reduction in fuel flow, from 17% for the larger turbofan engine to 21% for the larger turboprop.

B.J.

NASA CP-2033

1978

**JET AIRCRAFT HYDROCARBON FUELS TECHNOLOGY.** John P. Longwell, MIT, ed. (Workshop held LaRC, June 7-9, 1977). Jan. 1978. 62p.

Workshop on Jet Aircraft Hydrocarbon  
Fuels Technology

June 7-9,  
1977

**A78-31302 \* #** The NASA Aircraft Energy Efficiency Program. J. M. Klineberg (NASA, Washington, D.C.). In: Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977, Proceedings. (A78-31301 12-05) Ottawa, Canadian Aeronautics and Space Institute, 1978, p. 1-1 to 1-32.

The objective of the NASA Aircraft Energy Efficiency Program is to accelerate the development of advanced technology for more energy-efficient subsonic transport aircraft. This program will have application to current transport derivatives in the early 1980s and to all-new aircraft of the late 1980s and early 1990s. Six major technology projects were defined that could result in fuel savings in commercial aircraft: (1) Engine Component Improvement, (2) Energy Efficient Engine, (3) Advanced Turboprops, (4) Energy Efficient Transport (aerodynamically speaking), (5) Laminar Flow Control, and (6) Composite Primary Structures.

B.J.

**A78-31301** Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977, Proceedings. Symposium sponsored by NRC, Transport Canada, and CASI. Ottawa, Canadian Aeronautics and Space Institute, 1978. 284 p. (For individual items see A78-31302 to A78-31314)

Consideration is given to energy savings related to overall aircraft design, to propulsion system design and to operational factors. Particular papers are presented on the NASA Aircraft Energy Efficiency Program, prospects for energy conserving STOL transports using prop-fans, improved energy efficiency for small CTOL transport aircraft, energy conserving aircraft from the engine viewpoint, thrust computing system applications to increase engine life and provide fuel conservation, and the energy cost of some noise abatement procedures.

B.J.

**HAVE ENERGY, WILL TRAVEL.**  
J.E. Allen

*Aeronautical J.*, v.81, no.798, June 1977, p.259-70.

The purpose of this paper is therefore to consider, in order, the effects of alternative energy strategies i.e.:

- (i) diversion of oil for premium transport use
- (ii) new generations of low fuel-use aircraft
- (iii) transference to kerosene synthesized from coal or shale
- (iv) world-wide introduction of liquid hydrogen for aircraft
- (v) some other possibilities

SPAD: A DIRECT APPROACH TO FUEL CONSERVATION FOR AIRCRAFT

J. Howard Glover  
ICAO Bullentin

Vol. 32 no. 12 December 1977  
p. 19-22

*Flight tested earlier this year, this combined digital-computer and display system allows crews to vary flight parameters such that optimum efficiency and fuel economy can be achieved without significant increase in flight time . . .*

TL Canadian Symposium on Energy Conserving  
675.7 Transport Aircraft, Ottawa, 1977.  
.C36 A Canadian Symposium on Energy Conserving  
1977 Transport Aircraft = Symposium Canadien  
sur les Aeronefs de Transport a Faible  
Consommation d'Energie / sponsored by  
National Research Council of Canada,  
Transport Canada, Canadian Aeronautics and  
Space Institute. -- (c. l. : c. p. : 1977)  
1 v. ill. various : ill.  
1. Transport planes--Energy  
conservation-- Congresses.

PROSPECTS FOR ENERGY CONSERVING STOL TRANSPORTS  
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THRUST COMPUTING SYSTEM APPLICATIONS TO INCREASE  
ENGINE LIFE AND PROVIDE FUEL CONSERVATION

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STOL SYSTEM FUEL SAVINGS - GROUND AND AIR

by J. Nazareth and A.F. Toplis 11

THE IMPACT OF ENERGY CONSERVATION ON AIR CANADA'S  
FUTURE OPERATIONS

by P.F. Woodruff 12

AIR TRAFFIC CONTROL AND ENERGY CONSERVATION IN  
AIR OPERATIONS

by H.R. Merritt 14

THE MILITARY UTILITY OF VERY LARGE AIRPLANES AND  
ALTERNATIVE FUELS

William T. Mikolowsky, Larry W. Noggle and William  
L. Stanley

Vol. 15, no. 9, September 1977,  
p. 46-56.

Million-pound-plus  
airplanes using conventional  
jet fuel should be more  
cost-effective and energy  
effective than any of today's  
large airplanes in a variety  
of military applications

**FUEL CONSERVATION THROUGH AIRPLANE MAINTENANCE**  
Air World  
Vol. 29, no. 3, 1977,  
p. 64-69.

The Boeing *Airliner* in January of 1974 published results of an extensive Boeing study telling how airlines could reduce fuel consumption by improved operation procedures. The article, entitled *Fuel Conservation*, was addressed principally to flight crews. Since publication of the article, the price of jet fuel has continued to rise. At the request of the airlines and the Air Transport Association of America, Boeing continued research of ways airlines could save fuel—this time primarily through maintenance personnel and improved maintenance practices.

The situation posed to Boeing was this: airlines wanted help in pinpointing items which cause unnecessary fuel consumption and in assessing the value of making specific maintenance checks or repairs. A Boeing study begun last March examined causes of higher-than-normal airplane fuel consumption with emphasis on reducing drag.

**ALTITUDE ENGINE TEST OF A TURBOFAN EXHAUST GAS MIXER TO CONSERVE FUEL.**

R.R. Cullom and R.L. Johnson.

J. Eng. Power, v.99, ser.A, no.4, Oct.1977, p.645-49.

*A comparison of the specific fuel consumption was made with and without an internal mixer installed in a low bypass ratio, confluent flow turbofan engine. Tests were conducted at several Mach numbers and altitudes for core to fan stream total temperature ratios of 2.0 and 2.5 and mixing lengths of  $L/D = 0.95$  and 1.74. For these test conditions, the specific fuel consumption improvement varied from 25 to 40 percent.*

**NASA TM X-3568**

**1977**

**FULL-SCALE ALTITUDE ENGINE TEST OF A TURBOFAN EXHAUST-GAS-FORCED MIXER TO REDUCE THRUST SPECIFIC FUEL CONSUMPTION.** Richard R. Cullom and Roy L. Johnson, LeRC. July 1977. 30p.

**COMPUTER'S ROLE GROWS IN FUEL PLANNING.**

K.J. Stein.

A.W.S.T., Nov.21, 1977, p.28-29.

Computer-based fuel planning systems, which emerged in the jet fuel price/availability crunch as an effective technique for timely manipulation of variables in a complex equation, have entered a phase of expansion and refinement expected to enhance their value to major airlines.

**FUEL EFFICIENCY IMPROVEMENTS DESCRIBED.**

D.R. Griffiths.

A.W.S.T., Nov.21,1977, p.26.

**Atlanta**—Increased use of composite structural materials, new joining techniques and stricter airline maintenance and operational procedures may well yield improved fuel efficiency, aircraft manufacturers told airline maintenance executives here.

The presentations highlighted a recent Air Transport Assn. engineering and maintenance forum here attended by nearly 300 domestic and non-U.S. airline representatives and manufacturers.

**NASA TP-1054**

*Energy Conservation - 1977 - Transport*  
**EFFECT OF FIN PASSAGE LENGTH ON OPTIMIZATION OF CYLINDER HEAD COOLING FINS.** Robert Siegel and Robert W. Graham, LeRC. Sept.1977. 32p.

## VI. ANALYSIS, SYSTEMS, AND MODELING

ANALYSIS, SYSTEMS, AND MODELING

ENERGY MODELING AND FORECASTING AT THE U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION.

Richard H. Williamson & Edward J. Hanrahan  
Nuclear Technology, Vol. 9, No. 1, June 1978,  
p. 10-17

*The application of a combined set of energy and economic models describing the complex interactions of the nation's energy system improved the planning processes at the U.S. Energy Research and Development Administration for new technology development. The models include econometric techniques for macroeconomic projections, input-output techniques for sector detail, linear programming approaches for resource allocation, and accounting tools for other physical constraints. Comparison studies on the use of energy prices alone versus a combination of energy prices and new technology show that new technology permits higher gross national product growth rate, more jobs, lower delivered energy prices, and improved energy-economic efficiency.*

N80 15606# Wharton (E. F. A.) Inc., Philadelphia, Pa.  
**WHARTON ANNUAL ENERGY MODEL: DEVELOPMENT AND SIMULATION RESULTS** Final Report  
W. Finan and G. R. Schink Jul. 1979 93 p refs  
(EPRI Proj 440-1)  
(EPRI EA 1115) Avail NTIS HC A05/MF A01

The energy sector of a commercially available macroeconomic model was expanded in order to develop a tool for examining future energy-economy interactions. The specific methodologies employed are described and a set of energy policy simulations using the newly expanded model is presented. DOE

**AUTOMATIC PROGRAMMING FOR ENERGY MANAGEMENT USING SENSOR BASED COMPUTERS.** M. J. Shah.

IBM Systems Journal, vol 18, no 3, 1979.  
p. 457-469.

*An automatic programming approach has been developed for the use of sensor based computers (IBM System/7 and Series/1) for energy management in buildings. The purpose is to aid the facilities engineer who is unfamiliar with programming and who requires a system that can be defined by a sequence of questions and answers. Programmers can add or modify application source programs to extend the system to other user-defined functions.*

T  
57.6  
•N47  
New trends in systems analysis : international symposium, December 13-17, 1976 / Institut de Recherche d'Informatique et d'Automatique ; edited by A. Bensoussan and J. L. Lions. — New York : Springer-Verlag, 1976  
vii, 650 p. : ill. — (Lecture notes in control and information sciences ; v. 21)  
In English and French.

Macro-Economic Models, Differential Topology and Energy Strategies  
W. Häfelo, E. Park, E. Breitenacker, C. Biedel p. 245.  
FAIRBANKS, AL.

Resilience and its Application to Energy Systems e  
E.R. Gruemm ..... p. 331 ..... cover

Stochastic Modeling of Natural Resource Discovery - The Case of Oil and Gas  
G. Kaufmann, E. Barouch .... p. 334 .....

ORIGINAL PAGE IS  
OF POOR QUALITY

QA Control and dynamic systems : advances in  
 402.3 theory and applications, v. 14 / edited  
 .A35 by C. T. Leondes. -- New York : Academic  
 v.14 Press, 1979.

Power Systems Modeling: Estimation  
 and Control Applications  
*Samir A. Arafah*

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TJ Energy systems : an analysis for engineers  
 163.2 and policy makers / edited by James E.  
 .E492 Bailey. -- New York : M. Dekker, c1979.  
 vii, 121 p. : ill. ; 28 cm. -- (Energy  
 power, and environment ; v. 2)  
 Includes index.  
 ISBN 0-224-767-12-6

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.P5  
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Pittsburgh Conference on Modeling and Simulation, 9th, University of Pittsburgh, 1977.  
Modeling and simulation. v. 8. pt. 1 & 2 : proceedings of the eighth annual Pittsburgh conference / edited by William G. Vogt, Marlin H. Mickle. — Pittsburgh : Instrument Society of America, c1977.

EVALUATION OF ELECTRIC UTILITY LOAD MANAGEMENT STRATEGIES. P.37  
Peter D. Blair, C. N. Weygandt and Lawrence Eisenberg, University of Pennsylvania

STABILITY CONSIDERATIONS IN A CLASS OF HIERARCHICAL DYNAMIC ENVIRONMENTAL CONTROL SYSTEMS, H. J. Perlis, N. J. Institute of Technology and F. D. Chichester, The Austin Company P.45

TURBULENCE AND STABILITY ESTIMATES IN ATMOSPHERIC DISPERSION MODELING.

I. T. Wang and K. L. Dufner, Rockwell International P.51  
AN ENERGY MODEL FOR MISSISSIPPI, P.73  
Daniel G. Hotard and Murl W. Parker, Mississippi State University

AN ENERGY PLANNING MODEL FOR PENNSYLVANIA, Terrence Eichak and David L. The Pennsylvania State University P.77

USNRG A MODEL OF THE UNITED STATES ENERGY SYSTEM, Alan A. Leff and Fred The Pennsylvania State University P.83

REVIEW OF ENERGY MODEL TECHNIQUES, ENVIRONMENTAL IMPACTS AND CONTROL POLICIES, P.89  
Rhyon H. Kim and Albert H. Wehe, The Environmental Protection Agency

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National Research Council. Committee on Nuclear and Alternative Energy Systems. Synthesis Panel. Modeling Resource Group. Energy modeling for an uncertain future : the report of the Modeling Resource Group, Synthesis Panel of the Committee on Nuclear and Alternative Energy Systems, National Research Council. — Washington : National Academy of Sciences, 1978.  
xvii, 225 p. : ill. ; 28 cm. — (Study of nuclear and alternative energy systems : Supporting paper ; 2)  
(Continued on card 2)

ANALYSIS OF THE WAES SCENARIOS USING THE WORLD INTEGRATED MODEL, by Barry B. Hughes and Mihajlo D. Mesarovic

Energy Policy, vol. 6, no. 2, June 1978, p. 129-139

SANPE Quarterly, v.10, no.1

Oct.  
1978

MATERIALS APPLICATIONS IN ADVANCED ENERGY SYSTEMS. Special issue - 10th Anniversary Issue)

MATERIALS AND ECONOMICS OF ENERGY SYSTEMS .....36

H. E. Frankel and S. J. Dapkunas

TJ  
153  
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pt.3  
Energy development III / sponsored by the IEEE Energy Development Subcommittee of the IEEE Power Generation Committee of the IEEE Power Engineering Society. — New York : Institute of Electrical and Electronics Engineers, c1977.  
176 p. : ill. ; 28 cm. — (IEEE Power Engineering Society Papers ; 3)  
"77CH1215-3-PWR"

An Econometric Analysis of Energy Over the Next 75 Years, by R. W. Schmitt, D. J. BenDaniel, P. J. Stewart and A. S. Manne. P.77.

TJ  
163.2  
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Symposium in Applied Mathematics, San Antonio,  
1976.  
Mathematical aspects of production and  
distribution of energy : [proceedings of  
the Symposium in Applied Mathematics of the  
American Mathematical Society, held in San  
Antonio, Texas, January 20-21, 1976] /  
[edited by Peter D. Lax.] -- Providence :  
American Mathematical Society, 1977.  
v. 137 p. : ill. ; 26 cm. -- (Proceedings

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9502  
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Modeling energy-economy interactions : five  
approaches : papers presented at the Joint  
National Meeting of the Institute of Manage-  
ment Sciences and the Operations of Research  
Society of America, San Francisco, May 11,  
1977 / Charles J. Hitch, editor. -- Wash-  
ington, D.C. : Resources for the Future,  
1977.  
vii, 303 p. : ill. ; 25 cm.  
"Research paper R-5"

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350  
.H36  
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Hawaii International Conference on System  
Sciences, 10th, University of Hawaii, 1977.  
Proceedings: tenth Hawaii International  
Conference on System Sciences; held January  
6, 7, 1977 / editor: R. Chattergy. -- [North  
LARGE-SCALE POWER SYSTEMS ANALYSIS METHODS (LSI)  
Chairperson: M. E. Van Valkenburg, University of Illinois, Urbana

1. Modern Trends in System Modeling for Power System Transient Studies  
Olle I. Elgerd, University of Florida, Gainesville, Florida p. 17 17
2. A New Method for Reduced-Order Modeling N/A  
John J. Allemong, Wataru Mayeda and M. E. Van Valkenburg, University of Illinois N/A
3. Analysis of Large Scale Systems by Simultaneous Subsystems.  
James Steuert, National CSS, Inc., Norwalk, Connecticut p. 23 23

## VII. INFORMATION SOURCES AND DOCUMENTATION

INFORMATION SOURCES AND DOCUMENTATION

AN ENERGY SOURCE DIRECTORY, by Neal-Schuman  
Publishers, Inc.

Library Journal, vol. 104, no. 1, January, 1979,

p. 27-73. THE NEED for information about energy is obvious, as is the obligation of libraries to provide it. The growth pattern in the availability of such information is also clear. The *Energy Source Directory* has been expanded and updated to help libraries identify useful sources of information on energy for reference work, referral, collection building, and curriculum support. It presents close to 650 sources of print and nonprint information; over 100 are entirely new. Materials range from elementary level to professional and technical.

TJ Sullivan, Thomas F. P.  
163.2 Energy reference handbook / edited by Dr.  
.S04 Thomas F. P. Sullivan. -- 2d ed. -- Wash-  
1977 ington : Government Institutes, 1977.  
viii, 300 p. : ill. ; 24 cm.  
First ed. by N. C. McMerney and T. F. P.  
Sullivan.  
Bibliography: p. vii-viii.  
1. Power resources--Dictionaries. 2.  
Power (Mechanics)--Dictionaries. 3. Force  
and energy-- Dictionaries. I.  
McMerney, N. C. Energy reference hand-  
book. II. Title. 621

TA Association of Energy Engineers.  
12 The AEE directory of energy profes-  
.A87 sionals, 1979-1980. -- Atlanta : Fairmont  
1979-80 Press, c1979.  
280 p.  
ISBN 0915586134  
1. Engineers--Directories. 2. Energy  
industries--Directories. I. Title.

ENERGY MATERIALS, A CLASSIFIED LISTING  
Library Journal, vol. 104, no. 1, January 1978,  
p. 74-84.

ENERGY INFORMATION ONLINE  
Betty Miller  
Online  
Vol. 2 no. 1 Jan. 1978  
p. 27-30

N77-31661# Federal Highway Administration, Washington, D C.  
Office of Energy Information and Analysis.  
FEDERAL ENERGY INFORMATION LOCATOR SYSTEM:  
ENERGY INFORMATION IN THE FEDERAL GOVERNMENT  
30 Nov. 1976 334 p  
(PB 262331/2: FEA/B-76/492) Avail. NTIS  
HC A17/MF A01 CSCL 05B

This 1976 update has been prepared from a source survey conducted between August and November 1976. FEILS allows the user to identify Federal agencies collecting specific kinds of energy data and, therefore, to locate that data. The system itself does not contain the data available in the Federal Government; it is a directory for that data. GRA

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E52  
1977  
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Energy information locator. -- New York :  
Environment Information Center, c1977.  
177 p. ; 28 cm.  
Published annually by EIC as part of the  
Energy Directory Update Service.

**ORGANIZATIONS & SYSTEMS**

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49 Commercial Organizations

**PUBLICATIONS**

- 62 Abstracting & Indexing Services  
73 Legal Binder Services  
76 Directories  
88 Newsletters  
101 Journals

**INDEX**

- 131 Alphabetical Index: Organizations & Systems  
134 Title Index: Publications & Products  
138 Title Index: Annotated Publications  
143 Subject Index/keyword list  
146 Geographic Locator

**AN ENERGY SOURCE DIRECTORY.**

Neal-Schuman Publishers, Inc., compiler.  
Library Jour., v.103, no.1, Jan.1,1977, p.26-70.

The *Energy Source Directory* has been expanded and updated to help libraries identify useful sources of information on energy for reference work, referral, collection building, and curriculum support. It presents over 600 sources of print and nonprint information; over 200 are entirely new. Materials range from elementary level to professional and technical. These organizations, companies, publishers, government, and nongovernment agencies were identified after extensive research, correspondence, and telephone communication, including a questionnaire mailing to some 1200 new potential sources.

In the listings we describe each organization, indicate the emphases of its interests, characterize its publications program, and list a few examples of the materials available from it. Complete bibliographic information varies in amount and detail according to what each source reported to us. The Directory should be used to identify sources to which the librarian can write for further information, including listings and catalogs that might be available, or to request inclusion on lists for mailings from that organization. A classified list of sources follows the main listing.

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I. ENERGY AND POWER SOURCES - GENERAL

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ENERGY SOURCES - GENERAL

TJ  
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Culp, Archie W.  
Principles of energy conversion / by  
Archie W. Culp, Jr. New York :  
McGraw-Hill, 1979.  
xii, 499 p. : ill. ; 25 cm.  
Includes bibliographical references  
and index.  
1. Power (Mechanics). 2. Power  
resources. 3. Energy conservation. I.  
Title.  
621 78-14760 0-070148-92-9 78V41216

ECONOMIC, POLITICAL AND PSYCHOLOGICAL BARRIERS TO  
BUILDING THE NEW ENERGY CONVERSION MACHINERY, by  
J. O'M. Bockris.  
- Energy Research, vol. 3, no. 1, Jan/Mar. 1979, p.1-13.

The importance of the short time scale for the introduction of new energy technologies is indicated and the possible effects outlined. The barriers to changes in philosophy on energy matters are discussed and some approaches are suggested.

→ *International Journal of Energy Research*

GRASS-ROOTS ENERGY, by Robert B. Aronson

Machine Design, vol. 50, no. 23, October 1978,  
p. 20-30

CA-150,301, Audiotape & Videotape 1979  
PLANNING ADVANCED ENERGY TECHNOLOGIES (FUSION,  
MHD, AND SATELLITE POWER SYSTEMS EXAMPLES).  
Robert A. Summers. (Series title: Langley  
Colloquium Series). Feb.12,1979.

NASA,  
Langley Research Center

Power sources  
Lectures - NASA, LaRC  
Audiotapes - Power sources

Audiotape - LaRC - 129 8992, 129 8752, 129 9487  
Videotape - LaRC - 129 9008

FINANCING HIGH-COST, HIGH-RISK ENERGY DEVELOPMENT,  
by Franklin A. Lindsay  
Harvard Business Review, vol. 56, no. 6, November/  
December 1978, p. 161-170

*Provided Uncle Sam shares  
some of the risks with private  
capital, we can spur the needed  
advanced-technology projects*

NASA CP-2042 Power sources

EMERGING ENERGY ALTERNATIVES FOR THE SOUTHEASTERN STATES. Elias K. Stefankos, ed. (Symposium sponsored by DOE, LARC and NCA&TSU. Held NCA&TSU, Mar. 31, 1978). June 1978. 152p.

Department of Energy,  
Washington, D.C.  
NASA.

IMPACT OF NOVEL ENERGY SOURCES - OTEC, WIND,  
A. Sidney Roberts, Jr. p. 39

Symposium on Emerging Energy Alternatives: GEOTHERMAL, BIOMASS  
for the Southeastern States

A79-15879 Energy technology V: Challenges to technology; Proceedings of the Fifth Conference, Washington, D.C., February 27-March 1, 1978. Conference sponsored by DOE, EPRI, American Gas Association, and National Coal Association. Edited by R. F. Hill. Washington, D.C., Government Institutes, Inc., 1978. 1076 p. \$38. (For individual items see A79-15880 to A79-15925)

Papers are presented on such topics as particulate and sulfur oxide control options for conventional coal combustion, large-scale thermal energy storage for cogeneration and solar systems, an electric utility perspective on solar heating and cooling, the role and status of dispersed electric utility fuel cell power plants, ocean energy, energy from urban waste, and hybrid fossil-geothermal power plants. Also considered are solar power satellites, SNG production by the Rockgas process, OTEC program status and plans, petroleum plantations, and the fusion-fission energy concept. B.J.

IEEE Spectrum, v.15, no.1

Jan.  
1978

*Power sources*  
TECHNOLOGY '78. (Applications review)

Technology Utilization

49 Power/energy progress report Gadi Kaplan  
A pastiche of developments promises near and long-term applications

TJ Meador, Roy  
163.2  
.M43

Future energy alternatives : long-range energy prospects for America and the world / by Roy Meador. — Ann Arbor, Mich. : Ann Arbor Science Publishers, c1978. ix, 197 p. : ill. ; 22 cm.

Long-range prospects for energy production are assessed, with attention given to fusion reactors, solar energy systems, nuclear fission processes, the future uses of coal and hydrogen, as well as wind, tidal and geothermal power generation. In addition to Tokamak and stellarator fusion schemes, consideration is given to laser-pellet fusion reactions. Solar heating and domestic hot water system presently in use are described; coal gasification and oil shale exploitation are mentioned. Fast breeder reactors and municipal solid waste conversion processes also figure in the review. J.M.B.

A79-14718 Annual review of energy. Volume 3. Edited by J. M. Hollander (California, University, Berkeley, Calif.), M. K. Simmons (Solar Energy Research Institute, Golden, Colo.), and D. O. Wood (MIT, Cambridge, Mass.). Palo Alto, Calif., Annual Reviews, Inc., 1978. 550 p. \$17. (For individual items see A79-14719 to A79-14722)

Wind, waves, and tides are considered along with energy as it relates to the quality and style of life, passive solar design, energy technologies and natural environments, alternative breeder reactor technologies, a progress report concerning the efforts of industry to save energy, and international variations in energy use. Attention is also given to the evolution of the nuclear debate, industrial cogeneration, proliferation resistant nuclear fuel cycles, the environmental impacts of industrial energy systems in the coastal zone, soft energy technologies, and aggregate energy, efficiency, and productivity measurement. G.R.

MATERIALS AND ECONOMICS OF ENERGY SYSTEMS, by H. E. Frankel and S.J. Dapkunas. Same Quarterly, vol. 10, no. 1, October 1978, p. 36-44,

Materials problems associated with alternate energy systems such as solar electric, magnetohydrodynamic, fusion, geothermal, coal liquefaction and coal gasification are discussed in terms of their impact on the economics of the system. Present utility powerplant reliability is examined and recommendations are made to improve their availability to generate power.

MATERIALS PROBLEMS IN SOLAR AND NUCLEAR ENERGY AND STORAGE OF ENERGY, by R. S. Claassen. *Sampe Quarterly*, vol. 10, no. 1, October 1978, p. 27-35.

Typical examples are provided to illustrate the intimate relationship of materials and processing to the energy program. Developing energy technologies place increasing demand on material performance and in some cases exceed known material capabilities. Material choices in solar systems are dominated by cost; distributed collectors and the central receiver illustrate practical problems. The demand for absolute safety in nuclear power requires a depth of understanding and level of knowledge about materials unachieved in previous engineering systems; problems in water-cooled and breeder reactors emphasize the point. Fusion reactors will push far beyond our present knowledge of material response and behavior. Within limits, energy storage is practical today but present technologies such as batteries are being pushed hard and new schemes such as superconducting solenoids and thermochemical storage are under intense study.

**N78-27522\*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena  
**PROCEEDINGS OF THE ALTERNATE ENERGY SYSTEMS SEMINAR**

30 Mar. 1978 184 p Seminar held at Pasadena, Calif., 30 Mar. 1978. sponsored by DOE Sponsored in part by DOE (Contract NAS7-100) (NASA-CR-157255. JPL-Pub-78-45) Avail: NTIS HC A09/MF A01 CSDL 10A

The Alternative Energy Systems Seminar was held on March 30, 1978, and was sponsored jointly by the Southwest District Office of the U.S. Department of Energy and JPL. The seminar was an experiment in information exchange with the aim of presenting, in a single day, status and prospects for a number of advanced energy systems to a diverse, largely nontechnical audience, and to solicit post-seminar responses from that audience as to the seminar's usefulness. The major systems presented are: (1) Solar Photovoltaic; (2) Geothermal; (3) Cogeneration Power; (4) Solar Thermal; (5) Solar Heating and Cooling; (6) Wind Energy; and (7) Systems Considerations. For individual titles, see N78-27523 through N78-27529.

WORLD ENERGY PROSPECTS TO THE YEAR 2000  
C. L. Wilson  
Pro. R. Soc. Lond.  
Vol. 358 no. 1693 January 6, 1978  
p. 121-139.

NEW PERSPECTIVES ON THE MATERIALS INTERFACE WITH THE THREE E'S--ENERGY, ENVIRONMENT, AND ECONOMICS, by Donald S. Remer. *Sampe Quarterly*, vol. 10, no. 1, October 1978, p. 16-26.

New perspectives are presented on the materials interface with the three E's -- Energy, Environment, and Economics. The past, present, and future energy picture is described from 1850 through the year 2030. The major energy sources such as oil, natural gas, coal, nuclear, and several new emerging energy options are compared and contrasted. The lead time, capital, and materials required for bringing on-stream new energy sources is described. Previous U. S. energy forecasts are reviewed and are found to be too optimistic. The U. S. materials situation is outlined with an emphasis on per capita materials use and the critical role that foreign sources play in our materials supply. The interrelationship between energy and materials production is considered for three areas: (1) industrial processing, (2) construction and buildings, and (3) the automobile.

IK7800. I 256 1978  
A79-16726 Energy '78; Annual Conference, Tulsa, Okla., April 16-18, 1978, Record of Conference Papers. Conference sponsored by the Institute of Electrical and Electronics Engineers, New York, Institute of Electrical and Electronics Engineers, Inc., 1978. 286 p. Members, \$18.75; nonmembers, \$25. (For indivi' items see A79-16727 to A79-16744)

Consideration is given to such topics as energy storage for tokamak devices, solar-thermal electric energy conversion, energy economics, energy management, and the control of energy systems. Papers are also presented on energy saving technologies, energy conservation, renewable energy sources, energy systems planning, electric utility technology, solar power satellites, energy systems modeling, computers and energy, and wind energy systems. B.J.

THE ELECTRICITY FUTURE: WHAT CAN YOU BELIEVE.  
C. Starr.  
EPRI J., July/Aug. 1978, p.28-31.

Distinguishing the elements and time dimensions of our energy problem highlights the need for many energy technologies.

A COMPARATIVE ANALYSIS OF THREE OF ERDA'S MAJOR  
R & D PROGRAMS, by John P. Weyant.  
Energy, vol. 3, no. 6, December 1978, p. 701-735.

**Abstract**—The benefits attributable to alternative energy R&D programs should be evaluated in terms of how well the technologies contribute as integral elements of the total United States energy system (rather than as isolated entities, as has typically been done in the past). Thus, the present model simulates the dynamics of the evolution of the total energy system by requiring both existing and new technologies to compete for introduction (i.e. commercialization) on a cost-competitive basis that considers the time phasing of (1) retirement of energy conversion facilities, (2) growth in end-use demands, and (3) escalation of the costs of extracting depleting domestic energy resources. This approach contrasts with a static model used by the Energy Research and Development Administration (ERDA), wherein assumptions must be made for each future year of interest for (1) maximum capacity constraints for alternative types of conversion facilities and (2) the cost of energy resources.

The present model is used to compare the relative consequences and merits of the technology products from the following three of ERDA's major energy R & D programs: (1) the liquid-metal fast breeder reactor (LMFBR), (2) synthetic fuels derived from coal and oil shale, and (3) improved efficiencies for end-use devices (e.g. space heaters). It is found that the development of synthetic fuels derived from coal and oil shale is the only alternative (of the three considered) that provides energy independence for the United States in the next fifty years. However, the possible collapse of the world oil cartel is shown to pose a major retardant to synfuels commercialization by the private sector until at least the end of the century. The substantial environmental impact from synfuels commercialization could be reduced significantly with the accelerated introduction of end-use utilizing devices with improved efficiencies. This latter program could result in a significant reduction in the costs of operating the United States energy system over the 60-yr period considered by the model. The discounted present value of this "cost reduction" (i.e. the "economic benefit") would be two orders of magnitude greater than the R & D investment, at least one order of magnitude greater than the expected economic benefits from synfuels commercialization and two orders of magnitude greater than the economic benefits from the commercialization of the LMFBR. However, the lack of performance and cost studies of improved efficiency in end-use suggests increased funding for these technologies rather than reduced funding for the breeder.

**A79-18346** Wind power and other energy options. D. R. Inglis. Ann Arbor, Mich., University of Michigan Press, 1978. 308 p. 191 refs. \$16.

Past experience with wind power is considered along with the mechanics of wind energy conversion, small wind-power installations, large wind-power machines and installations, other solar-related energy sources, geophysical energy sources, nuclear power from fission, nuclear power from fusion, a comparison of dollar costs of wind power and nuclear power, social costs of wind power and nuclear power, and the choice of options. Attention is given to the power of the wind, early wind power development, windmills, home electric power and home heating, the visual acceptability of home windmills, the siting of large wind dynamos, offshore floating wind dynamos, home heating and cooling by using direct solar energy, large solar steam-electric systems, nuclear reactor development, advantages and disadvantages of nuclear power, the present status of nuclear power, the containment problem in nuclear fusion, the costs of large wind dynamos, transmission line costs, and the need for energy storage. G.R.

A MULTIVARIATE-UTILITY APPROACH FOR SELECTION OF  
ENERGY SOURCES, by Shahid Ahmed and A. A. Hussein.  
Energy, vol. 3, no. 6, December 1978, p. 669-700.

**Abstract**—A deterministic approach is devised to compare the safety features of various energy sources. The approach is based on multiattribute utility theory (MAUT). The method is used in evaluating the safety aspects of alternative energy sources used for the production of electrical energy. Four alternative energy sources are chosen which could be considered for the production of electricity to meet the national energy demand. These are nuclear, coal, solar, and geothermal energy. For simplicity, a total electrical system is considered in each case. A computer code is developed to evaluate the overall utility function for each alternative from the utility patterns corresponding to 23 energy attributes, mostly related to safety. The model can accommodate other attributes assuming that these are independent. The technique is kept flexible so that virtually any decision problem with various attributes can be attacked and optimal decisions can be reached. The selected data resulted in preference of geothermal and nuclear energy over other sources, and the method is found viable in making decisions on energy uses based on quantified and subjective attributes.

**A79-10001** Intersociety Energy Conversion Engineering Conference, 13th, San Diego, Calif., August 20-25, 1978, Proceedings. Volumes 1, 2 & 3. Conference sponsored by SAE, ACS, AIAA, ASME, IEEE, AIChE, and ANS. Warrendale, Pa., Society of Automotive Engineers, Inc., 1978. Vol. 1, 926 p.; vol. 2, 821 p.; vol. 3, 734 p. Price of three volumes, members, \$95.; nonmembers, \$110. (For individual items see A79-10002 to A79-10252)

These proceedings deal with advances and research developments in both conventional and nonconventional energy conversion systems as well as engineering applications. The papers cover such areas as aerospace, biomedical, electrochemical, geothermal, and wind power; the Brayton, Rankine, and Stirling cycles; alternate fuels; coal, shale, and tar sands; electric propulsion; energy conversion in general; energy storage systems and transport; hydrogen and marine energy systems; magnetohydrodynamics; nuclear fission and fusion; solar and thermionic energy conversion; space nuclear power; thermoelectric energy; unique power systems; and urban energy advances. Specific topics include synchronous-orbit power systems, energy storage systems and solar-cell developments for space, space power and satellite power systems, aerospace applications of nuclear reactors, various aspects of coal conversion and liquefaction, fluid bed combustion and coal conversion technology, solar concentrators, and thermoelectric photovoltaic systems. F.G.M.

ENERGY AND SOCIETY  
Chaucey Starr

Chemtech, vol. 8, no. 4, April 1978, p. 248-255

Starr lends perspective to energy prognostications by engagingly examining our past.

ALTERNATIVE ENERGY IN THE USSR, by Rolf Grunbaum  
Environment, vol. 20, no. 7, September 1978,  
p. 25-30

THE SOVIET UNION is a country which is fortunate in its energy resources. It has vast supplies of oil, natural gas, and coal, as well as of hydropower. Furthermore, it seems to have adequate amounts of fissionable materials. Consequently, the national program for energy development does not give very high priority to renewable energy sources such as solar, wind, and geothermal. The basic sources of energy will continue to be fossil fuels and hydropower, with an increasing shift away from oil and natural gas towards coal for firing thermal power stations. Parallel to this development, nuclear power plants, including breeders, will gain increasing weight in the country's energy balance and will supply about six percent of the total electrical energy production by 1980 (as compared with approximately two percent in 1976). In addition, there is MHD (Magnetohydrodynamic power generation) with its first commercial-scale units expected to be in operation by about 1985.<sup>1</sup>

TJ  
163.2  
.A6  
v.3  
Annual review of energy, v. 3 / Jack M. Hollander, editor ; Melvin K. Simmons, David O. Wood, associate editors. — Palo Alto, Calif. : Annual Reviews, 1978. 544 p.

Includes bibliographical references and index.

ISEN 0-8243-2303-3

1. Power resources—Addresses, essays, lectures. 2. Energy conservation—Addresses, essays, lectures.  
I. Hollander, Jack M. II. Simmons, Melvin K. III. Wood, David O.

SOFT ENERGY TECHNOLOGIES, Amory B. Lovins

477

TJ  
810  
.P53

Pierson, Richard E., 1934—  
Technician's and experimenter's  
guide to using sun, wind, and water  
power / Richard E. Pierson. West  
Nyack, N.Y. : Parker Pub. Co., 1978.  
270 p. : ill. ; 24 cm. \$9.95  
Includes index.

1. Solar energy. 2. Wind power.

This book is written for experimenters and technicians or anyone interested in building electrical generation units powered by the sun, wind, water, exercise and other FREE energy sources. Now you can benefit from reduced heating and electric bills with the advantage of having a virtually unlimited supply of fuel. (over)

Unlike most of the information available on the market today, this guidebook gives you clear, easy-to-understand explanations of such topics as: specific design criteria; materials you need to build your own equipment; and inexpensive components that you can build yourself.

What's more, you'll find that all of the design problems handled in this guidebook are treated from the standpoint of MINIMUM COST so that no matter what your budget may be, you can join the elite group of solar experimenters.

AN ECONOMIC COMPARISON OF THREE TECHNOLOGIES:  
PHOTOVOLTAICS, NUCLEAR POWER, CO - GENERATING  
ENGINES.

Robert Scott

Environment, Vol. 20, No. 3, April 1978, p.  
11-12

Three different means of providing electricity—photovoltaic cells, co-generating engines, and nuclear power plants—are compared in terms of the delivered cost of the power produced.

ENERGY AND TECHNOLOGY

Edward Falck

Public Utilities FORTNIGHTLY, vol. 101, no. 9

April 1978, p. 21-28

Herein a review of some of the energy technologies of the future. In broad perspective, but with an amount of detail necessary for meaningful demonstration, the author describes those new technologies which in his judgement hold the greatest promise for ending energy shortages and avoiding government rationing of energy supplies or imposition of user taxes to discourage consumption (or both). The result is, on the whole, a refreshing and encouraging prognosis of energy abundance.

ENERGY MATERIALS: A CLASSIFIED LISTING.

Library Jour., v.103, no.1, Jan.1,1977, p.71-79.

A listing of 615 entries from 17 publishers dealing with all aspects of the energy question from alternative sources to power in the wind. Included are 31 products in the field of Audio/Visual. There are also 64 titles appropriate to children's collections.

SANPE Quarterly, v.10, no.1

Oct. 1978

MATERIALS APPLICATIONS IN ADVANCED ENERGY SYSTEMS Special issue - 10th Anniversary issue)

NEW PERSPECTIVES ON THE MATERIALS INTERFACE WITH THE THREE E'S - ENERGY, ENVIRONMENT, AND ECONOMICS.....16

Donald S. Remer

TJ 153 .E6783 dt.3

Energy Development III / sponsored by the IEEE Energy Development Subcommittee of the IEEE Power Generation Committee of the IEEE Power Engineering Society. -- New York : Institute of Electrical and Electronics Engineers, c1977.

176 p. : ill. ; 28 cm. -- (IEEE Power Engineering Society Papers ; 3) "77CH1215-3-PWR"

Corporate Research and Development in Alternate Energy, by Stewart W. Herman and James S. Cannon.....p.20.....

Electric Energy Alternatives Appraisal for New York State, by Martin Becker and Alvin Kaufman.....p.64.....

Putting Alternative Sources of Energy into Perspective, by P. A. Budenholzer and Zalman Lavan.....p.70.....

Power sources Public Utilities Fortnightly, v.100, no.7

Sept. 29, 1977

With Energy, the Best Things in Life Are Not Free ..... Francis X. Welch 18

Whatever the long-term prospects for cheap and abundant supplies of energy, the author of this article, concentrating upon the near-term realities, finds that this nation will not see within the next twenty years a painless passage to a promised land.

N77-29624# Tetra Tech, Inc., Arlington, Va ENERGY FACT BOOK, 1977 Apr. 1977 437 p refs Supersedes TETRAT-A-642-76-254 (Contract NO0014-76-C-0239) (AD A038802; TETRAT-A-642-77-306) Avail NTIS HC A19/MF A01 CSCL 10/1

The Energy Fact Book-1977 summarizes the present U. S. Energy situation; Energy R and D Legislation; Federal Government

Energy R and D; and International Energy R and D. It includes a brief description of the various processes and developments related to hydrocarbon fuels, synthetic fuels, non-hydrocarbon energy sources and energy conservation. Author (GRA)

THE IMPACT OF THE NEW ENERGY TECHNOLOGIES.  
Gerald L. Decker

Mechanical Engineering, Vol. 99, no. 5,  
May 1977, p. 24-27

According to an authoritative study, U.S. energy demand in the year 2000 would reach 185 quads if historical trends were to continue. That's almost 2½ times present use. Probably none of the so-called "wonder solutions"—solar energy, geothermal, burning wastes, coal gasification, etc.—will be ready for any meaningful contribution by that date. Only by intense exploitation of just about every known energy source (with special emphasis on coal), in addition to conservation of energy in every possible way can we avoid economic stagnation and considerable change for the worse in the American life-style.

TJ 163.2.A6 V.2 RR

A78-10675 Annual review of energy. Volume 2. Edited by J. M. Hollander, M. K. Simmons (California, University, Berkeley, Calif.), and D. O. Wood (MIT, Cambridge, Mass.). Palo Alto, Calif., Annual Reviews, Inc., 1977. 530 p. \$17.

The global energy system is considered along with the history and the prospects of the international energy trade, the global energy resources, the policy alternatives of the major energy-importing nations, the role of multinational oil companies in world energy trade, global and international energy models, energy and food, and the impact of production and use of energy on the global climate. Attention is also given to the international safeguards problem, the coming age of conservation, energy and economic growth in Central America, perspectives on energy in the People's Republic of China, an energy perspective for the European Community, perspectives on energy in India, perspectives on energy in Japan, the objectives and the potential of the Organization of the Arab Petroleum Exporting Countries, perspectives on energy in Sweden, the Soviet version of the energy syndrome, and power and energy conversion factors. G.R.

NA Davis, Albert J.  
2542.3 Alternative natural energy sources in  
.D38 building design / Davis & Schubert. — New  
1977 York : Van Nostrand Reinhold, [1977], c1974.  
252 p. : ill. ; 22 x 28 cm.  
Cover title: Alternate natural energy

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1.3	Alternative solutions.....	15
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NINE INTEGRATED SYSTEMS. 193

IF FOSSIL AND FISSILE FUELS FALTER WE'VE GOT...  
Robert L. Klaus

. . . other sources of energy that might be exploited if researchers can give us the technology at a price we can all afford.

Exxon USA, Vol. XVI, no. 2, Second Quarter  
1977, p. 7-11

- HD Metzger, Norman.  
9502 Energy : the continuing crisis / Norman  
.U52 Metzger. — New York : Crowell, c1977.  
M47 x, 242 p. : ill. ; 24 cm.
- 1 Hocus-Pocus 1
  - 2 Circular Pursuit 15
  - 3 Coal: Wednesday's Child 35
  - 4 Oil: The Making of Farces 67
  - 5 The Costly Lessons of Natural Gas 86
  - 6 The Troubled Youth of Nuclear Power 103
  - 7 Futures—Fusion, Solar, Geothermal 139
  - 8 Watts and Money 162
  - 9 The Intruding Samaritan 181
  - 10 Copper Is Not Oil 200
  - 11 Looking Sideways 219
- Selected Bibliography 229

CREATING A WELCOME FOR AEROSPACE ENERGY TECHNOLOGY

Jerry Grey  
Astronautics & Aeronautics  
Vol. 15, no. 7/8, July/August 1977,  
p. 44-53.

Overcoming resistance to advanced energy technology and concepts will be a principal goal of the meeting of the electric utilities and the aerospace industry in an Institute conference next month in San Francisco

- HC Banks, Ferdinand E.  
S5 Scarcity, energy, and economic progress  
.B26 / Ferdinand E. Banks. — Lexington, Mass.  
: Lexington Books, 1977.  
xv, 200 p. : ill. ; 24 cm.  
Bibliography: p. 189-195.  
Includes index.

The first seven chapters of this book are intended as an easy introduction to some of the more important aspects of energy, environment, depletable resources, and economic development. The last chapter contains an introduction to the econometrics of primary commodities, which should interest both students of economics and professional economists. Most of the material in this book is suitable for supplementary reading in various courses in economics; the book could be employed as a text.

- TD McCallum, Bruce  
178.4 Environmentally appropriate technology :  
.M33 renewable energy and other developing technologies for a conserver society in Canada / Bruce McCallum. — 4th ed. — [s.l. : s.n.] 1977.  
v, 155 p. : ill.  
Includes bibliographical references.  
ISBN 0-660-01003-8  
1. Environmental protection—Canada. 2.

CREATING A WELCOME FOR AEROSPACE ENERGY TECHNOLOGY

Jerry Grey.  
Astronautics & Aeronautics, v.15, no.7/8,  
July/Aug.1977, p.44-47.

'FREE' AND RENEWABLE ENERGY SOURCES.

Clare E. Wise

Machine Design, Vol. 49, no. 12, May 26, 1977,  
p. 22-28

Decisions made in the next few years will commit the world to investing billions of dollars in energy facilities—investment in programs with vast momentum. For this reason, the major options must be assessed and a long-term combination decided upon now.

Free and renewable energy sources are high among the options available. Which ones show the most promise? Which are being most heavily funded? What percentage of the nation's energy demands can they be expected to supply over the short and long term?

In a series of articles beginning in this issue, MACHINE DESIGN will assess the potential impact of wind, solar, geothermal, ocean, and bioconversion systems on the nation's energy future.

PUTTING ALTERNATIVE SOURCES OF ENERGY INTO PROSPECTIVE

R.A. Budenholzer and Zalman Lavan  
IEEE Transactions on Power Apparatus and Systems

Vol. PAS-96, no. 4, July/August 1977,  
p. 1190-1195.

The present United States energy consumption pattern is discussed and a realistic evaluation of the various energy options for the next ten to thirty years is presented. In this period oil and natural gas will essentially be exhausted and the emphasis will most likely shift to coal, nuclear energy, solar energy and synthetic fuels. Other alternative energy sources should also be developed since they may offer excellent solutions to specific regions. Energy conservation is essential and must be continuously implemented in all sectors of the economy.

TJ  
153  
.E4783  
pt.3

Energy development III / sponsored by the IEEE Energy Development Subcommittee of the IEEE Power Generation Committee of the IEEE Power Engineering Society. — New York : Institute of Electrical and Electronics Engineers, c1977.

178 p. : ill. ; 28 cm. — (IEEE Power Engineering Society Papers ; 3)

"77CH1215-3-PWR"

"Papers presented at the National Power Engineering Society meetings."

A79-14676 Annual Conference on Energy, 4th, University of Missouri-Rolla, Rolla, Mo., October 11-13, 1977, Proceedings. Volume 4. Conference sponsored by the University of Missouri-Rolla, Missouri Department of Natural Resources, American Petroleum Institute, Ingersoll-Rand Co., and United States Metals Refining Co. Edited by J. D. Morgan (Missouri-Rolla, University, Rolla, Mo.). Rolla, Mo., University of Missouri-Rolla, 1978. 717 p. \$25. (For individual items see A79-14677 to A79-14706)

Papers are presented on energy conservation with reference to specific industries and on a variety of topics associated with solar energy such as the design of solar arrays, estimating hourly levels of solar radiation, and a solar energy system for space heating and cooling. Attention is given to the industrial regulation of energy conservation systems and to bioconversion, noting forest residues as an energy source and energy farming. A strategy for using nuclear power is presented and aspects of consumer energy management are suggested. Consideration is given to the political and social implications of energy conservation programs and to energy pricing strategies. Solar and wind energy resources are described with reference to programs in Missouri, Oklahoma, and Montana. S.C.S.

A79-14760 Miami International Conference on Alternative Energy Sources, Miami Beach, Fla., December 5-7, 1977, Proceedings of Condensed Papers. Conference sponsored by the U.S. Department of Energy and University of Miami. Edited by T. N. Veziroglu (Miami, University, Coral Gables, Fla.). Coral Gables, Fla., University of Miami, 1978. 954 p. \$50. (For individual items see A79-14761 to A79-14773)

Consideration is given to such areas as solar energy economics, solar collectors, ocean thermal energy conversion, coal conversion, geothermal energy, nuclear breeders, and fusion power. Papers are also presented in such fields as power generation and transportation, hydrogen energy, solar heating and cooling, energy transmission, bioconversion, energy conservation, photovoltaics, heat storage and transfer, wind energy, and synthetic fuels. B.J.

TJ Kadambi, V  
 153 An introduction to energy conversion. v. 3.  
 .K27 Turbomachinery / by V. Kadambi and Manohar  
 v.2 Prasad. -- New York : Wiley, c1977.  
 viii, 284 p.  
 "A Halsted Press book."  
 Includes bibliographical references  
 and index.  
 1. Power (Mechanics). 2. Thermodynamics.  
 I. Prasad, Manohar, joint author. II.  
 Title. III. Title : Turbomachinery.

THE COMING ENERGY TRANSITION

Denis Hayes

The Futurist

Vol. XI, no. 5, October 1977, p. 303 - 309.

The world will experience a historic change in its patterns of energy use during the years ahead. This change in energy use is dictated by the rapid exhaustion of easily exploited deposits of petroleum and natural gas. However, there is now a wide area of choice about how to reshape our approach to energy in order to have a prosperous world in the future. A researcher at the Worldwatch Institute in Washington, D.C., recently reviewed the energy options and here reports his conclusions.

TJ Girod, Jacques  
 153 La demand d'energie : methodes  
 .G57 et techniques de modelisation /  
 Jacques Girod. - Paris : Centre  
 National de la Recherche Scientifique,  
 1977.  
 185 p. : ill. - (Energie et  
 societe)  
 In French.  
 Bibliography: p. (173)-185.  
 1. Power resources--Research. I.

TJ New options in energy technology / sponsored  
 163.2 by the American Institute of Aeronautics and  
 .N47 Astronautics, Edison Electric Institute, IEEE  
 Power Engineering Society. -- New York :  
 American Institute of Aeronautics and Astro-  
 nautics, c1977.  
 149 p. : ill. ; 29 cm.  
 Papers nos. 77-1004-771034  
 Includes bibliographical references.  
 1. Power resources--Research--Congresses.

A78 24751 Energy technology IV: Proceedings of the  
 Fourth Conference, Washington, D.C., March 14-16, 1977. Edited by  
 R. F. Hill. Washington, D.C., Government Institutes, Inc., 1977. 493  
 p. \$25. (For individual items see A78 24752 to A78 24764)

Solar heating and cooling, natural gas and petroleum tech-  
 nology, nuclear power development, and the conversion of biomass  
 and municipal solid waste to energy are discussed. Topics of the  
 papers include the solar energy research sponsored by ERDA,  
 economic and environmental constraints on coal-burning power  
 plants, magnetic fusion power plant schemes, builders' and devel-  
 opers' reactions to the solar energy industry, solar heating and/or  
 cooling for residences, schools and offices, flue gas desulfurization to  
 limit SO2 emissions from coal-burning power plants, and the  
 production of methane from cattle feedlot residues. J.M.B.

TK Intersociety Energy Conversion Engineering  
 2896 Conference, 12th, Washington, 1977.  
 .155 Proceedings of the 12th Intersociety  
 1977 Energy Conversion Engineering Conference,  
 Washington, D. C., August 29 through  
 September 2, 1977. -- La Grange, Ill. :  
 American Nuclear Society, c1977.  
 2 v. : ill. ; 29 cm.  
 Presented by the American Nuclear  
 Society in cooperation with the IBCCEC  
 Steering Committee.

ORIGINAL PAGE IS  
 OF POOR QUALITY

THE THIRD WORLD NEEDS ENERGY TOO.

Jane Raloff  
Science News  
Vol. 112  
p. 234-235

No. 15 October 8, 1977

Selecting appropriate technologies for the energy poor involves merging economics, anthropology and engineering

**N77-24633#** National Academy of Sciences - National Research Council. Washington, D. C. Committee on Nuclear and Alternative Energy Systems.

**REPORT OF THE NATIONAL RESEARCH COUNCIL COMMITTEE ON NUCLEAR AND ALTERNATIVE ENERGY SYSTEMS**

21 Jan. 1977 60 p

(Contract EX-76-C-10-3784)  
(PB-263595/1) Avail: NTIS HC A04/MF A01 CSCL 181

The nation's energy future was studied with special consideration of the role of nuclear power in the context of alternative energy systems. Appropriate roles of nuclear and alternative energy systems in the nation's energy future, with a focus on the period between 1985 and 2010, are described. Energy conservation and demand, supply and delivery systems, risks and impacts of various delivery and end-use systems, and alternative future energy scenarios are considered. GRA

**A77-48701** Intersociety Energy Conversion Engineering Conference, 12th, Washington, D.C., August 28-September 2, 1977, Proceedings. Volumes 1 & 2. Conference sponsored by ANS, SAE, ACS, ASME, AIAA, IEEE, and AIChE. La Grange Park, Ill., American Nuclear Society, Inc., 1977. Vol. 1, 1007 p.; vol. 2, 986 p. Price of two volumes, members, \$45.; nonmembers, \$100. (For individual items see A77-48702 to A77-48909)

The papers in this collection deal with continuing advances in the search for and development of new sources of energy and more efficient processes that consume energy. The topics cover a wide range, including advanced auto propulsion, alternative fuels, Brayton cycle engines, fluid bed combustion, geothermal and solar power systems, Rankine cycle engines, thermionics, and wind power. P.T.H.

WORLD ENERGY IN PERSPECTIVE.

John W. Simpson

Public Utilities Fortnightly, vol. 99, n no. 12, June 9, 1977, p. 27 - 31

THE ECONOMICS OF ENERGY GROWTH

Hamilton Treadway

Public Utilities - Fortnightly

Vol. 100, no. 6, September 15, 1977,  
p. 9-18.

**A78-27776** World Energy Conference, 10th, Istanbul, Turkey, September 19-23, 1977, Proceedings (Conférence Mondiale de l'Energie, 10th, Istanbul, Turkey, September 19-23, 1977, Proceedings.) *Revue de l'Energie*, vol. 28, Aug. Sept. 1977. 218 p. In French and English. (For individual items see A78-27777 to A78-27790)

A series of articles concerning perspectives for energy production is presented. Several aspects of developing national and international energy policies are outlined, with reference to Europe, U.S., Japan, USSR, India, and Algeria. Prospects for developing new energy sources from oil shale, heavy oil, petroleum reserves, deep sea oil, coal gasification, heat pumps, and natural photosynthesis are reviewed. S.C.S.

II. FOSSIL FUELS . . . . .	109
A. General . . . . .	110
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3. Environmental Aspects . . . . .	269

GENERAL

TP  
630  
.A52

Anderson, Larry LaVon.  
Synthetic fuels from coal :  
overview and assessment / Larry L.  
Anderson and David A. Tillman. -- New  
York : Wiley, c1979.  
xii, 158 p.  
"A Wiley-Interscience publication."  
Includes bibliographical references  
and index.  
ISBN 0-471-01784-1 : \$17.50

I. Synthetic fuels. I. Tillman,  
David A., Joint author. II. Title.  
TP630.A52 662'.66 79-17786  
79V35593

SYNTHETIC FUELS CHEAPER THAN OIL?

Electric Power Research Institute Journal, vol 4,  
no 9, November 1979, p. 18-23.

Yes, says an EPRI comparison of estimated prices from mature  
commercial plants. But the financial incentives to build those  
plants will also determine when synfuels become the best buy.

CN-150,891 *Fuels, Synthetic* 1979  
COSTS AND ECONOMIC CONSEQUENCES OF SYNTHETIC  
FUELS PROPOSALS. (Hearings before the Sub-  
committee on Synthetic Fuels of the Committee  
on the Budget, U.S. Senate, 96th Congress,  
1st Session, Sept.5-6,1979). Nov.30,1979. 137p.

96th Congress, 1st Session  
Committee on the Budget

Hearings - Committee on the Budget,  
United States

Fuels - Synthesis

CN-150,892 *Fuels, Synthetic* 1979  
SYNTHETIC FUELS. (Rept. by the Subcommittee  
on Synthetic Fuels of the Committee on the  
Budget, U.S. Senate, Sept.27,1979). 1979.  
476p. (Committee Print).

96th Congress, 1st Session  
Committee on the Budget

Fuels - Synthesis  
Reports, Congressional  
Committees - Synthetic fuels

79A30554\*# ISSUE 11 PAGE 2062 CATEGORY 44  
RPT#: ASME PAPER 79-GT-38 79/03/00 16 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Benefits of solar/fossil hybrid gas turbine systems  
AUTH: A/BLOOMFIELD, H. S. PAA: A/(NASA, Lewis Research  
Center, Cleveland, Ohio)  
CORP: National Aeronautics and Space Administration, Lewis

Research Center, Cleveland, Ohio.  
American Society of Mechanical Engineers Gas Turbine  
Conference and Exhibit and Solar Energy Conference,  
San Diego, Calif., Mar. 12-15, 1979. 16 p.

MAJS: /ELECTRIC POWER PLANTS/\*FOSSIL FUELS/\*GAS TURBINES/\*  
SOLAR ENERGY CONVERSION

MINS: /BRAYTON CYCLE/ COST ANALYSIS/ ENERGY TECHNOLOGY/  
RETROFITTING

ABA: (Author)

ABS: The potential benefits of solar/fossil hybrid gas  
turbine power systems were assessed. Both retrofit and  
new systems were considered from the aspects of cost  
of electricity, fuel conservation, operational mode,  
technology requirements, and fuels flexibility. Hybrid  
retrofit (repowering) of existing combustion (simple  
Brayton cycle) turbines can provide near-term fuel  
savings and solar experience, while new and advanced  
recuperated or combined cycle systems may be an  
attractive fuel saving and economically competitive  
vehicle to transition from today's gas and oil-fired  
powerplants to other more abundant fuels.

79A37285 ISSUE 15 PAGE 2768 CATEGORY 44  
79/04/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fuel release from solid fossil-fuel deposits by  
electrical induction heating  
AUTH: A/FISHER, S. T. PAA: A/(F. T. Fisher's Sons, Ltd.,  
Montreal, Canada)

MAJS: /COAL GASIFICATION/\*FOSSIL FUELS/\*HYDROCARBON FUEL  
PRODUCTION/\*INDUCTION HEATING/\*MAGNETIC INDUCTION/\*OIL  
EXPLORATION

MINS: /COST ESTIMATES/ DRILLING/ ENERGY TECHNOLOGY/ HEATING  
EQUIPMENT/ TUNNELING (EXCAVATION)

ABA: (Author)

ABS: The solid fossil fuels are nonmagnetic electrical  
partial conductors with relatively high  
electromagnetic loss factors and therefore absorb  
energy efficiently from an alternating electromagnetic  
field. The electrical induction heating of fossil-fuel  
deposits permits low-cost, clean production in situ of  
petroleum, natural gas, coal tar and electricity on  
large scales. Physical and chemical data and  
laboratory investigations indicate the technical and  
economic feasibility of the processes.

N80 14259# Naval Research Lab., Washington, D. C.  
MICROBIAL DETERIORATION OF HYDROCARBON FUELS  
FROM OIL SHALE, COAL, AND PETROLEUM. 1: EXPLOR-

ATORY EXPERIMENTS Interim Report

Marian E. May and Rex A. Neihof 20 Aug. 1979 28 p. refs  
(ZF57571004)

(AD-A073761; AD-E000316; NRL-MR-4060) Avail. NTIS  
HC A03/MF A01 CSCL 21/4

As part of the Navy's program on alternative sources of  
hydrocarbon fuel, the susceptibility to microbial deterioration of  
JP-5 derived from oil shale and coal (referred to as synthetic  
fuels) was investigated and compared with that of petroleum  
JP-5. Six fungi, including three strains of *Cladosporium resinae*,  
a yeast (*Candida*) and a bacterium (*Pseudomonas*) which normally  
grow well in association with petroleum JP-5 were used as test  
organisms in two-phase systems containing fuel/aqueous media.  
Most of the test organisms were inhibited to various extents in  
the presence of the synthetic fuels. An exception was a *Fusarium*  
species (fungus) which grew equally well under all three fuels.  
In mixtures of 75% petroleum and 25% synthetic fuels, microbial  
growth was generally equivalent to that in 100% petroleum JP-5.  
A search was made among samples of soil, creosoted wood  
and tree resins for microorganisms that could thrive in the presence  
of synthetic fuels. This endeavor produced a strain of *C. resinae*  
that grew as well with oil shale JP-5 as with petroleum JP-5.  
These exploratory experiments indicate that microorganisms  
adapted to growth with conventional petroleum fuel tend to be  
inhibited by synthetic fuels, but that organisms probably exist in  
nature which can readily adapt to and grow in the presence of  
synthetic fuels. GRA

CN-150,941 Fuels - Synthetic 1979  
OVERSIGHT: SYNTHETIC FUELS. VOLUME XI.  
(Hearings before the Committee on Science  
and Technology, U.S. House of Representatives,  
96th Congress, 1st Session, Sept. 6, 7, 10, 12, 13,  
1979). 1979. 1168p.

96th Congress, 1st Session  
96th Congress, 1st Session No. 56  
Committee on Science and Technology

Hearings - Committee on Science and Technology  
Fuels - Synthesis

79N32746# ISSUE 23 PAGE 3117 CATEGORY 45 RPT#:  
DOE/EDP-0046 79/04/00 101 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Environmental development plan, fossil fuel  
utilization program  
CORP: Department of Energy, Washington, D. C. AVAIL NTIS  
SAP: HC A06/MF A01  
MAJS: /\*DECISION MAKING/\*ENERGY TECHNOLOGY/\*ENVIRONMENT  
PROTECTION/\*FOSSIL FUELS/\*PROJECT PLANNING  
MINS: / ENVIRONMENT EFFECTS/ PUBLIC HEALTH/ RESEARCH AND  
DEVELOPMENT/ SAFETY  
ABA: DOE  
ABS: A common basis for planning, managing, and reviewing  
all environmental aspects of the energy programs under  
DOE's jurisdiction is provided by environmental  
development plans (EDP) which identify the  
environmental concerns and research and development

necessary for assessing the potential environmental  
impacts and mitigating measures associated with an  
energy technology. To ensure that environmental,  
health, and safety (EH&S) considerations will be  
addressed adequately in the technology decision making  
process, the EDP (1) identifies and evaluates EH&S  
concerns; (2) defines EH&S research and related  
assessments to examine or resolve the concerns; (3)  
provides a coordinated schedule with the technology  
program for required EH&S research and development;  
and (4) indicates the timing for environmental  
assessments, environmental impact statements,  
environmental readiness documents, and safety analysis  
reports.

#### HEAVY OIL-AN UNTAPPED FIND. R.I. Berry

Chemical Engineering, vol 86, no 16, July 30, 1979,  
p. 25-27.

A far more plentiful resource than conventional  
crude, heavy oil has been held back by extraction  
and processing problems. But the economics of  
production and recovery are becoming increasingly  
attractive.

Fuel Conversion and its Environmental effects  
By: H.Gold Walter , J.A.Nardella and C.A.Vogal

Chemical Engineering Progress, Vol. 75, No. 8, Aug. 1979,  
P. 53-64

The objective of the work presented in this article was  
to determine the feasibility of siting specific conversion  
plants at given locations in the major U.S. coal and oil shale  
bearing regions; and the extent of the environmental  
impacts that could be expected from local water-related  
site, process and plant design criteria. Of the 90 plant-site  
combinations studied, 48 were in the central and eastern  
coal bearing regions and 42 in the western coal and oil shale  
bearing regions. The plants were assumed to be designed so  
as not to waste water. Effluent process waters were assumed  
to be reused, and different cooling options were selected  
based on the availability and cost of water. Estimates were  
made of the total net water consumed, wet solid residuals  
generated, and the cost and energy required for water  
treatment for each plant-site combination and then general-  
ized to each one of the major U.S. coal and oil shale  
bearing regions.

In this article the data are summarized for a number of  
conversion processes without distinguishing between coal  
rank or coal and oil-shale bearing region. These data have  
been generalized from individual plant-site results. Details  
of the complete study are reported by Gold and Goldstein  
(1) and Probst and Gold. (2)

#### FINANCING NEW ENERGY SOURCES

R. A. Moon, C. E. French and B. E. Byington

Chemical Engineering Progress, vol. 75, no. 12,  
Dec. 1979, pp. 13-16.

#### EVALUATION OF USE OF SYNGAS FOR COAL LIQUEFACTION. R. F. Batchelder and Y. C. Fu.

Process Design and Development, vol 18, no 4, October  
1979, p. 594-598.

FOSSIL FUEL AND ADVANCED SYSTEMS DIVISION.

Electric Power Research Institute Journal, vol 4,  
no 1, January/February 1979, p. 37-41.

SYNTHETIC FUELS DRAW DEFENSE FOCUS. David R. Griffiths

Aviation Week and Space Technology, vol 111, no 9,  
August 27, 1979, p. 19-20.

WHICH BOTTOM LINE?

Reuel Shinnar & Meir Shinnar  
Chemtech, Vol. 8, No. 7, July 1978, p.  
418-423.

Current conventional wisdom says that the price of synthetic fuels and especially the investment associated with them are prohibitively high. That's not necessarily so. Here we show why developing synthetic fuels is not intrinsically more expensive than is finding oil and gas. We'll demonstrate that the apparent high price of coal-derived fuels is due mainly to differences in tax, accounting and legal practices. This is an important general concept; that is, that cost of energy is under *public* control—through the Congress.

TP

360

.P76

**Probstein, Ronald F.**

**Water in synthetic fuel production ;  
the technology and alternatives /  
Ronald F. Probstein, David Goldstein,  
and Harris Gold. Cambridge, Mass. :  
MIT Press, 1978.**

xii, 296 p. : ill. ; 23 cm. pbk  
Includes bibliographies and index.

1. Synthetic fuel industry --  
Water-supply. 2. Synthetic fuel  
industry -- Waste disposal. I.

POWER IN PILL FORM

Mark D. Zimmerman

Machine Design

Vol. 50 no. 5 March 9,  
p. 86-89 1978

If a design requires a forceful kick and needs it in a hurry, consider systems powered by a rocket-type propellant. Small capsules or cartridges of solid fuel act faster and with more muscle than practically any other common power source.

COAL SLURRY FUELS A DIESEL

H.P. Marshall and D.C. Walters, Jr.

Automotive Engineering

Vol. 86, no. 1, January 1978  
pp. 67-69.

One of man's oldest fuels, coal, has been combined with one of his newest, Jet-A, to run a diesel research engine. While power and fuel consumption characteristics look promising, problems with fuel system clogging preclude a full assessment of this potential alternative fuel.

THE FUEL SITUATION

Robert B. Parke

Flying

Vol. 102 no. 3  
p. 43-49

March 1978

How much aviation fuel we'll have tomorrow, where its coming from, what we'll pay for it, and how to make the best use of it.

79A30215 ISSUE 11 PAGE 2059 CATEGORY 44  
78/12/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Electrical induction heating of solid fossil fuels in situ - Some estimates  
AUTH: A/FISHER, S. T. FAA: A/(F. T. Fisher's Sons, Ltd., Montreal, Canada)  
Speculations in Science and Technology, vol. 1, Dec. 1978, p. 441-451.  
MAJS: /\*FOSSIL FUELS/\*HYDROCARBON FUEL PRODUCTION/\*INDUCTION HEATING  
MINS: / CLEAN ENERGY/ ENERGY TECHNOLOGY/ GEOTHERMAL RESOURCES/ MATERIALS RECOVERY  
ABA: (Author)  
ABS: It is believed that the world has adequate reserves of solid fossil fuels to supply it with energy and petrochemicals for centuries. A proposed in-situ technique for high-yield low-cost clean exploitation, electrical induction heating, is described. This method consists of shafts and tunnels encompassing the fuel deposit drilled from the surface, with electrical conductors, forming a coil that may be a kilometer or more in diameter, threaded through these openings. A large alternating current passed through the coil sets up alternating electric and magnetic fields in the solid fossil-fuel deposit. These fields induce currents in the electrically dissipating material. These currents then heat the material so that the energy content of the fuel can be brought to the surface in the form of gaseous hydrocarbons, steam, or hot gas to be utilized there by conventional methods. This process may double or triple the recovery rates

79A41818 ISSUE 17 PAGE 3260 CATEGORY 44  
78/00/00 8 PAGES In FRENCH UNCLASSIFIED DOCUMENT

UTTL: Substitute fuels and development of recovery methods  
AUTH: A/BRUSSET, H. PAA: A/(Paris VI, Université; Ecole Centrale des Arts et Manufactures, Paris, France)  
In: INOVA: Industrial Innovation; Conference, Paris, France, June 13-17, 1977, Proceedings, Volume 2, (A79-41801 17-44) Paris, Ministère de l'Industrie, 1978, p. 193-200. In French.  
MAJS: /\*ENERGY SOURCES/\*FOSSIL FUELS  
MINS: / BIOMASS/ BITUMENS/ CARBON/ ENERGY TECHNOLOGY/ EVALUATION/ SHALE OIL/ TAR SANDS/ WASTE UTILIZATION  
ABA: B.U.  
ABS: After a brief discussion of the general energy problem (i.e., the depletion of conventional fossil fuels), the paper examines the development of substitute energy sources, including oil shale, bituminous sands, bituminous schists, coal, biomass, and urban waste. Techniques for the economic evaluation of such substitute fuels are briefly discussed and carbon is examined as the principal 'energy vector'.

79A17646 ISSUE 5 PAGE 864 CATEGORY 44 78/00/00  
603 PAGES UNCLASSIFIED DOCUMENT

UTTL: Perspectives on energy: Issues, ideas, and environmental dilemmas /2nd edition/ --- Book  
AUTH: A/RUEDISILI, L. C.; B/FIREBAUGH, M. W. PAA: A/(Toledo, University, Toledo, Ohio); B/(Wisconsin, University, Kenosha, Wis.) PAT: A/(ED.) SAP: \$8.95  
New York, Oxford University Press, Inc., 1978, 603 p (For individual items see A79-17647 to A79-17649)

ABA: G.R.  
ABS: Fossil fuel energy sources are considered along with nuclear fission as an energy source, alternative energy sources, conservation, life-styles, and energy policy for the future. Attention is given to boundary conditions in energy and ecology, health effects of energy production and conversion, energy use in the U.S. food system, the economics of the energy problem, a survey of world energy resources, coal conversion technology, the impact of technical advice on the choice for nuclear power, nuclear power generation, impacts of the nuclear energy industry on human health and safety, the toxicity of plutonium and some other actinides, security implications of alternative fission futures, cost escalation in nuclear power, the prospects for fusion, solar energy, solar heating and cooling, solar power from satellites, oil shale and the energy crisis, geothermal energy, and the potential for fuel conservation.

#### PEAT FOR FUEL: DEVELOPMENT PUSHED BY BIG CORPORATE FARM IN CAROLINA.

Science, v.199, Jan.6,1978, p.33-34.

Interest in development of peat deposits as an energy resource has, until the last year or two, been concentrated in the Midwest (Science, 12 December 1975), where the peat bogs are much more extensive than those found in most other parts of the United States. But a new center of initiative is now rapidly emerging in eastern North Carolina—peat development there would complement an extraordinarily ambitious private undertaking to convert large tracts of swampy, brushy terrain to productive farmland. But since 1975 First Colony has been developing plans to turn the peat to its advantage by mining it as fuel, either to be burned directly for generation of electricity or converted to synthetic gas.

RE:PEAT

William W. Bodle, Dharam V. Punwani, and Michael C. Mensinger  
Chemtech, vol. 8, no. 9, September 1978, p. 559-563

*Little explored fuel/raw material source.*

✓ 79A14112 ISSUE 3 PAGE 425 CATEGORY 45 78/00/00  
6 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Energy consumption of environmental controls - Fossil fuel, steam electric generating industry  
AUTH: A/MURPHY, B. L.; B/HOFFNAGLE, G. F.; C/MAHONEY, J. R.; D/WATSON, J. J. PAA: D/(Environmental Research and Technology, Inc., Lexington, Mass.)  
In: Energy and the environment; Proceedings of the Fifth National Conference, Cincinnati, Ohio, November 1-3, 1977. (A79-14106 03-45) Dayton, Ohio, American Institute of Chemical Engineers, 1978, p. 174-179.  
MAJS: /\*AIR POLLUTION/\*COMBUSTION CONTROL/\*ELECTRIC POWER PLANTS/\*ENERGY CONSUMPTION/\*ENVIRONMENTAL CONTROL/\*FOSSIL FUELS  
MINS: / COMBUSTION PRODUCTS/ ENERGY TECHNOLOGY/ FUEL COMBUSTION/ STEAM TURBINES/ SULFUR DIOXIDES/ WASTE ENERGY UTILIZATION  
ABA: B.J.  
ABS: Results are presented of a detailed study of environmental-control energy requirements for the fossil fuel, steam electric generating industry. The study represents a significant improvement in estimates of energy use because it is based on real data from a large sample of power plants. The final result of the study is that energy use for environmental control in this industry will be between 1% and 2% of total United States energy consumption by 1983. Consideration is also given to the relative importance of various regulatory areas and to control system options which lead to significant energy savings.

✓ 79A10220\* ISSUE 1 PAGE 119 CATEGORY 44 CNT#: NAS7-100 78/00/00 7 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Prospects of thermionic power systems  
AUTH: A/SHIMADA, K. PAA: A/(California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.)  
CORP: Jet Propulsion Lab., California Inst. of Tech., Pasadena.  
In: Intersociety Energy Conversion Engineering Conference, 13th, San Diego, Calif., August 20-25, 1973. Proceedings, Volume 3. (A79-10001 01-44) Warrendale, Pa., Society of Automotive Engineers, Inc., 1978, p. 1929-1935.  
MAJS: /\*ENERGY CONVERSION EFFICIENCY/\*FOSSIL FUELS/\*SPACECRAFT POWER SUPPLIES/\*STEAM TURBINES/\*TECHNOLOGICAL FORECASTING/\*THERMIONIC CONVERTERS  
MINS: / COST EFFECTIVENESS/ ENERGY TECHNOLOGY/ NUCLEAR ENERGY/ RADIOACTIVE ISOTOPES/ RELIABILITY ENGINEERING/ SOLAR HEATING/ SYSTEMS ENGINEERING/ THERMIONIC POWER GENERATION  
ABA: S.D.  
ABS: Potential thermionic power systems for space or terrestrial applications are described so that the development goals can be clearly identified. The thermionic power systems considered are a space nuclear power system, a fossil-fuel thermionic topping steam power system, a solar thermionic topping steam power system, and advanced systems. Attention is given to a discussion of the current status of technology development in thermionic converters and associated elements in power systems. Future prospects of thermionic power systems are also discussed. It is concluded that thermionic conversion has a great potential for a variety of applications.

✓ 79N27628 ISSUE 18 PAGE 2427 CATEGORY 43 RPT#: IIASA-RM-78-35 78/06/00 46 PAGES UNCLASSIFIED DOCUMENT DCAF E091206  
UTTL: On fossil fuel reserves and resources  
AUTH: A/GRENON, M.  
CORP: International Institute for Applied Systems Analysis, Laxenburg (Austria). SAP: Avail: Issuing Activity  
MAJS: /\*ENERGY POLICY/\*FOSSIL FUELS/\*RESERVES  
MINS: / COAL/ CRUDE OIL/ DEPLETION/ EARTH RESOURCES/ ESTIMATES/ NATURAL GAS/ RESOURCES MANAGEMENT  
ABA: Author (ESA)  
ABS: Three independent studies assessing fossil fuel

resources and reserves of coal, oil, and gas with their possible maximum production until 2020 are presented. Estimates and predictions are based on technical and economic considerations, but exclude political ones. These aspects are put into perspective with the current thinking of the majority of experts in this field and used to estimate some possible future production in relation to demand scenario for the world in the year 2030. Results and conclusions drawn are considered to be conservative.

79A10180 ISSUE 1 PAGE 150 CATEGORY B3 CNT#:  
EG-77-G-04-4138 78/00/00 7 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: The fossil fuel cost of solar heating  
AUTH: A/PAYNE, P. R.; B/DOYLE, D. W. PAA: B/(Payne, Inc.,  
Annapolis, Md.)

In: Intersociety Energy Conversion Engineering  
Conference, 13th, San Diego, Calif., August 20-25,  
1978, Proceedings, Volume 2. (A79-10001 01-44)  
Warrendale, Pa., Society of Automotive Engineers,  
Inc., 1978, p. 1650-1656.

MAJS: /\*COST ESTIMATES/\*FOSSIL FUELS/\*FUEL CONSUMPTION/\*  
SOLAR COLLECTORS/\*SOLAR COOLING/\*SOLAR HEATING

MINS: / CERAMICS/ COOLING SYSTEMS/ ENERGY CONVERSION  
EFFICIENCY/ ENERGY TECHNOLOGY/ FLAT PLATES/  
MAINTENANCE/ SYSTEM EFFECTIVENESS

ABA: F.G.M.

ABS: The fossil-fuel investment required to build and  
install a solar heating or cooling system is estimated  
in terms of the average energy needed to fabricate  
various raw materials and products as well as the  
energy assignable to labor. It is found that, in  
general, the energy investment for a flat-plate

fluid-heating collector system is about 1.9 million  
Btu/sq ft and that the payback time for this is 10.4  
yr. assuming an average collector efficiency of 0.35  
and neglecting maintenance costs. It is suggested that  
this energy payback time is unacceptable since not  
much fossil fuel is saved and that less  
energy-intensive materials be employed. Some  
low-energy solutions are discussed, including concrete  
solar collectors, concrete-block air heaters, and clay  
and ceramic collectors. It is concluded that the  
energy cost for a ceramic collector produced with the  
aid of a closed-circuit furnace is around 4000 Btu/sq  
ft, which is low enough for solar collectors to be  
used to power the collector manufacturing facility.

79N71496# CATEGORY 44 RPT#: ORNL-TM-6274 CNT#:  
W-7405-ENG-26 78/03/00 63 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Fossil energy program TLSP: Progress Report, Jan.  
1978

AUTH: A/MCNEESE, L. E.

CORP: Oak Ridge National Lab., Tenn. AVAIL:NTIS

MAJS: /\*ENERGY TECHNOLOGY/\*FLUIDIZED BED PROCESSORS/\*FOSSIL  
FUELS/\*PYROLYSIS

MINS: / CLADDING/ COAL GASIFICATION/ INCONEL (TRADEMARK)/  
PLASMA SPRAYING

79A10122 ISSUE 1 PAGE 114 CATEGORY 44 78/00/00  
7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fossil superheating in geothermal steam power plants  
AUTH: A/DIPIPPA, R.; B/KHALIFA, H. E.; C/CORREIA, R. J.;  
D/KESTIN, J. PAA: D/(Brown University, Providence,  
R.I.)

In: Intersociety Energy Conversion Engineering  
Conference, 13th, San Diego, Calif., August 20-25,  
1978, Proceedings, Volume 2. (A79-10001 01-44)  
Warrendale, Pa., Society of Automotive Engineers,  
Inc., 1978, p. 1095-1101. Research supported by the  
U.S. Department of Energy.

MAJS: /\*ELECTRIC POWER PLANTS/\*ENERGY TECHNOLOGY/\*FOSSIL  
FUELS/\*GEOTHERMAL ENERGY CONVERSION/\*SUPERHEATING

MINS: / EARTH RESOURCES/ FIGURE OF MERIT/ HYBRID STRUCTURES/  
STRUCTURAL DESIGN

ABA: (Author)

ABS: This paper reports the results of thermodynamic  
studies of geothermal steam power systems  
incorporating fossil-fired superheaters. One- and  
two-stage systems are covered. Realistic assumptions  
have been included to account for losses that may be  
incurred in actual plants. The systems are evaluated  
on the basis of a number of appropriate figures of  
merit. It is found that fossil superheat hybrid  
geothermal power plants offer a thermodynamic  
advantage over individual fossil and geothermal plants  
for a wide range of operating conditions, and deserve  
consideration whenever fossil and geothermal energy  
resources are found in reasonable proximity.

78N31586# ISSUE 22 PAGE 2965 CATEGORY 44 RPT#:  
NTIS/PS-78/0586/4 NTIS/PS-77/0520 78/06/00 219  
PAGES UNCLASSIFIED DOCUMENT

Supersedes NTIS/PS-77/0520

UTTL: State-of-the-art reviews and bibliographies on energy.  
A bibliography with abstracts TLSP: Final Report,  
1964 - May 1978

AUTH: A/HUNDEMANN, A. S.

CORP: National Technical Information Service, Springfield,  
Va. AVAIL:NTIS SAP: HC \$28.00/MF \$28.00

MAJS: /\*BIBLIOGRAPHIES/\*ENERGY TECHNOLOGY/\*FOSSIL FUELS/\*  
GEOTHERMAL RESOURCES/\*SOLAR ENERGY/\*WINDPOWER  
UTILIZATION

MINS: / ELECTRIC POWER/ HYDROGEN-BASED ENERGY/ STORAGE  
BATTERIES/ TECHNOLOGY ASSESSMENT

ABA: GRA

ABS: This updated bibliography contains 214 abstracts.  
Citations to bibliographies, state-of-the-art reviews,  
and literature surveys on various aspects of fossil  
fuels, wind, solar energy, hydrogen, geothermal  
energy, nuclear energy and batteries are presented. A  
few citations pertain to electric power.

79N14532# ISSUE 5 PAGE 617 CATEGORY 44  
78/09/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Current and projected fuel costs --- electric rate  
schedules and projected costs of fossil, synthetic,  
and nuclear fuels

CORP: Office of Technology Assessment, Washington, D. C.

AVAIL: NTIS SAP: HC A99/MF A01; HC S0D  
In its Appl. of Solar Technol. to Today's Energy  
Needs, Vol. 2 p 27-39 (SEE N79-14530 05-44)

MAJS: /\*COST ANALYSIS/\*ELECTRIC POWER/\*ESTIMATING/\*  
FORECASTING/\*FOSSIL FUELS/\*NUCLEAR FUELS/\*SYNTHETIC  
FUELS/\*UTILITIES

MINS: / CITIES/ DOMESTIC ENERGY/ ECONOMIC IMPACT/ PRODUCT  
DEVELOPMENT/ SOLAR ENERGY CONVERSION/ TABLES (DATA)

ABA: A.R.H.

ABS: Residential consumer prices for natural gas, heating  
oil, and electricity vary significantly in different  
parts of the country. Future prices will depend on:  
(1) the cost of developing and producing domestic fuel  
resources; (2) the price of imported fuels; (3) the  
cost of producing synthetic fuel substitutes; (4)  
externalities such as environmental regulations; and  
(5) explicit and implicit regulatory impact. Confident  
estimates in these areas simply are not possible,  
although a large number of the estimates can be  
supported. The predicted future price of fuel can have  
a strong influence on both private and public  
decisions about solar energy. Investments in solar and  
other conservation equipment will appear more  
attractive if energy prices are expected to rise  
sharply instead of remaining constant or increasing  
gradually.

79N70146# CATEGORY 44 RPT#: DOE/ET-0013(78)  
78/03/00 487 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fossil Energy Research and Development Program of the  
U. S. Department of Energy, fiscal year 1979

CORP: Department of Energy, Washington, D. C. AVAIL NTIS

MAJS: /\*ENERGY CONVERSION/\*FOSSIL FUELS

MINS: / COAL GASIFICATION/ ENVIRONMENT PROTECTION/ NATURAL  
GAS/ OILS/ TECHNOLOGY ASSESSMENT

79A16487# ISSUE 4 PAGE 575 CATEGORY 31  
78/00/00 70 PAGES UNCLASSIFIED DOCUMENT

UTTL: High-temperature oxidizer preheater --- for fossil  
fuel MHD energy conversion

AUTH: A/HALS, F. A.; B/VOLOVIK, A. V.

In: Open-cycle magnetohydrodynamic electrical power  
generation. (A79-16478 04-75) Argonne, Ill., Argonne  
National Laboratory; Moscow, Izdatel'stvo Nauka, 1978,  
p. 321-390.

MAJS: /\*FOSSIL FUELS/\*HEATING EQUIPMENT/\*HIGH TEMPERATURE  
ATR/\*MAGNETOHYDRODYNAMIC GENERATORS

MINS: / ENERGY CONVERSION/ FUEL COMBUSTION/ REGENERATORS

ABA: S.D.

ABS: Combustion air preheating in open-cycle fossil-fuel  
MHD energy conversion systems can be accomplished  
through the use of directly or indirectly fired  
heaters. Preheater subsystems are discussed relative  
to types of preheaters, system requirements and  
controls, and materials requirements. The design  
elements of high-temperature preheater subsystems are  
described, including analysis and design of  
regenerators of different types, and air preheaters  
under development in the United States and the Soviet  
Union. Experimental results for directly and  
indirectly fired regenerators as well as for  
directly-fired recuperators are summarized.

78A22843 ISSUE 8 PAGE 1413 CATEGORY 44  
77/00/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: From oil and gas to alternate fuels - The transition  
in conversion equipment

AUTH: A/BELDING, J. A.; B/BURNETT, W. M. PAA: B/IERDA,  
Div. of Conservation Research and Technology,  
Washington, D.C.)  
Energy Conversion, vol. 17, no. 2-3, 1977, p. 57-65.

MAJS: /\*CLEAN ENERGY/\*ENERGY POLICY/\*FOSSIL FUELS/\*  
TECHNOLOGICAL FORECASTING

MINS: / COMMERCIAL ENERGY/ DOMESTIC ENERGY/ ENERGY  
CONSERVATION/ ENERGY TECHNOLOGY/ INDUSTRIAL ENERGY/  
MARKET RESEARCH/ TRANSPORTATION ENERGY/ UTILITIES

ABA: P.T.H.

ABS: The paper outlines a strategy for a smooth transition  
from oil and natural gas to alternate fuels, focusing  
on the areas of conversion and transmission. The  
strategy is based on a consideration of the four  
market sectors: electric utilities, transportation,  
industry, and commercial/residential. These are  
studied in terms of their technology options and  
driving/retarding forces. A near-term strategy is  
suggested for the utilities, involving development of  
technology for clean combustion of coal and developing  
high-efficiency generation equipment. Transportation  
requires near-term efforts on efficiency. The plan for  
industry involves waste energy reduction and process  
efficiency

78A20244 ISSUE 6 PAGE 1011 CATEGORY 44 ENTR:  
E(40-10)-4398 77/11/00 18 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Comparison of the fossil fuel energy requirements for solar, natural gas, and electrical water heating systems

AUTH: A/ZUCCHETTO, J.; B/BROWN, S. PAA: A/(Stockholms Universitet, Stockholm, Sweden); B/(Florida University, Gainesville, Fla.)  
Resource Recovery and Conservation, vol. 2, Nov. 1977, p. 283-300. Research supported by the Federal Energy Administration;

MAJS: /\*COST EFFECTIVENESS/\*ELECTRIC POWER/\*ENERGY REQUIREMENTS/\*FOSSIL FUELS/\*NATURAL GAS/\*SOLAR HEATING

/\*WATER TEMPERATURE  
MINS: / ECONOMIC ANALYSIS/ ENERGY CONSUMPTION/ FLORIDA/ FUEL CONSUMPTION/ HEATING EQUIPMENT

ABA: D.M.U.

ABS: A comparison between solar and fossil fuel heating is presented with primary attention given to cost factors. In most areas of the United States, solar heating is found to be several times more cost efficient than comparable electric water heating, and about half as efficient as natural gas water heating per Joule of energy produced. An input/output flow model is devised, with all costs, including those of raw materials for solar heater construction, installation, energy consumption rates, and heat loss from inefficiencies in the heater system taken into account. Over the projected lifetime of solar heaters (10-25 years), the savings are said to be substantial in comparison with fossil fuel heaters; and solar heaters do not damage the environment.

77A42262# ISSUE 19 PAGE 3249 CATEGORY 44  
77/05/00 5 PAGES In RUSSIAN UNCLASSIFIED DOCUMENT

UTTL: Methodological questions concerning the evaluation of the economic potential of energy resources

AUTH: A/SEMENOV, A. A. PAA: A/(Severo-Zapadnyi Zaochnyi Politehnicheskii Institut, Leningrad, USSR)  
Energetika, vol. 20, May 1977, p. 112-116. In Russian.

MAJS: /\*ECONOMIC FACTORS/\*ENERGY POLICY/\*FOSSIL FUELS/\*RESOURCES MANAGEMENT

MINS: / COAL UTILIZATION/ CRUDE OIL/ ENERGY REQUIREMENTS/ HYDROELECTRIC POWER STATIONS/ WATER RESOURCES

ABA: M.L.

ABS: It is suggested that the economic significance of different forms of fuel resources are determined by trends in their national economic use. Resource supplies can be appraised in terms of their economic value. The calculation of value is achieved by forming a closed statistical system. Criteria are given for the economic potential of water resources.

77A42640 ISSUE 20 PAGE 3449 CATEGORY 44  
77/02/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Future energy options, ethics and a case for conservation

AUTH: A/ARMSTRONG, J. E.  
(Peninsula Professional Societies, Environmental Pollution Symposium on Practical Alternatives to Present Urban Life, 5th, Menlo Park, Calif., May 12, 13, 1976.) Water, Air, and Soil Pollution, vol. 7, Feb. 1977, p. 187-194.

MAJS: /\*DOMESTIC ENERGY/\*ENERGY CONSERVATION/\*ENERGY POLICY /\*FOSSIL FUELS

MINS: / DEMAND (ECONOMICS)/ ECONOMIC FACTORS/ ENERGY SOURCES / STRATEGY/ UNITED STATES OF AMERICA

ABA: (Author)

ABS: Up to 1980 the U.S. must rely upon four major sources for additional energy to meet the expected continued growth in energy use: (1) expanded coal and the associated synthetic fuels derived from it, (2) expanded production of continental shelf and Alaskan oil and gas, (3) nuclear, and (4) imported petroleum. After 1980, solar and oil shale could play increasingly important roles as additional sources. These major energy options will be compared at a national level in their broad environmental, economic, social, and political implementation impacts, with special emphasis on major effects of economic soundness, employment, food supply, national defense, and the emerging social unrest which characterizes the 1970s in the U.S.A. It is concluded that a major energy conservation program would be a prudent course for the U.S.A. to follow, with the stipulation that its gradual implementation over something like a 10 year time period is necessary.

TJ  
810  
.I465  
1976

International Conference on the Photochemical Conversion and Storage of Solar Energy, 1st, University of Western Ontario, 1976.

Solar power and fuels ... 1977. (Card 2)  
istry, Boston University. -- New York : Academic Press, 1977.

xvi, 254 p. : ill. ; 24 cm.

Bibliography: p. 243-245.

Includes indexes.

ISBN 0-121123-50-2

77A36328 ISSUE 16 PAGE 2779 CATEGORY 83  
77/00/00 25 PAGES UNCLASSIFIED DOCUMENT

UTTL: Economic evaluation by ERDA of alternative fossil energy technologies

AUTH: A/ADAMS, M. R.; B/KNUDSEN, C. W.; C/DRAFFIN, C. W.  
PAA: C/ERDA, Office of Program Planning and Analysis, Washington, D.C.)

In: Synthetic fuels processing: Comparative economics: Proceedings of the Symposium, New York, N.Y., April 4-9, 1976. (A77-36326 16-44) New York, Marcel Dekker, Inc., 1977, p. 13-37.

MAJS: /\*COAL UTILIZATION/\*COST ESTIMATES/\*ECONOMIC ANALYSIS  
/\*ENERGY TECHNOLOGY/\*FOSSIL FUELS/\*TECHNOLOGY  
ASSESSMENT

MINS: / COST EFFECTIVENESS/ FINANCE/ MARKET RESEARCH/  
RELIABILITY ANALYSIS/ TRANSPORTATION

ABA: (Author)

ABS: After explaining the economic criteria and methodology which the Energy Research and Development Administration is developing to evaluate fossil energy technologies, this paper considers the role and preliminary results of process economic comparisons. Implications of preliminary cost estimates of high-Btu gasification and liquefaction processes and sensitivities are explored. Analysis indicates the projected product selling prices are greatly affected by the method of financing and raw material costs. Also examined are potential impacts of reduction in capital requirements, determination of coal feedstock specifications, reliability, transportation and distribution of coal conversion products, and modification of liquefaction product specifications.

78N23585# ISSUE 14 PAGE 1870 CATEGORY 44 RPT#:  
CONF-7706100 77/12/00 560 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Fossil energy research meeting

AUTH: A/KROPSCHOT, R. H.; B/PHILLIPS, G. C.

CORP: Energy Research and Development Administration,  
Washington, D. C. CSS: (Div. of Physical Research.)  
AVAIL. NTIS SAP: HC A24/MF A01  
Presented at Fossil Energy Research Meeting, Wash., D.  
C.

MAJS: /\*ENERGY TECHNOLOGY/\*FOSSIL FUELS

MINS: / EARTH RESOURCES/ ENERGY CONSERVATION/ ENERGY  
REQUIREMENTS/ RESEARCH AND DEVELOPMENT

ASA: ERA

ABS: Research programs in fossil energy were reviewed with brief descriptions, budgets, etc. Discussions related to the capabilities for such research of national laboratories, universities, energy centers, etc. are presented.

78N14698# ISSUE 5 PAGE 655 CATEGORY 45 RPT#:  
ORNL/1M-5919 CN1#: W-7405-ENG-26 77/06/00 44  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Character and transformation of pollutants from major fossil fuel energy sources

AUTH: A/SHRINER, D. S.; B/MCLAUGHLIN, S. B.; C/BAES, C. F.  
CORP: Oak Ridge National Lab., Tenn. AVAIL. NTIS SAP: HC  
A03/MF A01

MAJS: /\*AIR POLLUTION/\*CONTAMINANTS/\*ECOSYSTEMS/\*FOSSIL  
FUELS

MINS: / EFFLUENTS/ ENVIRONMENTAL MONITORING/ FORECASTING

ABA: ERA

ABS: Factors influencing ecosystem effects of air

pollutants from major fossil fuel energy sources were investigated. Chemical speciation of major effluents, the variations in source term associated with type of source, and other factors which influence the characteristics of the effluent at the source/atmosphere interface were discussed. The major current and potential sources of energy-derived pollutant burdens, and projected future patterns of energy production were reviewed. In addition, factors controlling transformation of pollutants during atmospheric transport were described. The most critical controlling factors were identified, as were the major effluent constituents for which transformation was most significant. The chemical species which ultimately reach the atmosphere/vegetation interface were described with regard to their relative potential for effects on terrestrial ecosystems.

## ESTIMATES OF OIL AND GAS POTENTIAL. Ralph W. Garrett

CEP - Chemical Engineering Progress, vol. 73,  
no. 6, June, 1977, page 31-33.

Exxon's production forecast is lower than recent government predictions because the company is less optimistic about future economic incentives.

76N14697# ISSUE 5 PAGE 654 CATEGORY 45 RPT#:  
CONF-770622-5 CNT#: W-7405-ENG-26 77/00/00 22  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Character and transformation of pollutants from major fossil fuel energy sources  
AUTH: A/SHRINER, D. S.; B/MCLAUGHLIN, S. B.; C/BAES, C. F.  
CORP: Oak Ridge National Lab., Tenn. AVAIL.NTIS SAP: HC

A02/MF A01  
Presented at Air Pollution Control Assoc. Meeting,  
Toronto, 19 Jun. 1977

MAJS: /\*CONTAMINANTS/\*EXTRACTION/\*FOSSIL FUELS  
MINS: / AIR POLLUTION/ ATMOSPHERIC DIFFUSION/ ECOSYSTEMS/  
VEGETATION

ABA: ERA  
ABS: Chemical speciation of major effluents, the variations in source term associated with type of source, and other factors which influence the characteristics of the effluent at the source/atmosphere interface are discussed. The major current and potential sources of energy-derived pollutant burdens, and projected future patterns of energy production are reviewed. In addition, factors controlling transformation of pollutants during atmospheric transport are described. The most critical controlling factors are identified, as are the major effluent constituents for which transformation is most significant. The chemical species which ultimately reach the atmosphere/vegetation interface are described with regard to their relative potential for effects on terrestrial ecosystems.

78N26573# ISSUE 17 PAGE 2278 CATEGORY 44 RPT#:  
TID-28182 77/11/00 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fossil energy demonstration plants  
CORP: Department of Energy, Washington, D. C. AVAIL.NTIS  
SAP: HC A02/MF A01

ABA: ERA

ABS: The conversion of domestic coal resources into environmentally and socially acceptable substitutes for oil and natural gas is considered. In processing fossil fuels, the plant size needed for acceptable economics is very large. Capital requirements are, therefore, large and the time from conceptual design to capacity operation and process evaluation is long. The need for demonstration plant as an intermediate step between the pilot plant and the commercial plant is outlined. The program encourages private industry to become industrial partners who direct project and share the risks and costs of demonstrating unproven but potentially viable fossil energy conversion and utilization technologies. The industrial partner directs all design, construction and operation. Demonstration plant projects in the program areas of fuel gas and pipeline gas are described.

77A32755 ISSUE 15 PAGE 2528 CATEGORY 44  
77/05/12 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Economics of alternative energy sources  
AUTH: A/RYLE, M. PAA: A/(Cambridge University, Cambridge, England)

Nature, vol. 267, May 12, 1977, p. 111-117.  
MAJS: /\*ECONOMIC ANALYSIS/\*ENERGY SOURCES/\*FOSSIL FUELS/\*  
NUCLEAR ELECTRIC POWER GENERATION/\*RESOURCES

MANAGEMENT

MINS: / HEATING/ OIL EXPLORATION/ TIDEPower/ WINDPOWER  
UTILIZATION

ABA: M.L.

ABS: Partly because of large fluctuations in demand, the replacement of oil and gas fuels currently used to heat buildings in the UK by nuclear-generated electricity would seem to require the construction of about 250 GW of additional capacity by the end of the century, which does not seem feasible. If short-term (150-hour) energy storage in the form of heat is developed to a sufficient extent, the generating capacity required to fulfill peak demand could be reduced by half. With the same amount of short-term storage, however, other sources of energy, obtained from wind, wave, or tidal power, might become viable alternatives. It is suggested that the value of North Sea oil and gas to the chemical industry should lead, for economic reasons, to an early reduction in their consumption as fuel.

77A50499 ISSUE 24 PAGE 4187 CATEGORY 44  
77/00/00 6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Assuring the performance of fossil energy programs  
AUTH: A/CANJA, S. S. PAA: A/(ERDA, Washington, D.C.)  
In: Annual Reliability and Maintainability Symposium, Philadelphia, Pa., January 18-20, 1977. Proceedings. (A77-50451 24-38) Piscataway, N.J.: Institute of Electrical and Electronics Engineers, Inc., 1977, p. 421-426.

ABA: B.J.

ABS: In an effort to achieve timely commercialization, ERDA/Fossil Energy has developed the Performance Assurance System (PAS), a technique for reducing uncertainties in the economics of proposed processes and improving plant and component operability. PAS aids the decision making functions of ERDA program managers and industrial contractors through systematic application of standardized data collection and exchange procedures, analytical methods, mathematical models and information transfer techniques. This paper reviews the status of PAS, emphasizing objectives, approach, benefits, and implementation.

78N17486\*# ISSUE 8 PAGE 1038 CATEGORY 44 RPT#:  
NASA-TM-73820 E-9409 77/12/00 70 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Technical and economic feasibility study of solar/fossil hybrid power systems  
AUTH: A/BLOOMFIELD, H. S.; B/CALOGERAS, J. E.  
CORP: National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A04/MF A01  
MAJS: /\*ECONOMIC ANALYSIS/\*FOSSIL FUELS/\*SOLAR ENERGY/\* TECHNOLOGY ASSESSMENT  
MINS: / ELECTRIC POWER PLANTS/ ENERGY CONVERSION/ FEASIBILITY ANALYSIS/ TURBOGENERATORS  
ABA: Author  
ABS: Results show that new hybrid systems utilizing fossil fuel augmentation of solar energy can provide significant capital and energy cost benefits when compared with solar thermal systems requiring thermal storage. These benefits accrue from a reduction of solar collection area that results from both the use of highly efficient gas and combined cycle energy conversion subsystems and elimination of the requirement for long-term energy storage subsystems. Technical feasibility and fuel savings benefits of solar hybrid retrofit to existing fossil-fired, gas and vapor cycle powerplants was confirmed; however, economic viability of steam cycle retrofit was found to be dependent on the thermodynamic and operational characteristics of the existing powerplant.

HD Haqel, John  
9502 Alternative energy strategies ... cl976.  
.U52 RECENT TRENDS IN THE WORLD ENERGY MARKET 1  
H332  
1976 General Trends 1  
Crude Oil 1  
Natural Gas 8  
Implications of Recent Price Changes 9  
Continued Uncertainty over Future Price Trends 12  
Notes 13

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78N17229\*# ISSUE 8 PAGE 1003 CATEGORY 28 RPT#:  
NASA-TM-73836 77/06/00 22 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Alternative aircraft fuels  
AUTH: A/LONGWELL, J. P.; B/GROBMAN, J. S. PAA: A/(MIT, Cambridge)  
CORP: National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A02/MF A01  
Proposed for presentation at 23d Ann. Intern. Gas Turbine Conf., London, Engl., 9-13 Apr. 1978; sponsored by Am. Soc. of Mechan. Engineers  
MAJS: /\*AIRCRAFT FUEL SYSTEMS/\*AIRCRAFT FUELS/\*ENERGY CONSUMPTION/\*FOSSIL FUELS  
MINS: / AIR POLLUTION/ AROMATIC COMPOUNDS/ EXHAUST GASES/ JET ENGINE FUELS/ THERMAL STABILITY  
ABA: Author  
ABS: The efficient utilization of fossil fuels by future jet aircraft may necessitate the broadening of current aviation turbine fuel specifications. The most significant changes in specifications would be an increased aromatics content and a higher final boiling point in order to minimize refinery energy consumption and costs. These changes would increase the freezing point and might lower the thermal stability of the fuel, and could cause increased pollutant emissions, increased combustor liner temperatures, and poorer ignition characteristics. The effects that broadened specification fuels may have on present-day jet aircraft and engine components and the technology required to use fuels with broadened specifications are discussed.

QD Shale oil, tar sands, and related fuel sources;  
1 a symposium co-sponsored by the Division of  
.A355 Fuel Chemistry and the Division of Petroleum  
no.151 Chemistry, Inc. at the 167th Meeting of the  
American Chemical Society, Los Angeles,  
Calif., April 3-5, 1974 / Teh Fu Yen, editor.  
-- Washington, D. C. : American Chemical  
Society, 1976,  
vii, 184 p. : ill.; 24 cm. -- (Advances  
in chemistry series ; 151)

78N14679# ISSUE 5 PAGE 652 CATEGORY 44 RPT#:  
FE-2442-1 CNT#: EX-76-C-01-2442 77/01/00 186  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Application of near-term fossil technologies to the energy supply/demand profiles of the U.S. states and regions

CORP: Systems Consultants, Inc., Washington, D. C.  
AVAIL.NTIS SAP: HC A09/MF A01

MAJS: /\*DEMAND (ECONOMICS)/\*ENERGY REQUIREMENTS/\*FOSSIL FUELS

MINS: / ENERGY CONSERVATION/ ENERGY CONSUMPTION/ ENERGY POLICY/ ENERGY TECHNOLOGY

ABA: ERA

ABS: Critical energy problems were surveyed based on energy supply and utilization. Area with highest severity were the North Central, and the West South Central, the Middle Atlantic, the South Atlantic and New England. The following near-term technologies are most likely to have a major impact on the supply/demand energy characteristics of the regions: direct combustion of coal in atmospheric fluidized beds; low-Btu gas from coal for power generation and combined cycles; power plant technology; high-Btu gasification in entrained and fluidized beds; improved railroad coal-handling facilities; direct combustion by fuel substitution; low-Btu gas for process heat; improved underground and surface coal extraction techniques; coal slurry and coal-gas pipeline transport systems; and conservation in the residential/commercial and vehicular transportation sectors.

77N23620# ISSUE 14 PAGE 1877 CATEGORY 44 RPT#:  
PB-263338/6 76/08/00 136 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: State projections of industrial fuel needs

AUTH: A/SEIDEL, M. R.

CORP: Federal Power Commission, Washington, D. C. CSS: (Office of Energy Systems.) AVAIL.NTIS SAP: HC A07/MF A01

MAJS: /\*CRUDE OIL/\*DEMAND (ECONOMICS)/\*ENERGY POLICY/\*FUEL CONSUMPTION

MINS: / ECONOMIC ANALYSIS/ ENERGY CONSUMPTION/ FOSSIL FUELS/ INDUSTRIAL ENERGY/ REGIONAL PLANNING

ABA: GRA

ABS: The issue of how higher fuel prices and conservation will change economic growth and fuel use at state and regional levels is addressed. The assembly of detailed

and consistent data on fuel use, cross-sectional regressions on that data, and extrapolation of fuel requirements for 1990's economy are discussed.

78N25640# ISSUE 16 PAGE 2148 CATEGORY 44 RPT#:  
ANL/FE-49622-9 CNT#: W-31-109-ENG-38 77/07/00 97  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Instrumentation and process control for fossil demonstration plants TLSP: Quarterly Technical Progress Report, Apr. - Jun. 1977

AUTH: A/BENNETT, E. F.; B/COHN, C. E.; C/COX, S. A.; D/DATES, L. R.; E/DOERING, R. W.; F/DUFFEY, D.; G/GROH, E. F.; H/HERZENBERG, C. L.; I/KIRSCH, L. W.; J/MANAGAN, W. W.

CORP: Argonne National Lab., Ill. AVAIL.NTIS SAP: HC A05/MF A01

MAJS: /\*FOSSIL FUELS/\*PILOT PLANTS

MINS: / CALIBRATING/ FLOWMETERS/ MASS FLOW

ABA: ERA

ABS: Work was performed on updating the study of the state-of-the-art of instrumentation for fossil demonstration plants (FDP), development of mass-flow and other on-line instruments for FDP, process control analysis for FDP, and organization of a symposium on instrumentation and control for FDP. A solid gas flow test facility under construction for instrument development, testing, evaluation, and calibration is described. The development work for several mass-flow and other on-line instruments is described: acoustic flowmeter, capacitive density flowmeter, neutron activation flowmeter and composition analysis system, gamma ray correlation flowmeter, optical flowmeter, and capacitive liquid interface level meter.

77N19611# ISSUE 10 PAGE 1339 CATEGORY 44 RPT#:  
ERDA-76-63 76/04/00 276 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Fossil energy research program of the Energy Research and Development Administration, FY 1977

CORP: Energy Research and Development Administration, Washington, D. C. AVAIL.NTIS SAP: HC A13/MF A01

MAJS: /\*FOSSIL FUELS/\*MANAGEMENT PLANNING/\*RESEARCH AND DEVELOPMENT

MINS: / ECONOMICS/ ENVIRONMENT PROTECTION/ SOCIAL FACTORS

ABA: Author

ABS: The research planned and documented is guided by the following overall program goals: to develop the technology needed to make fossil fuels available in the form and quantity needed, and to assure that the nation's fossil fuels resources are developed at acceptable economic, social, and environmental costs. Funding requirements for the programs discussed are based on the attainment of these major goals.

77A39835 ISSUE 18 PAGE 3067 CATEGORY 44  
76/00/00 22 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Options for the conversion of fossil fuels  
AUTH: A/GORNOWSKI, E. J. PAA: A/(Exxon Research and  
Engineering Co., Linden, N.J.)  
In: Energy and the environment: A risk benefit  
approach. New York, and Oxford, Pergamon Press, 1976.  
p. 185-204; Discussion, p. 204-206.  
MAJS: /\*COAL UTILIZATION/\*COST ESTIMATES/\*ENERGY TECHNOLOGY  
/\*FOSSIL FUELS/\*HYDROCARBON FUELS/\*SYNTHETIC FUELS  
MINS: / AIR POLLUTION/ CLEAN ENERGY/ COAL GASIFICATION/  
ENERGY CONVERSION/ SHALE OIL/ SULFUR DIOXIDES  
ABA: C.K.D.  
ABS: An overview of options available for the development  
of oil shale and coal resources is presented.  
Available sources are estimated, and technological  
problems associated with their utilization are  
discussed. Coal gasification and the production of  
synthetic fuels from synthesis gas are considered,  
together with the hydrogenation of coal to make liquid  
hydrocarbons. The conversion of coal to electricity is  
discussed, with special attention to the problems of  
sulfur dioxide pollution and of waste heat. Cost  
estimates for different fossil-fuel conversion  
options are presented and compared.

77N19666# ISSUE 10 PAGE 1346 CATEGORY 44 RPT#:  
PB-261471/7 EPRI-NP-280 76/11/00 256 PAGES  
UNCLASSIFIED DOCUMENT  
UTTL: Failure analysis and failure prevention in electric  
power systems TLSP: Final Report  
AUTH: A/RAU, C. A., JR.; B/BESUNER, P. M.; C/EGAN, G. R.;  
D/JOHNSON, D. P.; E/TEELMAN, A. S.; F/BECKER, D. G.;  
G/CIPOLA, R. C.; H/GUPTA, P. K.; I/OMRY, U.,  
J/RETTIG, T. W.  
CORP: Failure Analysis Associates, Palo Alto, Calif.  
AVAIL.NTIS SAP: HC A12/MF A01  
Sponsored by EPRI  
ABA: GRA  
ABS: Present and potential problem areas have been  
identified both by development of an improved  
computerized data base of malfunctions in nuclear  
power plants and by detailed metallurgical and  
mechanical failure analyses of selected problems.  
Mathematical methods have also been developed to  
describe and analyze the statistical variations in  
materials properties and in component loading, and  
uncertainties in the flaw size that might be passed by  
quality assurance systems. These new methods have been  
combined to develop accurate failure rate predictions  
based upon probabilistic fracture mechanics.

77N19658# ISSUE 10 PAGE 1344 CATEGORY 44 RPT#:  
PB-259159/2 DOI-OMPRA-76/03 CNT#: DI-14-01-0001-2156  
76/04/00 73 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Net energy analysis: An energy balance study of  
fossil fuel resources. Summary report  
CORP: Colorado Energy Research Inst., Golden. AVAIL.NTIS  
SAP: HC A04/MF A01  
MAJS: /\*ENERGY CONSUMPTION/\*ENERGY POLICY/\*ENERGY SOURCES/\*  
FOSSIL FUELS/\*PRODUCTION ENGINEERING  
MINS: / COAL/ CRUDE OIL/ ENERGY REQUIREMENTS/ INDUSTRIAL  
ENERGY/ NATURAL GAS/ OIL EXPLORATION/ SHALE OIL  
ABA: GRA  
ABS: Industrial energy production in fossil fuels is  
examined with emphasis on the Western United States.  
Complete direct and indirect energies which must be  
used to produce energy from fossil fuels are included.  
These cover direct and indirect energies which drive  
or subsidize the production. Included are also those  
energies sequestered in materials needed to build and  
operate the industrial production and transportation  
facilities which either directly or indirectly are  
necessary for energy production. All steps in bringing  
fossil fuels from reserves in the ground to the point  
of end use are considered (exploration, extraction,  
conversion, and transportation).

77A23654 ISSUE 9 PAGE 1440 CATEGORY 44  
76/00/00 66 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Why solar energy --- advantages over fossil fuel and  
nuclear energy  
AUTH: A/NEWTON, A. B.  
(American Society of Heating, Refrigerating and  
Air-Conditioning Engineers, Annual Meeting, Seattle,  
Wash., June 27-July 1, 1976.) ASHRAE Transactions,  
vol. 82, pt. 2, 1976, p. 379-384.  
MAJS: /\*CLEAN ENERGY/\*ENERGY SOURCES/\*ENERGY TECHNOLOGY/\*  
SOLAR ENERGY/\*TECHNOLOGY ASSESSMENT  
MINS: / DOMESTIC ENERGY/ FOSSIL FUELS/ NUCLEAR ENERGY/ SOLAR  
HEATING/ THERMAL POLLUTION/ WINDPOWER UTILIZATION  
ABA: B.J.  
ABS: The advantages of solar energy over fossil-fuel and  
nuclear energy are discussed. Attention is given to  
energy reserves and the rate of use, and the effects  
of thermal pollution. The following uses and aspects  
of solar energy are examined: solar heating of  
buildings, direct conversion of solar radiation to  
electricity, windpower utilization, solar cooling of  
buildings, and solar energy for the rapid controlled  
growth of algae and other plants.

77N31425# ISSUE 22 PAGE 2935 CATEGORY 33 RPT#:  
FE-2453-1 CNT#: EX-76-C-01-2453 76/07/00 183  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Benefit-cost evaluation of the ERDA fossil energy  
combustion and advanced power development program  
AUTH: A/BERTMAN, L.; B/COX, D.; C/LAMB, G.; D/MORRIS, J.;  
E/PFEFFER, J.; F/RIVAS, M.  
CORP: Mitre Corp., McLean, Va. AVAIL.NTIS SAP: HC  
A09/MF A01  
MAJS: /\*COST ANALYSIS/\*ELECTRIC POWER PLANTS/\*ENERGY POLICY  
/\*FOSSIL FUELS/\*FUEL COMBUSTION  
MINS: / ECONOMIC ANALYSIS/ PROJECT PLANNING/ TECHNOLOGY  
UTILIZATION  
ABA: ERA

ABS: The implications of the investment of Federal funds in  
the ERDA/Fossil Energy Combustion and Advanced Power  
Development (CAPD) Program are assessed. Technologies  
considered in this study include five advanced systems  
under development in the CAPD Program and other  
baseline systems competing in the electric utility  
market for new base- and intermediate-load generating  
capacity. Life cycle busbar costs of electric power  
for each system are calculated, based upon estimated  
performance and cost characteristics. Market shares by

region and year are estimated for the systems, and the  
benefits associated with the projected Federal  
investment are determined.

77N31644# ISSUE 22 PAGE 2964 CATEGORY 44 RPT#:  
TID-27430 76/00/00 46 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy technologies for the West: The Fossil Option  
CORP: Energy Research and Development Administration,  
Washington, D. C. AVAIL.NTIS SAP: HC A03/MF A01  
Workshop held in San Francisco, 21 Sep. 1976  
MAJS: /\*COAL UTILIZATION/\*CONFERENCES/\*ENERGY POLICY  
MINS: / COAL/ FOSSIL FUELS/ HYDROCARBON FUELS  
ABA: ERA

ABS: The environmental impact of increased coal usage was  
examined, as well as the problems encountered by coal  
companies in recent years. Research was presented on  
alternate energy sources, especially that regarding  
the bituminous sandstones prevalent in California. A  
coal desulfurization project being conducted using  
powdered iron, coal, and fuel oil was examined and the  
space shuttle project and a methane-driven-automobile  
project were briefly mentioned. The direct use of coal  
was predicted as reaching 24 quads by the year 2000,  
with coal gasification and liquefaction moving to  
perhaps 14 quads; shale oil production could reach 7  
quads. The results of a study on manufacturing gas or  
generating electricity were presented in which coal is  
used specifically for both processes. The efficiency  
from an energy standpoint, cost to the consumer, and  
capital requirements were emphasized.

77N11546# ISSUE 2 PAGE 218 CATEGORY 44 RPT#:  
PB-255476/4 FEA/G-76/331 76/06/00 323 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Strategic petroleum reserve TLSP: Draft  
Environmental Impact Statement  
CORP: Federal Energy Administration, Washington, D. C.  
CSS: (Office of Energy Resource Development.)  
AVAIL.NTIS SAP: HC A14/MF A01  
MAJS: /\*ENVIRONMENTAL SURVEYS/\*FOSSIL FUELS/\*RESERVES/\*  
RESOURCES MANAGEMENT  
MINS: / COASTS/ ENERGY POLICY/ INVENTORY CONTROLS/ MINES  
(EXCAVATIONS)/ OIL FIELDS/ STORAGE TANKS  
ABA: Author

ABS: The strategic petroleum reserve program was mandated  
by the energy policy and conservation act of 1975. FEA  
has identified three alternative storage systems for  
satisfying the objectives of the program. These  
alternatives, which consist of solution mined cavities  
in salt, conventional mines and above ground tankage,  
are discussed. Prototype worst case facilities were  
developed to characterize these systems and to provide  
a basis for determining potential program impacts and  
resource requirements.

77N19657# ISSUE 10 PAGE 1344 CATEGORY 44 RPT#:  
PB-259158/4 DOI-OMPRA-76/02 CNT#: DI-14-01-0001-2156  
76/04/00 238 PAGES UNCLASSIFIED DOCUMENT

UTTL: Net energy analysis: An energy balance study of  
fossil fuel resources  
CORP: Colorado Energy Research Inst., Golden. AVAIL.NTIS  
SAP: HC A11/MF A01  
MAJS: /\*ENERGY POLICY/\*ENERGY REQUIREMENTS/\*ENERGY SOURCES/\*  
FOSSIL FUELS/\*INDUSTRIAL ENERGY  
MINS: / COAL/ CRUDE OIL/ NATURAL GAS/ OIL EXPLORATION/ SHALE  
OIL  
ABA: GRA

ABS: Fossil fuels from resources in the ground are examined  
through production processes which deliver usable  
energy ready for consumption. The complete direct and  
indirect energies which must be used to produce energy  
from fossil fuels are considered, including the  
energies which drive or subsidize the production.  
Included are those energies used in the production of  
materials needed to build and operate the industrial  
production and transportation facilities which either  
directly produce energy or which indirectly provide  
energy or materials to the energy production  
processes.

N76-21684

ENERGY FACTS II. (Prepared for the Subcommittee on Energy Research, Development, and Demonstration of the Committee on Science and Technology, U.S. House of Representatives, 94th Congress, 1st Session by the Science Policy Research Division, Congressional Research Service, Library of Congress, Aug. 1975). 1975. 536p. (Committee Print).

94th Congress, 1st Session  
94th Congress, 1st Session Serial H  
Committee on Science and Technology

✓ 77N70476 CATEGORY 98 RPT#: M74-82 74/09/00 69  
PAGES UNCLASSIFIED DOCUMENT  
UTTL: Energy options during the next twenty-five years.  
Conventional fuels, nuclear power and renewable energy  
sources  
AUTH: A/PIKUL, R. P.; B/ZRAKET, C. A.  
CORP: Mitre Corp., Bedford, Mass. AVAIL NTIS  
MAJS: /\*ENERGY POLICY/\*FOSSIL FUELS/\*GEOTHERMAL RESOURCES/\*  
NUCLEAR FUELS/\*SOLAR ENERGY  
MINS: / CHARTS/ COST ANALYSIS/ ENERGY CONSUMPTION/ ENERGY  
CONVERSION

✓ 78N73896# CATEGORY 43 RPT#: PB-275049/5  
EM-MYB-1974-VOL-2 74/00/00 793 PAGES UNCLASSIFIED  
DOCUMENT  
UTTL: Minerals yearbook 1974. Volume 2. Area reports:  
Domestic  
CORP: Bureau of Mines, Washington, D. C. AVAIL NTIS  
Sponsored by the Dept. of Interior.  
MAJS: /\*EARTH RESOURCES/\*FOSSIL FUELS/\*METALS/ MINERALS  
MINS: / ECONOMICS/ EMPLOYMENT/ INDUSTRIES/ MINING

TP Symposium on LP-Gas Engine Fuels, Los Angeles,  
359 1972.

.L5 LP-gas engine fuels. A symposium pre-  
S95 sented at the 75th annual meeting, American  
1972 Society for Testing and Materials, Los  
Angeles, Calif., 24-30 June, 1972. Phila-  
delphia, American Society for Testing and  
Materials, 1973.

134 p. illus. 24 cm. (ASTM special  
technical publication 525)

N74-12672

L

ENERGY FACTS. (Prepared for the Subcommittee on Energy of the Committee on Science and Astronautics, U.S. House of Representatives, 93rd Congress, 1st Session by the Science Policy Research Division, Congressional Research Service, Library of Congress, Nov. 1973). 1973. 539p. (Committee Print).

93rd Congress, 1st Session  
93rd Congress, 1st Session Serial H  
Committee on Science and Astronautics

COAL

79A45603 ISSUE 20 PAGE 3729 CATEGORY 25  
79/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Thermodynamic considerations in the production of synthetic fuels from coal

AUTH: A/WOLLEY, R. L. PAA: A/(Billings Energy Corp., Provo, Utah)

In: Hydrogen for energy distribution; Proceedings of the Symposium, Chicago, Ill., July 24-28, 1978. (A79-45576 20-44) Chicago, Institute of Gas Technology, 1979, p. 603-612.

MAJS: /\*COAL UTILIZATION/\*ENERGY CONSUMPTION/\*SYNTHANE/\*THERMODYNAMIC PROPERTIES

MINS: / AVAILABILITY/ CHEMICAL REACTIONS/ COST ESTIMATES/ ENTHALPY/ HYDROCARBON FUELS/ HYDROGEN FUELS

ABA: V.P.

ABS: An attempt is made to determine, on the basis of thermodynamic considerations, which of the candidate fuel synthetics, methane or hydrogen, will have the lowest thermodynamic cost of coal conversion to synthetic fuels. It is proposed that a proper measure of the thermodynamic cost can be obtained in the classical manner as a comparative change in the energy availability of ideal processes. The considerations favor production of hydrogen over methane from coal. A sizeable loss in availability takes place when coal is gasified. The additional loss in availability to shift the stream to hydrogen is not large. It may be argued that the benefits that accrue from making this shift are well worth the thermodynamic price. In contrast, the thermodynamic penalty for making methane is sizeable, while the benefits are comparable to the benefits of hydrogen production.

79A26538 ISSUE 9 PAGE 1592 CATEGORY 35  
79/03/00 6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Sampling and analysis of synthetic fuel processes --- coal gasification and liquefaction effluent analysis

AUTH: A/DZIERLENGA, P. S.; B/MESICH, F. G.; C/MAGEE, R. A. PAA: C/(Radian Corp., McLean, Va.)

Environmental Science and Technology, vol. 13, Mar. 1979, p. 288-293.

MAJS: /\*COAL GASIFICATION/\*COAL LIQUEFACTION/\*INDUSTRIAL WASTES/\*PROCESS CONTROL (INDUSTRY)/\*SAMPLING/\*SYNTHETIC FUELS

MINS: / ENVIRONMENTAL MONITORING/ GAS ANALYSIS/ PARTICULATE SAMPLING/ QUALITY CONTROL/ SOLID WASTES

ABA: B.J.

ABS: It is argued that sampling a synthetic fuel process and obtaining meaningful results is not a routine procedure and cannot be approached casually. The major

requirements for a successful sampling effort are careful planning prior to the test effort, including the development of a good sampling plan and the use of an experienced, professional staff capable of efficiently executing the test plan and making in-field decisions to adjust to process changes and unanticipated problems. Planning prior to the test effort involves determining the scope of the sampling effort, analyzing the process to be sampled, selecting sampling and analytical procedures, and designating the program data evaluation requirements.

79V25275 1979 ISS: 00 TP325.C5149 0-201083-00-0  
662.625 LC-79-12975

AUTH: A/Wen, Chin-Yung, A/1928-

UTTL: Coal conversion technology / edited by C. Y. Wen, E. Stanley Lee.

Addison-Wesley Pub. Co., Reading, Mass. :  
Energy science and technology ; no. 2 Includes  
bibliographical references and index.

LC: Coal. Coal gasification. Coal liquefaction.  
ADDED: Energy science and technology ; no. 2 Lee,  
Eugene Stanley, 1930-

MAIN-TITL TRACE-SERS-AUTH\* CATLG BY-LC  
/ /

79V37944 1979 ISS: 00 TP352.C63 0-841205-16-7 662.625  
LC-79-17936

AUTH: A/Pelofsky, Arnold H.

UTTL: Coal conversion technology : TLSP: based on a symposium sponsored by the ACS Division of Industrial and Engineering Chemistry at the I&EC winter symposium, Colorado Springs, Colorado, February 12-13, 1979 / Arnold Pelofsky, editor.

American Chemical Society, Washington : ACS symposium series : 110 0097-6156 Includes bibliographies and index.

LC: Coal liquefaction -- Congresses. Coal gasification -- Congresses.

ADDED: American Chemical Society, Division of Industrial and Engineering Chemistry, American Chemical Society, ACS symposium series : 110.

MAIN-AUTH TRACE-SERS\*CORP\*AUTH\* CATLG BY-LC  
/ /

79A49423 ISSUE 22 PAGE 41B1 CATEGORY 44  
79/09/24 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: The rough road to making oil and gas from coal

AUTH: A/STUART, A.

Fortune, vol. 100, Sept. 24, 1979, p. 50-52, 57, 60, 62, 64.

MAJS: /\*COAL GASIFICATION/\*COAL LIQUEFACTION/\*COST EFFECTIVENESS/\*ENVIRONMENT POLLUTION/\*FEASIBILITY ANALYSIS/\*TECHNOLOGICAL FORECASTING

MINS: / ENERGY CONVERSION EFFICIENCY/ ENERGY SOURCES/ ENERGY TECHNOLOGY/ PIPELINES/ POLLUTION CONTROL/ TECHNOLOGY ASSESSMENT

ABA: C.F.W.

ABS: Methods for developing oil and gas from coal are examined. Attention is given to past (German) coal gasification methods as well as new developments of existing processes, stressing the increasing costs of gas and its effects on present production. Emphasis is given to coal gasification and the problems that are encountered, noting ways to cope with 'caking' coals. The process of coal liquification to produce methanol is described and four second-generation techniques are mentioned including solvent refined coal, Exxon donor solvent, and H-coal.

PRINT 23/2/1-49.

TERMINAL=33

79V49397 1979 ISS: 00 TP360.U59 1979 662.6622 LC-79-602911

UTTL: Synthetic fuels from coal : TLSP: status and outlook of coal gasification and liquefaction / printed at the request of the Committee on Energy and Natural Resources, United States Senate.

United States, Library of Congress, Congressional Research Service.

U.S. Govt. Print. Off., Washington : x, 196 p. : 23 cm.

At head of title: 96th Congress, 1st session, Committee print. "Publication no. 96-17."

LC: Synthetic fuels, Coal gasification, Coal liquefaction.

ADDED: United States, Congress, Senate, Committee on Energy and Natural Resources.

MAIN-CORP TRACE-CORP\*TITL\* CATLG BY-LC

A79-38376 # Converting coal to liquid/gaseous fuels. J. T. Stewart and M. G. Klett (Gilbert Associates, Inc., Reading, Pa.), *Mechanical Engineering*, vol. 101, June 1979, p. 34-41, 16 refs.

A summary of the status, process development, product characteristics and costs of commercially viable coal gasification and liquefaction is discussed. Characteristics of fixed, entrained and fluidized bed gasification processes and data on existing and planned U.S. plants are presented, including gas combustion properties and economics. The three basic methods for coal liquefaction, hydrogenation, pyrolysis and the indirect route through gasification are discussed, noting that no commercial plants are operating in the U.S. today, but several advanced processes are being developed. Coal-derived liquid fuels are characterized and estimated economics of commercial plants tabulated. It is concluded that the economics of synthetic natural gas and coal liquids are not favorable as long as the supply of petroleum based oil and gas is adequate, so that government support will be needed to encourage synfuel production and resolve environmental issues, with low production of synfuels expected until oil production levels out in the 1980's. A.T.

**COAL SCIENCE: BASIC RESEARCH OPPORTUNITIES.**

Martin L. Gorbaty, Franklin J. Wright, Richard K. Lyon, Robert B. Long, Richard H. Schlosberg, Zeinab Baset, Ronald Liotta, Bernard G. Silbernagel, Dan R. Neskora.

Science, American Association for the Advancement of Science. vol 206, no 4422, 30 November 1979. p. 1029-1034.

*Summary.* More fundamental knowledge of coal (knowledge of its structure and its behavior during conversion processes) is essential before we can generate new technologies necessary for the efficient use of coal in the future. Herein are suggested specific basic research opportunities in the areas of coal characterization, gasification, combustion, and liquefaction, along with an assessment of the impact such research programs could have. Critical characterization needs include qualitative and quantitative determination of the chemical forms of carbon, oxygen, nitrogen, and sulfur and reliable methods for the measurement of surface area, pore volume, and weight-average molecular weights. Mechanistic studies aimed at increasing understanding of the thermal breakdown of the functionalities in coal, the behavior of coal in the presence of molecular and donor hydrogen environments, and carbon gasification and hydrocarbon synthesis reactions starting from carbon monoxide and hydrogen will lay the scientific foundation for the development of new processes for converting coal into clean usable fuels and chemicals.

**DIESEL-ETHANOL FUEL BLENDS INVESTIGATED**

Automotive Engineering, vol. 87, no. 9, Sept. 1979, p.58-61.

**TECHNICAL POSSIBILITIES AND ECONOMIC PROSPECTS FOR COAL REFINING.** A. Ziegler and R. Holighaus.

Endeavour, vol 3, no 4, 1979, p.150-157.

**CLEAN BURNER FOR COAL**, by Peter Britton.  
Popular Science, vol. 214, no. 4, April 1979, p.70-73.

In a fluidized bed  
of churning limestone,  
coal burns more efficiently  
with much less pollution

**Mechanical Engineering, v.101, no.1, Jan. 1979**

**SOLAR-ELECTRIC ENERGY. (Special Issue).**

**30 FLUIDIZED BED COMBUSTION ... A NEW ERA IN SHIP PROPULSION ...**  
.....H. W. Bredin  
Fluidized bed combustion technology allows the use of low-grade fuels to produce steam at higher temperatures and pressures for an advanced design marine steam turbine plant.

**Chemical Engineering Progress, June 1979**  
v.75, no.6, p.33-40.

**COAL PROCESSING TECHNOLOGY: THE TRI-GAS GASIFICATION PROCESS.** M.A. Colaluca, M.A. Paisley and K. Mahajan.

**TP 325 Coal conversion technology / edited by C. Y. Wen, E. Stanley Lee. Reading, Mass. : Addison-Wesley Pub. Co., 1979.**  
..C5149  
(Energy science and technology ; no. 2)  
Includes bibliographical references and index.  
1. Coal. 2. Coal gasification. 3. Coal liquefaction. I. Wen, Chin-Yung. II. Lee, Eugene Stanley.

ENCYCLOPEDIA OF CHEMICAL PROCESSING AND DESIGN.  
Executive Editor: John J. McKetta.  
pages 386.

v. 9  
All concerned with Coal and  
Coal Conversion

TP 9 .E66 v. 9 RR

Department of Energy Report DOE/ET-0061/2, September 1979

The United States has more energy available in coal than in petroleum, natural gas, oil shale, and tar sands combined. Nationwide energy shortages, together with the availability of abundant coal reserves, make commercial production of synthetic fuels from coal vital to the Nation's total supply of clean energy. In response to this need, the Division of Fossil Fuel Processing — U.S. Department of Energy (DOE) is conducting a research, development and demonstration (RD&D) program to provide technology that will permit rapid commercialization of processes for converting coal into products that substitute for those derived from oil and natural gas. These substitute fuels include crude oil, fuel oil and distillates; chemical feedstocks; pipeline quality and fuel gas; and other products such as char that may be useful in energy production.

TN  
800  
.C50  
Coal are operating handbook of coal surface  
mining and reclamation / edited by  
Nicholas P. Chironis. — New York : Coal  
Age Mining Informational Services, c1979.  
vi, 442 p. : ill. ; 29 cm. — (Coal age  
library of operating handbooks ; v. 2)  
Includes index.  
ISBN 0-07-011458-7  
1. Coal mines and mining—Handbooks,  
manuals, etc. 2. Strip mining—Handbooks,  
manuals, etc. 3. Reclamation of  
land—Handbooks, manuals, etc. I.  
Chironis, Nicholas P. (Continued on card 2)

N80-11621# Department of Energy, Washington, D. C.  
INTERNATIONAL COAL TECHNOLOGY SUMMARY DOCU-  
MENT

Dec. 1978 113 p refs Prepared in cooperation with TRW,  
Inc. McLean, Va.  
(Contract EX-76-C-10-3885)  
(DOE/PE-0010, HCP/P3885) Avail: NTIS HC A06/MF A01

The status of coal technologies expected to be available for  
commercial application by 1990 is reviewed. Technologies  
discussed include direct combustion using flue gas desulfurization,  
fluidized bed combustion, gasification, liquefaction, and advanced  
power cycles. Coal mining and transportation are also reviewed.  
Social, environmental, safety, and health constraints on coal use  
are considered. K L

N80-14264# SRI International Corp., Menlo Park, Calif.  
PROCEEDINGS OF THE 1978 COAL CHEMISTRY WORK-  
SHOP

S. B. Radding and Howard M. Peters, Nov. 1978 204 p refs  
Conf. held at Menlo Park, Calif., 8-10 Mar. 1978  
(Contract ET-78-X-01-2402)  
(CONF-780372) Avail: NTIS HC A10/MF A01

The structural chemical analysis of coal and the chemistry  
of coal gasification and coal liquefaction are discussed. The DOE  
Fossil Energy Program is discussed in detail and recommendations  
for further research in coal gasification and coal liquefaction are  
made. DOE

HD  
9545.6  
.C6  
Coal resources, characteristics, and ownership  
in the U.S.A. / edited by Robert Noyes. —  
Park Ridge, N.J. : Noyes Data Corp., 1979.  
xi, 346 p. : ill. ; 25 cm.  
Bibliography: p. 345-346.  
ISBN 0-8155-0698-8.  
1. Coal—United States. 2. Coal trade—  
United States. I. Noyes, Robert.  
333.0'2

79A34086 ISSUE 13 PAGE 2420 CATEGORY 44  
78/00/00 481 PAGES UNCLASSIFIED DOCUMENT

UTTL: Alternative energy sources; Proceedings of the Miami International Conference, Miami Beach, Fla., December 5-7, 1977. Volume 7 - Hydrocarbon conversion technology

AUTH: A/VEZIROGLU, T. N. PAA: A/(Miami, University, Coral Gables, Fla.) PAT: A/(ED.) SAP: PRICE OF ELEVEN VOLUMES, \$495

Conference sponsored by the U.S. Department of Energy and University of Miami Washington, D.C., Hemisphere Publishing Corp., 1978, 481 p. (For individual items see A79-34087 to A79-34105)

MAJS: /\*COAL GASIFICATION/\*COAL LIQUEFACTION/\*CONFERENCES/\* ENERGY TECHNOLOGY/\*FUEL COMBUSTION/\*HYDROCARBON FUEL PRODUCTION

MINS: / BIOMASS ENERGY PRODUCTION/ BOILERS/ CHEMICAL REACTORS/ COAL UTILIZATION/ FLUIDIZED BED PROCESSORS/ FUEL OILS/ HYDROCARBON COMBUSTION/ HYDRODYNAMIC EQUATIONS/ MAGNETOHYDRODYNAMIC GENERATORS/ PILOT PLANTS/ SHALE OIL/ SYNTHANE/ SYNTHETIC FUELS/ WHEAT

ABA: B.J.

ABS: Consideration is given to the technology of coal gasification, liquefaction, and combustion. Papers are presented on such particular topics as the Synthane and HYGAS gasification processes, the effect of operating variables on reactor performance in the Synthoil liquefaction process, and the status of fluidized-bed coal combustion.

79N31415# ISSUE 22 PAGE 2935 CATEGORY 28 RPT#:  
FE-2006-12 CNT#: EX-76-C-01-2006 78/07/00 49  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Applied research and evaluation of process concepts for liquefaction and gasification of western coals  
TLSP: Quarterly Progress Report, Apr. - Jun. 1978

AUTH: A/WISER, W. H.

CORP: Utah Univ., Salt Lake City. CSS: (Dept. of Mining and Fuels Engineering.) AVAIL:NTIS SAP: HC A03/MF A01

MAJS: /\*CHEMICAL REACTORS/\*COAL GASIFICATION/\*COAL LIQUEFACTION/\*ENERGY TECHNOLOGY/\*PYROLYSIS

MINS: / CATALYSIS/ HYDROCARBONS/ HYDROGENATION/ METAL HYDRIDES

ABA: DOE

ABS: Sixteen research projects in the gasification or liquefaction of coal, catalysis, or related research are reviewed. Fundamental principles involved and the properties of coal and coal conversion products are discussed.

79A17636# ISSUE 5 PAGE 863 CATEGORY 44  
78/00/00 19 PAGES UNCLASSIFIED DOCUMENT

UTTL: Synthetic fuels from coal

AUTH: A/POLLAERT, T. J.

In: Coal technology '78: International Coal Utilization Convention, Houston, Tex., October 17-19, 1978. Conference Papers. Volume 1. (A79-17631 05-44) Houston, Tex., Industrial Presentations, 1978, p. 247-265.

MAJS: /\*COAL GASIFICATION/\*COAL LIQUEFACTION/\*COAL UTILIZATION/\*ENERGY POLICY/\*ENERGY TECHNOLOGY/\* SYNTHETIC FUELS

MINS: / CATALYSIS/ CHARCOAL/ GASOLINE/ HYDROGENATION/ PYROLYSIS

ABA: G.R.

ABS: An analysis of the technology available to produce syn fuels shows that this technology is rather mature and developed to an extent that major economic breakthroughs should not be expected. Once the economic incentives and the regulatory climate are favorable, a synthetic fuels industry based on coal will establish itself. Coalgas, methanol, methanol-derived gasoline, and pyrolysis liquids will be the heart of this industry. Attention is given to the Lurgi gasifier, the advantages of a coal gasification plant, the catalytic conversion of methanol to gasoline, the Fischer-Tropsch conversion of coalgas, the hydrogenation of coaltars from low temperature pyrolysis, and the Lurgi-Ruhrgas Process.

79N29378# ISSUE 20 PAGE 2662 CATEGORY 28 RPT#:  
FE-2416-37 CNT#: EX-76-C-01-2416 78/00/00 11  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Coal-to-gasoline conceptual design and market evaluation of methanol fuel and methanol-derived gasoline  
TLSP: Quarterly Technical Progress Report, 31 Jul. - 27 Oct. 1978

CORP: Badger Plants, Inc., Cambridge, Mass. AVAIL:NTIS SAP: HC A02/MF A01

MAJS: /\*COAL UTILIZATION/\*ENERGY TECHNOLOGY/\*HYDROCARBON FUEL PRODUCTION/\*SYNTHANE

MINS: / ENERGY CONVERSION/ GASOLINE/ MARKETING/ PRODUCT DEVELOPMENT

ABA: DOE

ABS: Conceptual design work completed during the quarter on the conversion of coal to gasoline using the Mobil M-gasoline process is summarized. Preliminary work done on the marketing study for methanol is also summarized.

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OF POOR QUALITY

78A10055 ISSUE 1 PAGE 107 CATEGORY 44 CNT#:  
EX-76-C-01-2044 EX-77-C-01-2518 78/00/00 7 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Coal conversion by flash hydrolysis and  
hydrogasification  
AUTH: A/OBERG, C. L.; B/COMBS, L. P.; C/SILVERMAN, J.  
PAA: C/(Rockwell International Corp., Rocketdyne Div.,  
Canoga Park, Calif.)  
In: Intersociety Energy Conversion Engineering  
Conference, 13th, San Diego, Calif., August 20-25,  
1978, Proceedings, Volume 1. (A79-10001 01-44)  
Warrendale, Pa., Society of Automotive Engineers,  
Inc., 1978, p. 402-408.  
MAJS: /\*COAL GASIFICATION/\*COAL LIQUEFACTION/\*ENERGY  
TECHNOLOGY/\*HYDROGENATION/\*PYROLYSIS  
MINS: / CHEMICAL REACTORS/ COLD FLOW TESTS/ REACTOR DESIGN  
ABA: (Author)  
ABS: Results are described from two programs directed

toward development of high-mass-flux,  
short-residence-time reactors for conversion of coal  
into high-value gases and liquids, for either  
liquefaction or gasification, pulverized coal is  
rapidly and thoroughly mixed with preheated hydrogen  
and allowed to react for periods ranging from a few  
milliseconds to a few seconds. In the liquefaction  
case, the reaction is subsequently quenched rapidly.  
Successful reactor tests have been carried out at  
nominal coal flowrates of 1/4- and 1-ton/hour with  
caking bituminous coals. Up to 1500 pounds of coal has  
been processed in single test with test durations up  
to 1 hour. Favorable quality liquids and gases have  
been produced with overall conversions consistent with  
the requirements of a commercial plant. Results from  
liquefaction tests with western Kentucky bituminous  
coals and gasification tests with bituminous and  
sub-bituminous coals will be described.

78V36926 1978 ISS: 00 TP352.H63 0-9601552-1-X 662.6622  
LC-77-93533

AUTH: A/Hoffman, Edward Jack, A/1925-  
UTTL: Coal conversion / by E. J. Hoffman.  
Energon Co., Laramie, Wyo. : viii, 464 p. : ill. : 24  
cm.  
Includes bibliographical references and index.  
LC: Coal liquefaction. Coal gasification.  
MAIN-AUTH TRACE-TITL\* CATLG BY-LC  
/ /

78N27609# ISSUE 18 PAGE 2419 CATEGORY 44 RPT#:  
NTIS/PS-78/0345/5 NTIS/PS-77/0305 NTIS/PS-76/0391  
NTIS/PS-75/386 COM-74-10967 78/04/00 282 PAGES  
UNCLASSIFIED DOCUMENT

Supersedes NTIS/PS-77/0305, NTIS/PS-76/0391,  
NTIS/PS-75/386 and COM-74-10967

UTTL: Coal gasification and liquefaction technology, volume  
3. A bibliography with abstracts TLSP: Progress  
Report, Jun. 1976 - Apr. 1978  
AUTH: A/CAVAGNARO, D. M.  
CORP: National Technical Information Service, Springfield,  
Va. AVAIL NTIS SAP: HC \$28.00/MF \$28.00  
MAJS: /\*BIBLIOGRAPHIES/\*COAL GASIFICATION/\*COAL LIQUEFACTION  
/\*ENERGY TECHNOLOGY  
MINS: / ABSTRACTS/ ENERGY POLICY/ HYDROGENATION/  
MATHEMATICAL MODELS/ METHANE/ SOLVENTS/ SYNTHETIC  
FUELS  
ABA: GRA  
ABS: Techniques and processes of the conversion of coal to  
gaseous and liquid chemicals are cited in this  
bibliography. It also includes solvent refined coal  
liquids and coal derived fuels. Coal desulfurization,  
cleaning, or preparation which does not involve  
conversion to gas or liquid fuels, or in situ  
combustion (underground gasification of coal deposits)  
are not covered. (This updated bibliography contains  
277 abstracts, 157 of which are new entries to the  
previous edition.)

78V29141 1978 ISS: 00 TP156.C35C87 0-121999-35-1  
662.6622 LC-77-25620

AUTH: A/Cusumano, James A.; B/Dalla Betta, Ralph A.;  
C/Levy, Ricardo.; D/Farkas, Adalbert. PAT: B/joint  
author.  
UTTL: Catalytic in coal conversion / by James A. Cusumano,  
Ralph A. Dalla Betta, Ricardo Levy ;  
Academic Press, New York : xiii, 272 p. : ill. : 24  
cm.

Includes bibliographical references and index.  
LC: Catalysis. Catalysts. Coal liquefaction. Coal  
gasification.

NASA: / CATALYSIS/ CATALYSTS/ CHEMICAL REACTORS/ COAL  
GASIFICATION/ COAL LIQUEFACTION/ ENERGY TECHNOLOGY/  
HYDROCARBON FUELS

JPL: / TP156.C35C984  
MAIN-AUTH TRACE-TITL\*AUTH\* CATLG BY-LC  
/ / COPYRIGHT AVAIL: / JPL/ LANGLEY/ LEWIS

**AMMONIA FROM COAL: A TECHNICAL/ECONOMIC REVIEW**

Donald A. Waitzman

Chemical Engineering

Vol. 85, no. 3, January 30, 1978,

p. 69-71.

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Concern over meeting U.S. fertilizer needs—because of the natural gas shortage—has spurred projects to produce ammonia from alternative feedstocks, mainly coal. This article looks at efforts being made in the U.S. and overseas.

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**FLUIDISED-BED COMBUSTION & HEAT TREATMENT**, by Dr. J.R. Howard.

Engineering, vol. 218, no. 12, December 1978, p.I-XII.  
Tech. File no. 60.

**The primary incentives to develop fluidised-bed combustion and heat transfer are to produce more economic systems for burning coal in industry and to utilise sulphurous coals and oil without excessive emission of pollutants. Higher efficiency of electricity generation is possible by development of pressurised fluidised-bed combustion for combined gas**

**and steam cycles. Dr J R Howard\* discusses the combustion of coal, oil and gas, and the application of the technology to incineration, waste-heat recovery and metallurgical heat treatment, together with some of the remaining technical uncertainties. Rotating fluidised beds are described briefly. Finally, some of the constraints on exploitation are indicated.**

**CORROSION OF SUPERALLOYS, INCONELS, AND STAINLESS STEELS BY THE PRODUCTS FROM FLUIDIZED BED COAL COMBUSTION**

Henry F. Wigton

Materials Performance

Vol. 17, no. 1, January 1978,

p. 31-43.

*Tests of gas turbine materials, Incoloy, Inconels, CrNi alloys, CoCrNiW, and other high temperature alloys at temperatures up to 950 C and 400 KPa in gas from coal fluidized beds is reported. Temperature was the critical parameter, with no sulfidation at 910 C when Mg oxide/clay inhibitor was used and at about 870 C with or without an inhibitor. Characteristics of the coal are significant. Oxidation appears to be the primary reaction under 910 C. Of the 22 alloys tested, IN 713 and 738, both high Al concentration alloys performed best, while nonturbine alloys AISI 446, 304, and 316 were good. Particulate control is important because of possible damage from spalled scale. Short run tests are indicative.*

79V14588 1978 ISS: 00 TP352.M66 338.47662662 LC-78-662489 78-622489

AUTH: A/Moore, H. F.; B/Kim, E. T.; C/Kermode, R. I.,  
PAT: B/joint author.

UTL: Synthetic oil from coal : TLSP: the economic impact of five alternatives for making hydrogen from coal : prepared for the Institute for Mining and Minerals Research, Kentucky Center for Energy Research Laboratory. / by H. F. Moore, E. T. Kim, R. I. Kermode.

IMMR, Lexington : 69 p. (p. 67-69 publisher's list) : ill. ; 28 cm.

\$4.50. \$1.50 (microfiche) \*IMMR33-PD20-78.\* Includes bibliographical references.

LC: Coal liquefaction. Coal gasification.

ADDED: Kentucky. University. Institute for Mining and Minerals Research.

MAIN-AUTH TRACE-CORP-TITL-AUTH\* CATLG BY-LC

/ /

MODELING AND SIMULATION OF A MULTICELL FLUIDIZED-BED STEAM GENERATOR.

Asok Ray, et al.

J. Energy, v.2, no.5, Sept.-Oct.1978, p.269-78.

This paper describes a nonlinear dynamic model of the 6-MW<sub>e</sub> multicell atmospheric-pressure FBC Component Test and Integration Unit (CTIU) to be built at Morgantown Energy Research Center, West Virginia.<sup>4,5</sup> The model is suitable for digital simulation and analytical controller design, and provides the basis for: 1) understanding interactive process dynamics, 2) design verification and predicting effects of subsystem changes on the entire process, 3) interactive multivariable controller design, and 4) overall system (process and controller) performance evaluation.

78V42417 1978 ISS: 00 TP759.C652 1978 662.625 LC-78-606163

UTTL: Coal conversion systems : TLSP: technical data book / prepared for U.S. Department of Energy, Assistant Secretary for Energy Technology, Division of Coal Conversion.

Chicago. Institute of Gas Technology.

U.S. Govt. Print. Off., Washington :

Loose-leaf for updating. "HCP/T2286-01: UC-30."

"Contract no. EX-76-C-01-2286." Includes

bibliographical references and index.

LC: Coal gasification. Coal liquefaction.

ADDED: United States. Dept. of Energy. Division of Coal Conversion.

NASA: / COAL GASIFICATION/ COAL LIQUEFACTION/ ENERGY CONVERSION EFFICIENCY/ ENERGY POLICY/ GEOTHERMAL ENERGY CONVERSION

MA: / TP759.C652 1978 MC.1

MAIN-CORP TRACE-CORP\*TITL\* CATLG BY-LC

/ / AVAIL: / MARSHALL

ENVIRONMENTAL ASSESMENT OF THE FLUIDIZED-BED COMBUSTION OF COAL: METHODOLOGY AND INITIAL RESULTS

Ke shava S. Murthy, Herman Nack and Bruce Henschel  
J. of the Air Pollution Control Association, vol.28,  
no. 3, p. 213-220

In parallel with efforts in the United States to develop new energy technologies, the U.S. Environmental Protection Agency is conducting a program of environmental assessment of the developing technologies. The results of the environmental assessment effort are used to design a program for environmental control technology development. The conduct of the environmental assessment/control technology development simultaneously with the development of the energy technology itself should lead to early identification of any potential environmental problems associated with the energy technology, and to most cost effective and timely development of any necessary control technology.

TK  
2896  
.I55  
1977

Intersociety Energy Conversion Engineering Conference, 12th, Washington, 1977.

Proceedings of the 12th Intersociety Energy Conversion Engineering Conference, Washington, D. C., August 28 through September 2, 1977. — La Grange, Ill. : American Nuclear Society, c1977.

Fluid Bed Combustion I—Cycle Analysis and Plant Designs p. 690 - 736

Fluid Bed Combustion II—Experimental Results and Environmental Effects p. 737 - 785 d 2)

AICHE Symposium Series, v.74, no.177. 1978

ENERGY AND ENVIRONMENTAL CONCERNS IN THE FOREST PRODUCTS INDUSTRY. William T. McKean, ed. (Papers presented at Forest Products Div. sessions of the 69th Annual Meeting of AICHE in Chicago, Ill., Nov.1976).

American Institute of Chemical Engineers

BURNING COAL IN FLUIDIZED BEDS.

E. C. McKenzie

Chemical Engineering, Vol. 85, No. 18, August 14, 1978, p. 116-127.

After setting the stage with a review of the operation of conventional coal-fired boilers, this report discusses the use of fluidized beds, including topics such as coal preparation, load control and emissions control.

TP Patterson, Walter C.  
156 Fluidized-bed energy technology:  
.F65 coming to a boil / by Walter C.  
P37 Patterson and Richard Griffin. New  
York, INFORM, 1978.  
viii, 132 p. : ill. ; 28 cm.  
1. Fluidization. 2. Combustion. I.  
Griffin, Richard, joint author. II.  
Inform, inc. III. Title.  
621.4028 78-60484 0-918780-10-1  
78V46577

QC Advances in heat transfer. v. 14 / edited  
320 by Thomas F. Irvine, Jr., James P.  
.A1 Hartnett. -- New York : Academic Press,  
A3 1978.  
v.14 xv, 363 p. : ill.

Heat Transfer between a Gas Fluidized Bed and Immersed Tubes

S. C. SAXENA, N. S. GREWAL, J. D. GABOR, S. S. ZABRODSKY,  
and D. M. GALERSHTEIN

I. Introduction . . . . . 150  
II. Local Heat Transfer Coefficients for Horizontal and Slanted  
Tubes . . . . . 160  
III. Total Heat Transfer Coefficients for Horizontal and Slanted  
Tubes . . . . . 172  
IV. Local Heat Transfer Coefficients for Vertical Tubes . . . . . 207  
V. Total Heat Transfer Coefficients for Vertical Tubes . . . . . 212  
VI. Packed-Fluidized Beds . . . . . 231  
VII. General Conclusions . . . . . 236  
References . . . . . 242

CN-150,528 1978  
POTENTIAL HEALTH AND ENVIRONMENTAL EFFECTS OF TRACE  
ELEMENTS AND RADIONUCLIDES FROM INCREASED COAL UTILI-  
ZATION. R.I. Van Hook (Rept. submitted Nov.21,1977  
to President's Committee on Health & Ecological Effects  
of Increased Coal Utilization). Apr.1978. 54p.

Oak Ridge National Lab., ORNL-5367  
Tenn.  
Oak Ridge National Lab., Pub.  
Tenn., Environmental 1117  
Sciences Div.  
Contract W-7405-eng-26  
Coal - Combustion ✓ Pollution  
Trace contaminants Coal

79N79942# CATEGORY 28 RPT#: ANL-FE-49622-21  
CNT#: W-31-109-ENG-38 78/07/00 69 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Instrumentation and process control for coal  
conversion TLSP: Quarterly Technical Progress  
Report, Apr. - Jun. 1978

AUTH: A/LESAGE, L. G.

CORP: Argonne National Lab., Ill. AVAIL NTIS

MAJS: /\*COAL GASIFICATION/\*COAL LIQUEFACTION/\*FLOWMETERS/\*  
PROCESS CONTROL (INDUSTRY)

MINS: / CALIBRATING/ MASS FLOW/ TWO PHASE FLOW

77A11241 ISSUE 1 PAGE 74 CATEGORY 44 76,00/00  
11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Prospects for coal as a direct fuel and its potential  
through application of liquefaction and gasification  
technology

AUTH: A/BOWDEN, J. R. PAA: A/(Conoco Coal Development Co.,  
Stamford, Conn.)  
(Society of Petroleum Engineers, Annual Fall Meeting,  
50th, Dallas, Tex., Sept. 30-Oct. 1, 1976.) Energy  
Sources, vol. 3, no. 1, 1976, p. 1-11.

MAJS: /\*COAL GASIFICATION/\*COAL LIQUEFACTION/\*COAL  
UTILIZATION/\*DOMESTIC ENERGY/\*ENERGY TECHNOLOGY/\*  
TECHNOLOGY UTILIZATION

MINS: / CLEAN ENERGY/ COST EFFECTIVENESS/ DESULFURIZING/  
ENERGY BUDGETS/ ENERGY CONSUMPTION/ ENERGY CONVERSION  
EFFICIENCY/ ENERGY SOURCES

ABA: (Author)

ABS: During the next 20 years, domestic energy consumption  
will grow at a rate of somewhat less than 3% per year.  
Coal production can grow 75% in this period, which  
will increase coal's contribution to our energy budget  
from 18 to 27%. New technology in mining and  
processing will play only a modest role in expanded  
utilization of coal, and that mostly after 1985.  
Principal opportunities and constraints rest in the  
political arena as we try to accommodate our social  
concerns with physical and economic realities. No  
technical fix is on the horizon which will permit coal  
to be converted cheaply to our present definition of a  
clean fuel. For processes other than flue gas  
desulfurization, value added during conversion exceeds  
the basic cost of the energy in coal. All conversion  
costs lie within the range of uncertainty of the  
untried processes and no process has emerged as  
clearly superior. An aggressive federal support  
program is required for verification of the economics  
on a small commercial scale of several competing  
conversion processes so that more intelligent choices  
can be made for the second generation of conversion  
plants which will emerge in the late 1980s or early  
1990s.

77A38100 ISSUE 17 PAGE 290B CATEGORY 44  
77/00/00 24 PAGES UNCLASSIFIED DOCUMENT

UTTL: COGAS status report --- coal processing for clean  
liquid and gas fuels

AUTH: A/PAIGE, W. A. PAA: A/(COGAS Development Co.,  
Princeton, N. J.)

(Conference on Synthetic Fuels from Coal, 5th,  
Oklahoma State University, Stillwater, Okla., May 5,  
6, 1975.) Energy Communications, vol. 3, no. 2, 1977,  
p. 127-150.

MAJS: /\*CLEAN ENERGY/\*COAL GASIFICATION/\*COAL LIQUEFACTION/\*  
SYNTHETIC FUELS

MINS: / COAL UTILIZATION/ CRUDE OIL/ METHANE/ TECHNOLOGY  
ASSESSMENT

ABA: (Author)

ABS: The COGAS Process provides a way to produce clean  
liquid fuels and moderate or high Btu gas from coal.  
It integrates multi-stage coal pyrolysis and steam  
gasification of char, with heat provided by a separate  
air-blown combustor. It derives advantages from: the  
co-production of oil, use of low pressure, carbon  
efficiencies, avoidance of oxygen, and emphasis on  
demonstrated technology. Two gasification pilot plants  
have been built and operated to evaluate inert heat  
carrier vs char heat carrier. The char heat carrier  
process, piloted in England, has demonstrated very  
promising performance and has been selected for  
continued development. The program is now proceeding  
toward design and construction of large pilot plant of  
600-1000 TPD coal capacity.

## DESIGN OF AN OCEAN THERMAL ENERGY PLANT SHIP TO PRODUCE AMMONIA VIA HYDROGEN

G.L. Dugger and E.J. Francis  
Internation Journal of Hydrogen Energy  
Vol. 2, no. 3, 1977,  
p. 231-249.

## MATERIALS FOR DIRECT COMBUSTION FLUIDIZED- BED STEAM GENERATORS

John E. Mesko

Metal Progress, July 1977, vol. 112, no.  
2, p. 30-34

77N11535# ISSUE 2 PAGE 217 CATEGORY 44 RPT#:  
FE-0390-1 CNT#: E(49-18)-390 75/11/00 46 PAGES

UNCLASSIFIED DOCUMENT

UTTL: Problems and solutions in the use of coal analyses  
AUTH: A/GIVEN, P. H.; B/YARZAB, R. F.  
CORP: Pennsylvania State Univ., University Park. CSS: (Coal Research Section.) AVAIL:NTIS SAP: HC A03/MF A01

MAJS: /\*COAL GASIFICATION/\*COAL LIQUEFACTION/\*ENERGY CONVERSION

MINS: / CARBON/ CHEMICAL ANALYSIS/ FOSSIL FUELS/ INORGANIC COMPOUNDS/ ORGANIC COMPOUNDS

ABA: Author (ERA)

ABS: The various complex energy problems have stimulated a great resurgence of interest in processes for the conversion of coals into clean gaseous and liquid fuels. Chemical analyses are important to the development of these new processes to a much greater extent than in the well established methods of using coal. Standard procedures for performing the various necessary analyses have been available for many years. The problems arise because all coals are composed of an organic component (originally derived from green plants) and an inorganic component (consisting of minerals such as clays and pyrite). If one wishes to know how much of each of these major components is present, the obvious thing to do is to burn away the

organic matter and weigh the remaining ash. But in the process the inorganic components also change. Alternatively, it is desired to determine how much of the element carbon is present in the organic fuel. The standard method unfortunately cannot distinguish between the organic carbon and a form of inorganic carbon present in significant amounts in some coals. Various problems of interpreting and using coal analyses are reviewed. Finally, some consideration is given to the contribution modern instrumental methods may make to coal analysis.

FLUIDIZED-BED COMBUSTION TECHNOLOGY: A REVIEW.  
C.S.R. Rao.  
Combustion Sci. & Tech., v.16, no.3-6, 1977, p.215-227.

*Combustion, Fluidized-bed*  
Combustion Science and Technology,  
v.16, nos.3-6

1977

COAL RESEARCH. (This issue consists of a collection of papers dealing with combustion of coal approached from the view point of its utilization as a fuel for industrial and utility burners).

FLUIDIZED-BED COMBUSTION TECHNOLOGY—A REVIEW  
CHARAGUNDLA S. R. RAO *P. 215-*

TH  
7140  
.Y38

Yaverbaum, Lee

Fluidized bed combustion of coal and waste materials / Lee Yaverbaum. — Park Ridge, N.J. : Noyes Data Corporation, 1977. xii, 268 p. : ill. ; 25 cm. — (Pollution technology review ; no. 35) (Energy technology review ; no. 15)  
Bibliography: p. 263-267.  
ISBN 0-8155-0671-6

1. Combustion. 2. Coal. 3. Fluidized-bed furnace. I. Title. II. Series. III. Series: Energy technology review ; no. 15. 621.4025

ABOUT COKE - AND WHERE THE SULFUR WENT  
Thomas Reis

Chemtech, vol. 7, no. 6, June 1977, p. 366-373

Coke is both an energy source and reagent. Reis brings us up to date on the modern technology of making it.

CN-150,538

1977  
(HEAVY METALS AND OTHER TRACE ELEMENTS IN BLACK COAL AND THEIR EMISSION TO THE AIR AT COAL COMBUSTION. A LITERATURE SURVEY). (Tungmetaller och Andra Spårämnen i Stenkol Samt Emissioner till Luft av Dessa Ämnen vid Kolförbränning - En Litteraturstudie). Gun Lövblad and Peringe Grennfelt. Jan.1977.

Institutet for Vatten- och  
Luftvardsforskning, Goteborg  
(Sweden)  
(Swedish Water and Air Pollution  
Research Lab., Goteborg (Sweden))

IVL-B-345

IVL-B-345

Coal ~~Coal - Combination~~  
Bibliography - Air pollution

TD American Society of Mechanical Engineers.  
897 Research Committee on Industrial and  
.A64 Municipal Wastes.  
v.3 Disposal of industrial wastes by combustion : present state-of-the-art, v. 3/ prepared by the ASME Research Committee on Industrial and Municipal Wastes. - New

1. Fluidized Bed Combustion

1.1 Description .....	1
1.2 Comparison Between Fixed Bed and Fluidized Bed .....	1
1.3 Initial Application of Fluidized Beds .....	2
1.4 The Advantages of Fluidized Bed Combustion .....	2
1.5 Additional Considerations .....	3

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OF POOR QUALITY

77N11511# ISSUE 2 PAGE 214 CATEGORY 43 RPT#:  
PB-254878/2 NSF/RA-760156 QPR-4 CNT#: NSF  
AER-75-13673 76/00/00 25 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Basic studies of coal pyrolysis and hydrogasification  
TLSP: Quarterly Progress Report, 21 Feb. - 20 May 1976  
AUTH: A/BUSH, T. W.; B/HOWARD, J. B.; C/PETERS, W. A.;  
D/SUUBERG, E. M.  
CORP: Massachusetts Inst. of Tech., Cambridge. CSS: (Energy Lab.) AVAIL. NTIS SAP: HC A02/MF A01  
MAJS: /COAL GASIFICATION/COAL LIQUEFACTION/PYROLYSIS  
MINS: / GASIFICATION/ INDUSTRIAL PLANTS/ LAMINAR FLOW/  
STRUCTURAL DESIGN

ABA: GRA

ABS: The low pressure batch sample reactor apparatus underwent the final modifications necessary to accomplish total product analyses. Concurrently with the development of the low pressure system, the successful modifications were incorporated into a design of the high pressure hydrogenation reactor. The analysis scheme for either reactor involves capturing products in four classes: (1) char; (2) gas; (3) condensable liquid; and (4) tar. The designs for many components of the laminar flow reactor were finalized. These components include the gas preheater, the coal particle feeder, the gas pressure and flow rate control system, and the process temperature control system.

77N27563# ISSUE 18 PAGE 2409 CATEGORY 44 RPT#:  
PB-265552/0 NBS-SP-468 LC-77-608043 77/04/00 237  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Prevention of Failures in Coal Conversion Systems:  
Proceedings of the 24th Meeting of the Mechanical  
Failures Prevention Group

AUTH: A/SHIVES, T. R.; B/WILLARD, W. A.  
CORP: National Bureau of Standards, Washington, D.C. CSS:  
(Metallurgy Div.) AVAIL. NTIS SAP: HC A11/MF A01  
Sponsored in part by Frankford Arsenal, CNR, FAA,  
ERDA, NADC, and Battelle Columbus Labs. Conf. Proc.  
held at Columbus, Ohio, 21-23 Apr. 1976

MAJS: /COAL GASIFICATION/COAL LIQUEFACTION/CONFERENCES/  
CORROSION PREVENTION  
MINS: / FRACTURES (MATERIALS)/ NONDESTRUCTIVE TESTS/ QUALITY  
CONTROL

ABA: GRA

ABS: A series of overview lectures dealing with reliability problems in coal conversion systems, economics of failures in energy generating systems, corrosion, and gaps in engineering data are presented. In addition,

failure analysis, materials problems, and related materials research are discussed.

78V54094 1976 ISS: 00 TP759.595 1976 3-773001-81-X  
662.625 LC-76-381723

AUTH: A/Giesel, Harald B.; B/Peters, Werner.  
UTTL: Symposium on Gasification and Liquefaction of Coal,  
Dusseldorf, 1976 = TLSP: Colloque sur la  
gaz eification et la liqu efaction du charbon =  
(Simposium po voprosam gazifika t sil i szhizheni i a  
ugli i a (romanized form)) / (hrsg. von Harald B.  
Giesel u Werner Peters).  
Symposium on Gasification and Liquefaction of Coal,  
Dusseldorf, 1976.  
Verlag G. Luckauf, Essen : (420) p. In various pagings  
: ill., maps ; 21 cm.  
Rohstoffwirtschaft International ; Bd. 5 DM46.00 In  
English with French, Russian summaries in  
French and Russian. Includes 2 speeches in German.  
Sponsored by the United Nations Economic Commission  
for Europe, Coal Committee. On spine: ECE-Symposium  
Dusseldorf 1976. Includes bibliographical references.  
LC: Coal gasification -- Congresses. Coal liquefaction  
-- Congresses.  
ADDED: United Nations, Economic Commission for Europe.  
Colloque sur la gaz eification et la liqu efaction du  
charbon. Simposium po voprosam gazifika t sil i  
szhizheni i a ugli i a. ECE-Symposium Dusseldorf 1976.  
MAIN-MEET TRACE-SERS\*CORP\*TITL\*AUTH\* CATLG BY-LC  
/ / Publ In GERMANY, FEDERAL REPUBLIC OF

77A36806 ISSUE 16 PAGE 2732 CATEGORY 44  
76/00/00 165 PAGES UNCLASSIFIED DOCUMENT

UTTL: Symposium on Gasification and Liquefaction of Coal,  
Duesseldorf, West Germany, January 12-16, 1976,  
Reports

Symposium sponsored by the U.N. Economic Commission  
for Europe, Geneva, United Nations, Economic  
Commission for Europe, 1976. 165 p. (For individual  
items see A77-36807 to A77-36814)

MAJS: /\*COAL GASIFICATION/\*COAL LIQUEFACTION/\*CONFERENCES  
MINS: / ELECTRIC POWER PLANTS/ FLUIDIZED BED PROCESSORS/  
SYNTHANE/ TECHNOLOGY ASSESSMENT

ABA: M.L.

ABS: The present state and development potential of coal  
gasification are discussed with attention directed to  
the fundamentals of coal gasification and  
liquefaction, gasification coupled with the generation  
of electricity, and underground gasification. Several  
gasification technologies, including the Winkler,  
Lurgi, Hygas, and Synthane processes, are discussed in  
two reports, one dedicated to conventional processes,  
the other to advanced processes. Research and intended  
uses in different regions of the world are also  
considered.

77V19459 1977 ISS: 00 OC100.057 NO. 468 602.1 S:  
662.662 LC-77-608043 TA409; SOD C13.10:468.

AUTH: A/Shives, T. R.; B/Willard, William A.  
UTTL: Prevention of failures in coal conversion systems ;  
TLSP: proceedings of the 24th meeting of the  
Mechanical Failures Prevention Group, held at  
Battelle, Columbus Laboratories, Columbus, Ohio, April  
21-23, 1976 / edited by T. Robert Shives and William  
A. Willard ; sponsored by the Institute for Materials  
Research of the National Bureau of Standards ... (et  
al.).  
Mechanical Failures Prevention Group.  
U.S. Dept. of Commerce, National Bureau of Standards ;  
for sale by the Supt. of Docs., U.S. Govt. Print.  
Off., (Washington) : vii, 231 p. : ill. : 26 cm.  
NBS special publication ; 468 \$3.00  
LC: Fracture mechanics -- Congresses. Coal  
gasification -- Congresses. Coal liquefaction --  
Congresses.  
ADDED: United States, National Bureau of Standards.  
Institute for Materials Research, United States.  
National Bureau of Standards. Special publication ;  
468.  
MAIN-CORP TRACE-SERS\*CORP\*TITL\*AUTH\* CATLG BY-LC  
/ /

78N30264# ISSUE 21 PAGE 2780 CATEGORY 28 RPT#:  
EPRI-AF-523 77/08/00 129 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Screening evaluation: Synthetic liquid fuels  
manufacture TLSP: Final Report

AUTH: A/CHOW, T. K.; B/STANBRIDGE, D. W.  
CORP: Parsons (Ralph M.) Co., Pasadena, Calif. AVAIL. NTIS  
SAP: HC A07/MF A01  
Sponsored by EPRI

MAJS: /\*COAL GASIFICATION/\*COAL LIQUEFACTION/\*INDUSTRIAL  
PLANTS/\*METHYL ALCOHOLS/\*SYSTEMS ANALYSIS  
MINS: / CHEMICAL REACTIONS/ ECONOMIC ANALYSIS/ PRODUCTION

ENGINEERING/ SYNTHETIC FUELS/ SYSTEMS ENGINEERING

ABA: Author

ABS: Various available and proposed gasification processes  
in combination with one methanol process in conceptual  
commercial ziegler plant designs for production of clean  
liquid fuel from coal were compared. A Fischer-Tropsch  
liquids plant design was included for direct  
comparison with a methanol case using one gasification  
process. The results of this study indicate that there  
is an economic advantage to advanced gasification  
system for production of methanol. They also show that  
there is an economic advantage to production of  
methanol over that of Fischer-Tropsch liquids when the  
same type of gasifier is used in both plants.

78N23250# ISSUE 14 PAGE 1828 CATEGORY 28 RPT#:  
CONF-770814-10 CNT#: EX-76-C-01-1221 77/00/00 8  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Riser cracking of coal to oil and gas  
AUTH: A/DUNCAN, D. A.; B/BEESON, J. L.; C/OBERLE, R. D.  
CORP: Institute of Gas Technology, Chicago, Ill.  
AVAIL.NTIS SAP: HC A02/MF A01  
Presented at Ann. Am. Chem. Soc. Meeting, Chicago, 28

Aug. - 2 Sep. 1977

MAJS: /\*COAL GASIFICATION/\*COAL LIQUEFACTION/\*ENERGY  
CONVERSION/\*FUEL OILS/\*GASOLINE

MINS: / ENERGY CONVERSION/ ENTRAINMENT/ HIGH PRESSURE/  
HYDROGENATION/ PYROLYSIS

ABA: ERA

ABS: A short residence time entrained flow process for  
converting low-rank coal to gases and hydrocarbon  
liquids that can be used as gasoline blending stock  
and fuel oil was investigated. In the hydrolysis  
process, lignite was heated concurrently with hydrogen  
at a high pressure in a helical coil reactor having a  
predetermined temperature profile to yield ethylene,  
pyrolysis gasoline, and other products. Results  
indicate that: (1) fifty percent of the carbon in the  
feed lignite can be converted to oils and gases at a  
system operating pressure of 2000 psig, a coil out  
temperature of from 1400 to 1500 F, and a residence  
time of approximately 2 second; (2) approximately 15%  
of the feed carbon reports as oils, and by choice of  
temperature and hydrogen dilution, some selectivity  
with respect to the constituents present in the make  
oil is possible; and (3) high operating temperatures  
and hydrogen dilutions tend to suppress the appearance  
of phenol, toluene, and xylene in the make oil. It is  
concluded that high yields of methane, hydrocarbon  
oils, and blending gasoline constituents make the  
hydrolysis process economically favorable to  
pyrolysis of coal.

77N85042# CATEGORY 44 RPT#: FE-2286-8 CNT#:  
EX-76-C-01-2286 76/12/00 249 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Preparation of a coal conversion systems technical  
data book TLSP: Quarterly Report, 1 Aug. - 31 Oct.  
1976

CORP: Institute of Gas Technology, Chicago, Ill.  
AVAIL.NTIS

MAJS: /\*COAL GASIFICATION/\*COAL LIQUEFACTION/\*ENERGY POLICY  
/\*ENERGY TECHNOLOGY

MINS: / FLUIDIZED BED PROCESSORS/ LIQUID-VAPOR EQUILIBRIUM/  
PYROLYSIS/ SLURRIES

78N24382# ISSUE 15 PAGE 1978 CATEGORY 28 RPT#:  
FE-2307-17 CNT#: EX-76-C-01-2307 77/06/00 54  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Research and development of rapid hydrogenation for  
coal conversion to synthetic motor fuels (riser  
cracking of coal) TLSP: Annual Report, 1 Apr. 1976 -  
31 Mar. 1977

JTH: A/DUNCAN, D. A.; B/BEESON, J. L.; C/OBERLE, R. D.  
CORP: Institute of Gas Technology, Chicago, Ill.  
AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /\*AUTOMOBILE FUELS/\*COAL GASIFICATION/\*COAL  
LIQUEFACTION/\*HYDROGENATION

MINS: / CATALYSIS/ CHEMICAL REACTORS/ HIGH PRESSURE/ HIGH  
TEMPERATURE

ABA: ERA

ABS: The use of a short residence-time riser reactor, of  
the type used in contemporary catalytic cracking was  
extended to the conversion of coals and lignites to  
gaseous and liquid products by reaction with gases  
such as hydrogen, synthesis gas, or mixtures of carbon  
monoxide and steam. The gases also carry the feed coal  
through the riser reactor. A maximized production of  
high-octane gasoline constituents (C4 to 400 F boiling  
range including BTX) is an important aspect of this  
investigation. Light gases (C1 to C3) will also be  
produced and will contain substantial proportions of  
methane and other light hydrocarbons that could be  
used either for fuel or for petrochemical feedstock.  
Spent char would be used for synthesis gas or hydrogen  
production for use in the riser reactor.

184  
A5  
v. 32  
pt. 1-4  
pt. 3

Advances in instrumentation, v. 32, pts. 1-4;  
proceedings of the ISA Conference and Ex-  
hibit, Niagara Falls, New York, October 17-  
20, 1977. — Pittsburgh: Instrument So-  
ciety of America, c1977.

4 v. : ill. ; 29 cm.

1. Engineering instruments—Congresses.  
2. Automatic control—Congresses. I.  
Instrument Society of America. II. ISA  
Conference and Exhibit, Niagara Falls, 1977.

744. STATUS OF FLUIDIZED-BED COMBUSTION, W. W. Roachborough .....  
p. 187

**AMMONIA FROM COAL**

David Netzer and James Moe

Chemical Engineering

Vol. 84, No. 23, October 24, 1977,

p. 129-132.

As the price of natural gas goes up, and with increased restrictions on its use, it becomes preferable to make ammonia from coal. Here is a description of a process for making ammonia by using this widely available feedstock, together with a detailed analysis of economics.

**COMBUSTION OF COAL IN FLUIDISED BEDS.**

S.J. Wright.

Physics in Technology, v.8, no.6, Nov.1977, p.244-48.

Commercial exploitation of fluidised-bed combustion has already begun, and research in hand offers the potential of more efficient generation of electricity. The manager of the International Energy Agency's major coal utilisation project explains the principles and practice of the new technique for burning coal

77N75776# CATEGORY 44 RPT#: PB-260664/8  
NSF/IDOE-75-04 75/09/01 34 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Coal conversion technologies TLSP: Final Report

AUTH: A/GRANDYS, K.

CORP: Illinois State Dept. of Business and Economic  
Development, Springfield. CSS: (Div. of Energy.)  
AVAIL NTIS

MAJS: /\*COAL GASIFICATION/\*COAL LIQUEFACTION/\*ENERGY POLICY  
/\*ENERGY TECHNOLOGY

MINS: / DESULFURIZING/ PYROLYSIS/ REVIEWING

COAL - GASIFICATION

79A23827 ISSUE 8 PAGE 1435 CATEGORY 44  
79/01/00 7 PAGES In GERMAN UNCLASSIFIED DOCUMENT

UTTL: Substitute natural gas from coal using  
high-temperature reactor heat - Project 'Prototype  
Plant Nuclear Process Heat'

AUTH: A/ARNDT, E.; B/FISCHER, R.; C/FROEHLING, W.;

D/WEISPRODT, I.; E/JUENTGEN, H.; F/TEGGERS, H.  
PAA: A/(Hochtemperatur-Reaktorbau GmbH, Mannheim, West  
Germany); B/(Gesellschaft fuer

Hochtemperaturreaktor-Technik MbH, Bergisch-Gladbach,  
West Germany); D/(Kernforschungsanlage Juelich GmbH,  
Juelich, West Germany); E/(Bergbau-Forschung GmbH,  
Essen, West Germany); F/(Rheinische Braunkohlenwerke  
AG, Cologne, West Germany)

Erdoel und Kohle Erdgas Petrochemie vereinigt mit  
Brennstoff-Chemie, vol. 32, Jan. 1979, p. 17-23. In  
German. Research supported by the Bundesministerium  
fuer Forschung und Technologie.

MAJS: /\*COAL GASIFICATION/\*HIGH TEMPERATURE GAS COOLED  
REACTORS/\*NUCLEAR POWER PLANTS/\*SYNTHANE/\*WASTE ENERGY  
UTILIZATION

MINS: / BLOCK DIAGRAMS/ CLEAN ENERGY/ ENERGY TECHNOLOGY/  
RESEARCH AND DEVELOPMENT

ABA: G.R.

ABS: The considered project is concerned with the further  
development of the processes for the transformation of  
solid fossil fuels on the basis of a use of heat from  
high-temperature reactors. Designs which are suitable  
for the construction of a prototype plant for an  
operational study of these processes are also to be  
obtained. The development of nuclear coal gasification  
takes place in several steps. The first steps are  
related to the design of suitable gasification  
procedures on a laboratory-scale basis, the design and  
operations of medium-scale experimental equipment for  
the selected gasification procedures, and studies  
concerning the design of large-scale installations for  
nuclear coal gasification. Details regarding the  
design of large-scale installations are discussed.  
Attention is also given to research and development  
work concerning the gasification technologies and the  
high-temperature reactor.

79A41375 ISSUE 17 PAGE 3323 CATEGORY 82 CNT#:  
EX-76-C-10-3863 79/07/00 9 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: An information approach to examining developments in  
an energy technology - Coal gasification

AUTH: A/FRAME, J. D.; B/BAUM, J. J.; C/CARD, M. PAA:

B/(Computer Horizons, Inc., Washington, D.C.);  
C/(U.S. Department of Energy, Office of Policy and  
Evaluation, Washington, D.C.)  
American Society for Information Science, Journal,  
vol. 30, July 1979, p. 193-201.

MAJS: /\*COAL GASIFICATION/\*ENERGY TECHNOLOGY

MINS: / CATALOGS (PUBLICATIONS)/ DATA ACQUISITION/ DATA  
BASES/ DATA PROCESSING/ INDEXES (DOCUMENTATION)/  
INFORMATION SYSTEMS/ LITERATURE/ PILOT PLANTS/  
RESEARCH AND DEVELOPMENT

ABA: (Author)

ABS: Developments in coal gasification research are  
investigated by examining the coal gasification  
literature, which is broadly defined to include  
journal articles, research reports, engineering  
proceedings, and patents. A substantial number of  
items were found for 1974, 1975, and the early part of  
1976 (N = 1461). The coal gasification literature has  
experienced explosive growth in recent years, trebling  
in size between 1972 and 1974. While some of this  
growth may be associated with the recent 'energy  
crisis', in large measure it appears to be associated  
with the establishment of bench-scale and pilot plant  
coal gasification operations in the late 1960s and  
early 1970s. Most published coal gasification research  
is produced by the U.S. private sector (38.7%),  
followed by the U.S. government (24.0%), foreign  
researchers (20.5%), universities (8.5%), and  
'unknown' (8.5%). This study suggests that  
technologies which are government supported and  
reported in the public domain are - like most  
scientific areas - good candidates for bibliometric  
inquiries. These inquiries allow for relatively  
economic, efficient, and reliable examinations of  
national research activity in given scientific and  
technological areas.

79A51866 ISSUE 23 PAGE 4380 CATEGORY 44 CNT#:  
W-7405-ENG-48 79/00/00 7 PAGES UNCLASSIFIED  
DOCUMENT

JTTL: Field performance of underground coal gasification  
AUTH: A/STEPHENS, D. R.; B/BRANDENBURG, C. F.; C/BURWELL,  
E. L. PAA: A/(California, University, Livermore,  
Calif.); B/(U.S. Department of Energy, Laramie Energy  
Technology Center, Laramie, Wyo.); C/(U.S. Department  
of Energy, Div. of Fossil Fuel Extraction, Washington,  
D.C.)  
In: Intersociety Energy Conversion Engineering  
Conference, 14th, Boston, Mass., August 5-10, 1979.  
Proceedings, Volume 1. (A79-51726 23-44) Washington,  
D.C., American Chemical Society, 1979, p. 996-1002.  
MAJS: /\*COAL GASIFICATION/\*COMBUSTION PHYSICS/\*COST  
ESTIMATES/\*PYROLYSIS/\*TECHNOLOGY ASSESSMENT  
MINS: / COAL UTILIZATION/ COMBUSTION PRODUCTS/ ENERGY  
TECHNOLOGY/ GRAPHS (CHARTS)/ TABLES (DATA)  
ABA: A.T.

ABS: This paper reviews the state of art in underground  
coal gasification (UCG), with emphasis on the U.S. DOE  
program. UCG offers potential advantages as a source  
of pipeline quality gas cost competitive with other  
syngas, the use of 1.2 trillion tons of coal that  
would not be economical to strip or deep mine, and  
possible environmental advantages. The environmental  
issues, pipeline gas and electricity cost comparisons  
with alternate sources, and recent UCG results in the  
DOE program are discussed. Experimental gasification  
with air producing low BTU gas and steam/oxygen  
gasification producing medium BTU gas are described,  
and it is concluded that (1) UCG can recover the  
energy in unminable coal seams to ease demand for  
imported oil and natural gas, (2) the coal reserve for  
UCG is vast and widely distributed and could supply at  
least 300 quads as SNG, electricity, or clean liquids,  
(3) conversion of medium-BTU gas to transportation  
fuels and SNG and low-BTU gas to electricity are  
priorities for UCG, and (4) tests to-date confirm  
economic and environmental advantages.

79V29581 1979 ISS: 00 TP759.K36 0-824769-23-6 662.66  
LC-79-20745

AUTH: A/Kasem, A.  
UTTL: Three clean fuels from coal : TLSP: technology and  
economics : synthetic natural gas, methanol, medium  
Btu gas / A. Kasem.  
M. Dekker, New York :  
Technological opportunities unlimited, report ; no. 2  
Includes index.  
LC: Coal gasification, Methanol, Synthesis gas.  
MAIN-AUTH TRACE-SERS-TITL\* CATLG BY-LC  
/ /

79A51867 ISSUE 23 PAGE 4380 CATEGORY 44  
79/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: A numerical model of underground coal gasification for  
air-water injection into a permeable bed  
AUTH: A/PASHA, M. L.; B/FAROUQ-ALI, S. M. PAA:  
B/(Pennsylvania State University, University Park,  
Pa.)  
In: Intersociety Energy Conversion Engineering  
Conference, 14th, Boston, Mass., August 5-10, 1979.  
Proceedings, Volume 1. (A79-51726 23-44) Washington,  
D.C., American Chemical Society, 1979, p. 1019-1017.  
MAJS: /\*CHEMICAL REACTIONS/\*COAL GASIFICATION/\*FLUID  
INJECTION/\*MATHEMATICAL MODELS/\*NUMERICAL FLOW  
VISUALIZATION  
MINS: / COAL UTILIZATION/ ENERGY TECHNOLOGY/ GRAPHS (CHARTS)  
ABA: (Author)  
ABS: The present investigation is devoted to the  
development of an unsteady state model of underground  
coal gasification for a porous and permeable bed. The  
coal may produce ash and tar and a mixture of  
nitrogen, methane, carbon dioxide, carbon monoxide,  
steam and hydrogen, as a result of pyrolysis. The  
reaction stoichiometry is described by nine reactions  
involving coal, char, and seven gases. The  
gasification of mixture may consist of both water and  
gas and thus this investigation simulates a two-phase  
fluid flow system. The problem is formulated in terms  
of thirteen equations. Because of the amount of  
available computer memory, the solution approach used  
is a combination of simultaneous and sequential steps.  
The set of equations is divided into three strongly  
coupled sets of equations and each set of equations is  
solved separately using direct solution techniques.

79V47561 1979 ISS: 00 TP759.C62 1976 662.625 LC-  
79-624429

AUTH: A/Smith, Carl J.; B/Nichols, Duane G.  
UTTL: Proceedings of the Coal Processing and Conversion  
Symposium, June 1-3, 1976, Morgantown, WV / compilers,  
Carl J. Smith, Duane G. Nichols ; sponsors, West  
Virginia Geological and Economic Survey, West  
Virginia University, College of Engineering.  
Coal Processing and Conversion Symposium, Morgantown,  
W. Va., 1976.  
The Survey, (Morgantown, W. Va.) : xii, 115 p. : ill.  
; 28 cm.  
Coal geology bulletin ; CGB-6 Cover title. Includes  
bibliographical references and index.  
LC: Coal gasification -- Congresses. Coal liquefaction  
-- Congresses. Coal preparation -- Congresses.

ADDED: West Virginia, Geological Survey, West  
Virginia, University, College of Engineering.  
MAIN-MEET TRACE-SERS-CORP-AUTH\* CATLG BY-LC  
/ /

79A51860 ISSUE 23 PAGE 4379 CATEGORY 44  
79/00/00 3 PAGES UNCLASSIFIED DOCUMENT  
UTTL: The pyrolysis route to gasification  
AUTH: A/EDDINGER, R. T. PAA: A/(COGAS Development Co.,  
Princeton, N.J.)  
In: Intersociety Energy Conversion Engineering  
Conference, 14th, Boston, Mass., August 5-10, 1979,  
Proceedings, Volume 1. (A79-51726 23-44) Washington,  
D.C., American Chemical Society, 1979, p. 886-888.  
MAJS: /\*COAL GASIFICATION/\*COMBUSTION PRODUCTS/\*PYROLYSIS/\*  
TECHNOLOGY ASSESSMENT  
MINS: / COAL UTILIZATION/ ENERGY TECHNOLOGY/ PILOT PLANTS/  
SYNTHETIC FUELS  
ABA: A.T.

ABS: The advantages of pyrolysis for coal gasification and  
the details of the COGAS process pyrolysis step are  
presented. The pyrolysis section of this process  
converts a portion of the feed coal to oil and gas by  
the thermal decomposition of the coal in several  
reactors in series. The advantages of pyrolysis  
including its capability for making all types of coal  
suitable for gasification and producing a reactive  
char of a size similar to the feed coal are discussed;  
design of the pyrolysis section to heat coal in  
absence of oxygen and drive off volatiles as oil and  
gas, while avoiding agglomeration, is described. The  
COGAS pilot plant designed to process 50 tons/day of  
coal-derived char is detailed, together with the COGAS  
demonstration plant to produce synthetic pipeline gas,  
fuel oil, and naphtha from Illinois coal. It is  
concluded that the COGAS process combining pyrolysis  
with gasification is economically attractive for the  
production of fuel oil and naphtha.

79A49158 ISSUE 21 PAGE 3985 CATEGORY 44  
79/00/00 17 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Small-scale coal-gasification plants  
AUTH: A/VERMA, A.; B/READ, P. J. PAA: A/(Saskatchewan  
Power Corp., Regina, Canada); B/(Department of  
Energy, Mines and Resources, Ottawa, Canada)  
Energy Sources, vol. 4, no. 3, 1979, p. 281-297.  
Research supported by the Saskatchewan Power Corp. and  
Department of Energy, Mines and Resources.  
MAJS: /\*COAL GASIFICATION/\*ENERGY TECHNOLOGY/\*INDUSTRIAL  
PLANTS  
MINS: / CARBON DIOXIDE/ COST ESTIMATES/ GASEOUS FUELS/  
SCRUBBERS/ SYNTHANE  
ABA: (Author)

ABS: This paper presents technical and economic analyses of  
coal-gasification processes to manufacture  
medium-heating-value gas and synthetic natural gas  
from two commercially available processes:  
Koppers-Totzek and Lurgi. The plants were designed for  
a capacity of 30 x 10 to the 9th Btu/day.

79A32434# ISSUE 13 PAGE 2391 CATEGORY 37 RPT#:  
ASME PAPER 79-GT-173 CNT#: EX-76-C-01-2291  
79/03/00 9 PAGES UNCLASSIFIED DOCUMENT  
UTTL: A high temperature turbine for operation on  
coal-derived fuel  
AUTH: A/MOGUL, J. M.; B/WOLF, J. C.; C/BUNKER, W. W.  
PAA: B/(Curtiss-Wright Corp., Wood-Ridge, N.J.);  
C/(U.S. Department of Energy, Washington, D.C.) SAP:  
MEMBERS, \$1.50; NONMEMBERS, \$3.00  
American Society of Mechanical Engineers, Gas Turbine  
Conference and Exhibit and Solar Energy Conference,  
San Diego, Calif., Mar. 12-15, 1979, 9 p.  
MAJS: /\*COAL GASIFICATION/\*GAS TURBINE ENGINES/\*HIGH  
TEMPERATURE GASES/\*STEAM TURBINES/\*TRANSPIRATION/\*  
TURBINE BLADES  
MINS: / AIR COOLING/ COAL UTILIZATION/ ENERGY TECHNOLOGY/  
ENGINE DESIGN/ GAS TEMPERATURE/ OPERATING TEMPERATURE  
ABA: (Author)

ABS: An opportunity exists for generating clean, high  
efficiency electric power from coal by integrating a  
low Btu coal gasification system with a combined gas  
turbine-steam turbine cycle. Achieving this objective  
is dependent on developing a gas turbine which can  
operate at temperatures over 2600 F (1427 C) in a  
combusted coal-gas environment.  
Transpiration-air-cooling of hot section blades and  
vanes is a concept which can effectively deal with  
both high gas temperatures and the aggressive

atmosphere. A description of the concept, early test  
experience, and the building block testing approach  
for evaluating transpiration-air-cooling on simulated  
coal derived fuel are discussed.

79A48049 ISSUE 21 PAGE 3984 CATEGORY 44  
79/09/00 9 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Synthetic fuels at the crossroads --- coal  
gasification technology  
AUTH: A/STOKES, C. A.  
Technology Review, vol. 81, Aug.-Sept. 1979, p. 25-33.  
MAJS: /\*COAL GASIFICATION/\*ENVIRONMENTAL CONTROL/\*SYNTHETIC  
FUELS  
MINS: / AIR POLLUTION/ CHEMICAL CLEANING/ COAL UTILIZATION/  
ENERGY TECHNOLOGY/ FUEL COMBUSTION/ TECHNOLOGICAL  
FORECASTING  
ABA: B.J.

ABS: The paper examines to what extent the several  
available alternative fuels and processes (including  
synthetic fuels) be exploited in order to reduce the  
heavy dependence of the United States on oil and gas  
in the short term (e.g., through about 1985) if  
domestic policies and international political actions  
do not foreclose the opportunities which technology  
may offer. In addition, attention is given to the  
impact of new research after 1985.

79A38871 ISSUE 16 PAGE 3030 CATEGORY 44  
79/00/00 350 PAGES UNCLASSIFIED DOCUMENT

UTTL: Pulverized-coal combustion and gasification: Theory and applications for continuous flow processes --- Book

AUTH: A/SMOOT, L. D.; B/PRATT, D. T. PAA: A/(Brigham Young University, Provo, Utah); B/(Utah, University, Salt Lake City, Utah) PAT: A/(ED.) SAP: \$39.50 New York, Plenum Press, 1979. 350 p

MAJS: /\*COAL GASIFICATION/\*COMBUSTION PRODUCTS/\*FUEL COMBUSTION/\*GRINDING (COMMINUTION)/\*MATHEMATICAL MODELS/\*REACTION KINETICS

MINS: / AIR POLLUTION/ COMBUSTION PHYSICS/ FINITE DIFFERENCE THEORY/ POLLUTION CONTROL/ TRANSPORT THEORY

ABA: C.K.D.

ABS: A collection of review articles on analytical modeling of coal reaction processes is presented, with emphasis on processes utilizing finely pulverized coal entrained in a gaseous phase. Topics include turbulent and laminated reacting multiphase systems, gas-phase combustion, mechanisms and kinetics of pollutant formation, gas-particle conductive interactions, and mathematical models of one- and multidimensional systems. Appendices provide conversion factors and physical parameters for prediction of transport coefficients, and give the derivations of a four-flux radiation model and Eulerian finite-difference equations.

79A28438 ISSUE 11 PAGE 2055 CATEGORY 44  
79/02/00 7 PAGES In FRENCH UNCLASSIFIED DOCUMENT

UTTL: Lignite - Abundant raw material of the future

AUTH: A/SPEICH, P.  
Revue de l'Energie, vol. 30, Feb. 1979, p. 103-109. In French.

MAJS: /\*COAL GASIFICATION/\*COAL UTILIZATION/\*FOSSIL FUELS/\* RESEARCH AND DEVELOPMENT

MINS: / AMMONIA/ CRUDE OIL/ ENERGY CONSUMPTION/ ENERGY TECHNOLOGY/ FERTILIZERS/ GERMANY/ HYDROCARBON FUEL PRODUCTION/ METHYL ALCOHOLS/ NUCLEAR ENERGY/ SYNTHETIC FUELS

ABA: (Author)

ABS: This is the last of a series of articles devoted to the use of lignite in the Federal Republic of Germany. It deals with research and development activities and a calendar of research and development projects. The biggest deposit of lignite, with reserves of 55 billion tons, is located in the Rhineland. The technical projects elaborated over the past decades call for the exploitation of the major part of this deposit, that is about 35 billion tons of lignite. The reserves correspondent to about the same energy reserves as all of Iran's oil deposits. It is one of the 'solated energy' raw material deposits in the world.

79A32249 ISSUE 13 PAGE 2429 CATEGORY 45  
79/04/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: High temperature, high pressure electrostatic precipitation

AUTH: A/BUSH, J. R.; B/FELDMAN, P. L.; C/ROBINSON, M. PAA: C/(Research-Cottrell, Inc., Somerville, N.J.) Air Pollution Control Association, Journal, vol. 29, Apr. 1979, p. 365-371.

MAJS: /\*COAL GASIFICATION/\*ELECTROSTATIC PRECIPITATORS/\* FLUIDIZED BED PROCESSORS/\*HIGH PRESSURE/\*HIGH TEMPERATURE TESTS

MINS: / ELECTRODES/ ENERGY TECHNOLOGY/ FEASIBILITY ANALYSIS/ GAS TEMPERATURE/ VOLT-AMPERE CHARACTERISTICS

ABA: (Author)

ABS: The feasibility of electrostatic precipitation at temperatures and pressures varying from ambient condition to 1366 K and 3550 kPa, respectively, has been demonstrated in a laboratory wire-pipe electrode system. Stable corona discharges are obtained at all temperatures subject to appropriate choices of electrode dimension, polarity, and pressure. Current-voltage characteristics are reported for dry air, a simulated combustion gas, and a substitute fuel gas. The effects of temperature, pressure, electrode geometry and polarity on sparkover voltage, corona-starting voltage, and current are evaluated. A precipitator performance model is included to incorporate this data into a high temperature, high pressure (MTHP) precipitator design. This model has been evaluated for an electrostatic HTHP precipitator following a pressurized fluidized bed combustor at 1089 K and 920 kPa. It is recommended that prototype HTHP electrostatic precipitators be applied to pilot coal gasifiers and fluidized bed combustors to obtain detailed design data and to verify the accuracy of the performance model under actual operating conditions.

79A29314 ISSUE 11 PAGE 1970 CATEGORY 25  
79/03/00 23 PAGES UNCLASSIFIED DOCUMENT

UTTL: Coal gasification studies. III - Reduction in the presence of some metal iodides and iron halides

AUTH: A/BUTLER, R.; B/SNELSON, A. PAA: B/(IIT Research Institute, Chicago, Ill.) Fuel Processing Technology, vol. 2, Mar. 1979, p. 99-121. Research supported by the Consolidated Natural Gas Service Co.

MAJS: /\*COAL GASIFICATION/\*METAL HALIDES/\*REDUCTION-- (CHEMISTRY)

MINS: / CATALYSTS/ COAL UTILIZATION/ ENERGY TECHNOLOGY/ HYDROGENATION/ IODIDES

79A23829 ISSUE 8 PAGE 1351 CATEGORY 23  
79/01/00 6 PAGES In GERMAN UNCLASSIFIED DOCUMENT

UTTL: Methane formation during the hydrogasification and the gas phase pyrolysis of defined aromatics  
AUTH: A/GRÄBER, W.-D.; B/HUETTINGER, K. J. PAA:  
B/(Karlsruhe, Universitaet, Karlsruhe, West Germany)  
Erdöl und Kohle Erdgas Petrochemie vereinigt mit  
Brennstoff-Chemie, vol. 32, Jan. 1979, p. 26-31. In  
German. Research supported by the Deutsche  
Forschungsgemeinschaft.  
MAJS: /\*AROMATIC COMPOUNDS/\*COAL GASIFICATION/\*PYROLYSIS/\*  
SYNTIANE  
MINS: / CHEMICAL REACTIONS/ ENERGY TECHNOLOGY/ HYDROGENATION  
/ NATURAL GAS  
ABA: G.R.  
ABS: Advantages regarding a production of substitute  
natural gas from coal are related to the high  
calorific value of methane and the possibility to  
utilize existing supply and distribution installations  
for natural gas. The reported investigation is  
concerned with problems related to the methane  
formation process. Aromatics used in a number of  
experiments include benzene, naphthalene, 1-methyl  
naphthalene, 2-methyl naphthalene, and diphenyl  
methane. Reaction temperatures in the range from 600  
to 1000 C were used. In the case of benzene and  
naphthalene noticeable methane formation was first  
observed at temperatures in the range from 850 to 900  
C. The formation of methane in the case of 1-methyl  
naphthalene, 2-methyl naphthalene, and diphenyl  
methane begins already at temperatures in the range  
from 600 to 700 C.

78V45289 1979 ISS: 00 TP328.P84 0-306400-84-7 662.62  
LC-78-12564

AUTH: A/Smoot, Leon Douglas.; B/Pratt, David T.  
UTTL: Pulverized coal combustion and gasification : TLSP:  
theory and applications for continuous flow processes  
/ edited by L. Douglas Smoot and David T. Pratt.  
Plenum Press, New York : xvii, 333 p. : ill. : 24 cm.  
Includes bibliographical references and index.  
LC: Coal. Pulverized. Combustion engineering. Coal  
gasification.  
NASA: / COAL GASIFICATION/ COMBUSTION PRODUCTS/  
GRINDING (COMMINUTION)/ HETEROGENEITY/ MATHEMATICAL  
MODELS  
MAIN-TITL TRACE-AUTH\* CATLG BY-LC  
/ / COPYRIGHT AVAIL: / LANGLEY

79N31413# ISSUE 22 PAGE 2935 CATEGORY 28 RPT#:  
SERI/TR-33-151 CNT#: EG-77-C-01-4042 79/02/00 61  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Process designs and cost estimates for a medium Btu  
gasification plant using a wood feedstock  
AUTH: A/DESROSIERS, R. E.  
CORP: Midwest Research Inst., Golden, Colo. AVAIL NTIS  
SAP: HC A04/MF A01  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*COST ESTIMATES/\*ENERGY  
CONVERSION/\*GASIFICATION/\*HYDROCARBON FUEL PRODUCTION  
/\*PYROLYSIS/\*WOOD  
MINS: / COMBUSTION CHAMBERS/ COSTS/ ECONOMIC ANALYSIS/  
ENERGY TECHNOLOGY/ HYDROCARBONS/ TECHNOLOGY ASSESSMENT  
/ WASTE DISPOSAL/ WATER TREATMENT  
ABA: DOE  
ABS: A gasification plant to effect the conversion of wood  
to medium Btu gas described. The cost of the  
processing steps common to all gasification schemes  
and specific research areas are examined. Capital  
investment statements for three plant sizes are  
included along with manufacturing costs for each of  
these at three feedstock prices. The design  
incorporates a front end handling system, package  
cryogenic oxygen plant, the gasifier, a gas cleaning  
train consisting of a spray scrubber, ionizing wet

scrubber, and condenser, and a wastewater treatment  
facility including a cooling tower and a package  
activated sludge unit. Cost figures for package units  
were obtained from suppliers and used for the oxygen  
and wastewater treatment plants. The gasifier is fed  
with wood chips at 20% moisture (wet basis). For each  
pound of wood, 0.32 lb of oxygen are required, and  
1.11 lb of gas are produced.

77V11229 19-- ISS: 47 T1164.U2

UTTL: MHD system with dual pressure melt gasification and  
carbon dioxide recycle. Prepared by Westinghouse  
Research and Development Center, Pittsburgh, Pa., for  
Office of Coal Research,  
U.S. Office of Coal Research, Westinghouse Research  
and Development Center, Pittsburgh, Pennsylvania,  
U.S. Govt. Print. Off. Washington, 17 p.  
U.S. Office of Coal Research. R and D report no. 58.  
LC: Coal gasification. Magneto-hydrodynamic generators.  
Power plants.  
NASA: / CARBON DIOXIDE/ COAL GASIFICATION/  
MAGNETOHYDRODYNAMIC GENERATORS/ POWER PLANTS  
MAIN-CORP TRACE-CORP-TITL\* CATLG BY-AMES-LSL  
76/11/05 AVAIL: / AMES-ATLL

79N21215 ISSUE 12 PAGE 1544 CATEGORY 28  
79/00/00 216 PAGES UNCLASSIFIED DOCUMENT

UTTL: Catalytic effect of Ni and K<sub>2</sub>CO<sub>3</sub> in the gasification  
of carbon and coal TLSP: Ph.D. Thesis

AUTH: A/GUZMANR, G. L.  
CORP: Notre Dame Univ., Ind. SAP: Avail: Univ. Microfilms  
Order No. 7908378

MAJS: /\*CARBON/\*CATALYTIC ACTIVITY/\*COAL GASIFICATION/\*  
NICKEL/\*POTASSIUM COMPOUNDS

MINS: / ACTIVATION ENERGY/ ILLINOIS/ METHANE/ REACTION  
KINETICS/ SULFUR

ABA: Dissert. Abstr.

ABS: The catalytic effect of nickel and K<sub>2</sub>CO<sub>3</sub> on the  
gasification of activated carbon and Illinois Number 6  
coal was studied at atmospheric pressure and  
temperatures between 500 to 927 C. using a Cahn RG  
elect. balance. Nickel was a very active catalyst in  
the gasification of activated carbon, producing CH<sub>4</sub> in  
hydrogasification and mainly CO<sub>2</sub> and CO in steam  
gasification. In coal, nickel exhibited very low  
activity, probably due to sulphur poisoning. The  
catalytic effect of K<sub>2</sub>CO<sub>3</sub> on the steam gasification of  
activated carbon and coal was investigated. K<sub>2</sub>CO<sub>3</sub> is a  
good catalyst in both carbon samples but its activity  
was less than the activity observed for nickel in  
activated carbon. Unlike nickel, K<sub>2</sub>CO<sub>3</sub> is not  
deactivated by the sulphur content of the coal and can  
be recovered from the remaining ashes.

79V19461 1979 ISS: 00 TP759.064 1979 0-471055-75-1  
665.772 LC-79-10439

AUTH: A/Johnson, James Lee. A/1937-1977.

UTTL: Kinetics of coal gasification : TLSP: a compilation of  
research / by James Lee Johnson, 1937-1977.  
Wiley, New York :

"A Wiley-Interscience publication."

LC: Coal gasification. Chemical reaction. Rate of.

MAIN-AUTH TRACE-TITL\* CATLG BY-LC

/ /

79V10685 1979 ISS: 72 TN23.U43 7408

AUTH: A/Gronhovd, Gordon H.

UTTL: Slagging fixed-bed gasification of North Dakota  
lignite at pressures to 400 psig. by G. H. Gronhovd  
and others.

U. S. Dept. of the Interior. Washington, 40 p. illus.  
U. S. Bureau of Mines. Report of Investigations 7408

NASA: / COAL/ GASIFICATION/ NORTH DAKOTA

JSC: / TN23.U43 7408

MAIN-AUTH TRACE-SERS\*TITL\* CATLG BY-JOHNSON

79/02/27 AVAIL: / JOHNSON

CONVERTING COAL TO LIQUID/GASEOUS FUELS, J. T. Stewart  
and M.G. Klett

Mechanical Eng., v.101, no.6, June 1979, p.34

Coal converted to synthetic oil and gas will have to  
help take up the slack as world oil production  
inevitably levels off and falls. Here's a review of  
the current state of development of coal gasification  
and liquefaction processes and the outlook for the  
future.

Combined-cycle using gas from coal holds promise for  
electric generation.

Power. v. 123, no. 6, June 1979, p. 99-102.

In this day of high fossil-fuel costs and stricter  
environmental standards, integrated low-Btu-gas  
combined-cycle systems offer the potential for higher  
efficiencies while removing more pollutants than  
conventional coal-fired steam stations.

ELECTRICAL INDUCTION HEATING: A NEW APPROACH  
TO UNDERGROUND COAL GASIFICATION

S. T. Fisher

Energy Conversion, vol. 19, no. 2, 1979, pp. 77-84.

Abstract—Coal has a high eddy-current loss, and thus absorbs energy efficiently from an intense mag-  
netic field. This principle can be used to distill high-heat-value gas and tar from a coal deposit. Subse-  
quently, the residual char may be gasified by combustion heating. The overall process shows significant  
advantages over present methods of underground coal gasification by combustion. Available physical  
and chemical data and laboratory investigations indicate the technical and economic feasibility of  
the process.

THE ROUGH ROAD TO MAKING OIL AND GAS FROM COAL.  
Alexander Stuart.

Fortune, vol 100, no 6, September 24, 1979.  
p. 50-52, 57, 60, 62, 64

More actual production experience is needed to clear away uncertainties. Meanwhile, plant costs go up and up.

SIMULATION OF A MOVING BED GASIFIER FOR A WESTERN COLA. R. Stillman.

IBM Journal of research and Development, vol 23, no 3, May 1979, p. 240-252.

This paper describes an adiabatic steady state plug flow model for a moving bed cola gasifier with gas solid heat transfer. The model considers 17 solid stream components, 10 gas stream components and 17 reactions. The kinetic and thermodynamic parameters were derived for a Wyoming subbituminous coal.

TRANSIENT BEHAVIOR OF MOVING-BED COAL GASIFICATION REACTORS. H. Yoon, J. Wei and M.M. Denn.

AICHE Journal, vol 25, no 3, May 1979, p. 429-439.

The transient response of dry ash and slagging moving-bed coal gasification reactors is analyzed for small step changes in feed conditions. The approach to the new steady state for perturbations about the optimum in the Lurgi gasifier has a time scale of about 10 hr. Transients in the slagging gasifier can result in a decrease in the coal bed height, which occurs on a time scale of several hours. There is a rapid initial response in both types of reactors in product gas temperature and heating value.

ABO-12946 # Progress and development trends in coal gasification and liquefaction technologies - New gasification methods developed on a laboratory or large scale. G. Fumich. U.N. Economic Commission for Europe. Symposium on the Gasification and Liquefaction of Coal, Katowice, Poland, Apr. 23-27, 1979, Paper. 10 p.

New large-scale and laboratory coal gasification methods are examined. The three stages in gasifier developments, the Lurgi fixed bed reactor, the second generation reactor split into separate sections making it possible to optimize each section, and the third generation hydrolysis reactor which reacts the coal with pure hydrogen to produce only methane are described. The review of the evolution of gasifier and gasification process is made considering electrofluid reactors, fluidization, slagging, hydrogasification, and the flash hydrolysis catalytic method. Fluidization provides good gas-solids contacting, heat transfer, and uniform temperatures; slagging gasifiers are suitable for a wide range of products from synthesis gas to processing coal liquefaction residues; and flash hydrolysis gasifier features effective single-element injector scaling and a minimization of the H<sub>2</sub>/coal ratio. A.T.

Chemical Engineering Progress,  
v.75, no.6, p.33-40.

June  
1979

COAL PROCESSING TECHNOLOGY: THE TRI-GAS GASIFICATION PROCESS. M.A. Colaluca, M.A. Paisley and K. Mahajan.

ABO-12945 # Progress and development trends in coal gasification and liquefaction technologies. A. A. Krichko. U.N. Economic Commission for Europe, Symposium on the Gasification and Liquefaction of Coal, Katowice, Poland, Apr. 23-27, 1979, Paper. 42 p. Translation.

In the present paper, methods of converting coal into combustible gases are reviewed with particular reference to the Lurgi process, the Winkler process, and the Koppers-Totzek process. Thermodynamic analysis of the reactions which occur in the reduction zone indicates that by conducting the process of CO<sub>2</sub> and H<sub>2</sub>O reduction under equilibrium conditions, the gasification process can be considerably intensified and gas generator capacity can be drastically increased. The mechanisms and kinetics of the principal reactions between carbon and gases are examined. V.P.

ABO-12947 # Progress and development trends in coal gasification and liquefaction technologies - Recent achievements in conventional coal gasification processes. H. J. F. Stroud. U.N. Economic Commission for Europe, Symposium on the Gasification and Liquefaction of Coal, Katowice, Poland, Apr. 23-27, 1979, Paper. 18 p. 13 refs.

In the present report, some recent developments in the technology of coal gasification, using conventional processes, or a modern variant developed directly from them, are reviewed. Particular attention is given to fixed bed gasifiers, the Lurgi process, and to advances made in Czechoslovakia and India. V.P.

#### ECONOMICS OF GASOLINE FROM UNDERGROUND COAL GASIFICATION. M. S. Edwards.

Coal Processing Technology, vol 5, 1979, p. 219-225.

Conceptual process design and cost estimate for a facility producing about 50,000 barrels/day via methanol from synthesis gas from 20,000 daily tons of in-place sub-bituminous coal consumption.

ABO-14263# Institute of Gas Technology, Chicago, Ill.  
**HIGH-Btu COAL GASIFICATION PROCESSES**  
C. F. Blazek, N. R. Baker, and R. R. Tison Jan. 1979 82 p  
refs Prepared for Argonne National Lab.  
(Contract W-31-109-eng-38)

(ANL/CES/TE-79-2) Avail: NTIS HC A05/MF A01

Estimates of performance and cost data for advanced technology, high-Btu, coal gasification facilities are provided. The six processes discussed reflect the current state-of-the-art development. The information presented is based only on pilot-plant experience. Performance characteristics that were investigated include unit efficiencies, product output, and pollution aspects. Total installed plant costs and operating costs are tabulated for the various processes. The information supplied is expected to assist in selecting energy conversion units for an Integrated Community Energy System. DOE

ABO-12948 # Progress and development trends in coal gasification and liquefaction technologies - Underground coal gasification. P. Ledent. U.N. Economic Commission for Europe, Symposium on the Gasification and Liquefaction of Coal, Katowice, Poland, Apr. 23-27, 1979, Paper. 17 p. 26 refs. Translation.

Development trends in underground coal gasification are presented. Current methods being tested including the percolation method for horizontal deposits and drilling in steeply inclined seams are described, technical problems of lining between bore-holes, ground subsidence, and water intrusions are considered. Improved control of the advance of the gasification front by use of high pressure air and gasification of deep deposits by compressed air pressure are discussed, noting that operation at great depth has advantages of absence of air leakages and of not interfering with surface aquifers. Economic studies made in U.K., U.S., and Belgium are presented, concluding that this method may produce large amounts of energy at competitive prices and provide lean gas for power stations, synthesis gas for chemical plants, and replace natural gas in distribution networks. A.T.

ENTRAINMENT COAL GASIFICATION MODELING. C. Y. Wen and T. Z. Chaung.

Process Design and Development, vol 18, no 4, October 1979, p. 684-695.

TP  
328  
.P84

**Pulverized-coal combustion and gasification : theory and applications for continuous flow processes / edited by L. Douglas Smoot and David T. Pratt. -- New York : Plenum Press, c1979.**

xvii, 333 p. : ill. ; 24 cm.

Includes bibliographical references and index.

ISBN 0-306-40084-7

1. Coal, Pulverized. 2. Combustion engineering. 3. Coal gasification. I. Smoot, Leon Douglas. II. Pratt, David T.

662'.62

A79-45994 A survey of methods of coal hydrogenation for the production of liquids. J. M. Lytle, B. C. B. Hsieh, L. L. Anderson, and R. E. Wood (Utah, University, Salt Lake City, Utah). *Fuel Processing Technology*, vol. 2, July 1979, p. 235-251. 114 refs.

A79-45991 The effect of coal characteristics on the catalytic liquefaction of Utah coals. G. T. Garr, J. M. Lytle, and R. E. Wood (Utah, University, Salt Lake City, Utah). *Fuel Processing Technology*, vol. 2, July 1979, p. 179-188. 15 refs. Research supported by the Mineral Leasing Fund.

79A42898 ISSUE 18 PAGE 3476 CATEGORY 44  
78/00/00 6 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Analysis of conduction responses during an underground coal gasification experiment  
AUTH: A/HOMMERT, P. J. PAA: A/(Sandia Laboratories, Albuquerque, N. Mex.)  
In: International Heat Transfer Conference, 6th, Toronto, Canada, August 7-11, 1978. General Papers, Volume 2. (A79-42886 18-34) Washington, D.C., Hemisphere Publishing Corp., 1978, p. 153-158. ERDA-supported research.  
MAJS: /\*COAL GASIFICATION/\*CONDUCTIVE HEAT TRANSFER/\*LEAST SQUARES METHOD  
MINS: / ENERGY TECHNOLOGY/ SENSITIVITY/ THERMAL CONDUCTIVITY / THERMOCOUPLES  
ABA: S.D.  
ABS: An extensive thermocouple array was fielded in the underground coal gasification experiment in the 9-m thick subbituminous coal seam near Hanna, Wyo. The instrumentation provided thermal data on the process during both reverse combustion linkage and forward gasification. A nonlinear least squares inverse heat conduction analysis was carried out. The results allowed the position of the reverse combustion linkage path to be mapped, and estimates of its size and average temperature to be obtained. For forward gasification, the analysis yielded estimates of the final boundaries established by the burn and characterizations of how the front approached its final position.

78A25323 ISSUE 9 PAGE 1525 CATEGORY 23  
78/01/00 7 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Mathematical model for the gasification of coal under pressure  
AUTH: A/BIBA, V.; B/MACAK, J.; C/KLOSE, E.; D/MALECHA, J. PAA: D/(Vysoka Skola Chemickotechnologicka; Vedecko-Vyzkumni Ustav Faliv, Prague, Czechoslovakia; Freiberg, Bergakademie, Freiberg, East Germany; I & EC - Industrial and Engineering Chemistry, Process Design and Development, vol. 17, Jan. 1978, p. 92-98.  
MAJS: /\*CLEAN ENERGY/\*COAL GASIFICATION/\*HIGH PRESSURE/\* MATHEMATICAL MODELS  
MINS: / CHEMICAL REACTIONS/ DRYING/ ENERGY TECHNOLOGY/ OXIDATION/ REACTION KINETICS/ REDUCTION (CHEMISTRY)  
ABA: (Author)  
ABS: The detailed mathematical description of technological processes is a decisive prerequisite for an optimal operation and design of the respective plants. In line with this objective a mathematical model for the high-pressure gasification of solid fuels in the charged layer is presented which permits the quantitative description of the static behavior of the generator. With due consideration of the partial processes taking place in the high-pressure gasifier, the paper deals with the parameters of reaction kinetics and of the transfer of matter and energy which are necessary for developing the model of a fixed-bed reactor. To obtain a practicable model, simplifications are needed which concern the gasification, degasification, and drying processes. They are dealt with individually. For calculating the concentration and temperature profiles for the solid and gas phases along the gasification bed height, a system of differential equations was obtained which was supplemented by some algebraic equations. The modified Euler method was used for the solution. The algorithm for the solution of the system was programmed in FORTRAN. A Tesla 200 computer was used for calculations.

79A1005B ISSUE 1 PAGE 107 CATEGORY 44 78/00/00  
9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Process development for the Westinghouse advanced fluidized-bed coal gasification system

AUTH: A/SALVADOR, L. A.; B/CHERISH, P.; C/MARGARITIS, P. J.; D/RATH, L. K. PAA: D/(Westinghouse Electric Corp., Advanced Coal Conversion Dept., Madison, Pa.)  
In: Intersociety Energy Conversion Engineering Conference, 13th, San Diego, Calif., August 20-25, 1978, Proceedings, Volume 1. (A79-10001 01-44)  
Warrendale, Pa., Society of Automotive Engineers, Inc., 1978, p. 422-430.

MAJS: /\*COAL GASIFICATION/\*ENERGY TECHNOLOGY/\*FLUIDIZED BED PROCESSORS

MINS: / CHEMICAL REACTORS/ CONTROLLABILITY/ ELECTRIC POWER SUPPLIES/ PERFORMANCE TESTS/ PRODUCTION ENGINEERING/ REACTOR DESIGN/ RELIABILITY ANALYSIS

ABA: (Author)

ABS: Westinghouse Electric Corporation has developed an advanced fluidized bed coal gasification process for low-Btu gas. The major emphasis on the program has been the operation of the 14,000 kg/d (15 t/d) process development unit (PDU) which contains the main subsystems of the gasification process, the devolatilizer, which decakes and devolatilizes the coal, and the gasifier, which consumes the char produced in the devolatilizer and agglomerates the ash. The feasibility of the devolatilizer was demonstrated in 1976 with a variety of coals including highly caking eastern bituminous coals. During 1977 and 1978, the feasibility of the gasifier reactor was demonstrated in a series of highly successful tests run for a cumulative time of 1500 hours at design conditions of nominally 1038 C (1900 F) and 1550 kPa (225 psig). Techniques for routine operation of the reactor were established, and stable, controlled combustion, gasification, and agglomeration were achieved with a number of char and coal feedstocks fed directly to the unit without devolatilization or pretreatment.

79A3408B ISSUE 13 PAGE 233B CATEGORY 23  
78/00/00 20 PAGES UNCLASSIFIED DOCUMENT

UTTL: Chemical solutions to problems encountered in the gasification of coal

AUTH: A/KITTLE, P. A.; B/BENNETT, R. P. PAA: B/(Apollo Chemical Corp., Whippany, N.J.)  
In: Alternative energy sources; Proceedings of the Miami International Conference, Miami Beach, Fla., December 5-7, 1977, Volume 7. (A79-34086 13-44)  
Washington, D.C., Hemisphere Publishing Corp., 1978, p. 3001-3020.

MAJS: /\*CHEMICAL ENGINEERING/\*COAL GASIFICATION/\*COMBUSTION PRODUCTS/\*ENERGY CONVERSION EFFICIENCY/\*SLAGS

MINS: / ASHES/ CARBON/ CATALYSIS/ CHEMICAL PROPERTIES/ ECONOMIC ANALYSIS/ ENERGY TECHNOLOGY/ FOULING/ FUSION (MELTING)/ MELTING POINTS

ABA: (Author)

ABS: Two main problems have been encountered in pilot plant and actual operating coal gasifiers. These are the production of carbon-containing char residues and difficulties encountered in the buildup and removal of slag on and from the gasifier vessel. These problems can be solved with chemical technology. The prime reason for slag buildup and removal problems is the production of coal ash with fusion point properties

Inconsistent with gasifier design operating conditions. Application of a slag modifier to produce an ash with the desired melting point range will greatly alleviate the slag-handling and maintenance problems experienced in many units. The production of carbon-containing residues represents a loss of usable product production. A combustion catalyst can be applied to reduce the amount of residual carbon, thereby improving coal conversion efficiency and, hence, plant output.

78V35553 1978 ISS: 00 TP156.F65F575 662.6622 LC-78-8963

AUTH: A/Wen, Chin-Yung, A/1928-

UTTL: Fluidization : TLSP: application to coal conversion processes / C. Y. Wen, editor.  
American Institute of Chemical Engineers, New York : vi, 242 p. : ill. : 28 cm.

AICHE symposium series : v. 74, no. 176

LC: Fluidization -- Congresses, Coal gasification -- Congresses.

ADDED: American Institute of Chemical Engineers, American Institute of Chemical Engineers, AIChE symposium series : v. 74, no. 176.

NASA: / COAL GASIFICATION/ CONFERENCES/ FLUIDICS

JPL: / TP156.F65F64B

MAIN-AUTH TRACE-SERS\*CORP\*AUTH\* CATLG BY-LC

/ / AVAIL: / JPL

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79A10063 ISSUE 1 PAGE 108 CATEGORY 44 CNT#:  
DFG-A1-104/6 78/0C/00 7 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Theoretical studies of coal pyrolysis in an entrained bed flow reactor

AUTH: A/REIDELBACH, H.; B/ALGERMISSEN, J. PAA:  
B/(Stuttgart, Universitaet, Stuttgart, West Germany)  
In: Intersociety Energy Conversion Engineering  
Conference, 13th, San Diego, Calif., August 20-25,  
1978, Proceedings, Volume 1. (A79-10001 01-44)  
Warrendale, Pa., Society of Automotive Engineers,  
Inc., 1978, p. 469-475. Deutsche  
Forschungsgemeinschaft  
MAJS: /\*COAL GASIFICATION/\*FLUIDIZED BED PROCESSORS/\*

PYROLYSIS  
MINS: / ENERGY TECHNOLOGY/ FREE CONVECTION/ HEAT TRANSFER/  
MASS FLOW RATE/ PARTICLE SIZE DISTRIBUTION/ THERMAL  
RADIATION/ WALL TEMPERATURE

ABA: (Author)

ABS: The theoretical investigation of the devolatilization of coal in an entrained-bed flow reactor included the simulation of the heat transfer processes (thermal convection and radiation) and the simulation of the chemical decomposition reactions using a simplified kinetic scheme describing the primary pyrolysis reactions. Three important thermodynamic parameters were identified: reactor wall temperature, preheat temperature of the carrier gas, and mass flow ratio coal-to-gas. The particle size is very important for the heating process. The influence of the particle size distribution of pulverized coal and possible advantages of using size graded coals are discussed. Preliminary results indicating the influence of radiation and the effects of the addition of a solid heat carrier on the pyrolysis process are presented. This approach toward theoretical optimization studies shows promising results in spite of the rather simple physical models used.

**N79-28737# Sulzer Bros. Ltd. Winterthur (Switzerland)  
THE GAS TURBINE/STEAM TURBINE CYCLE WITH COAL  
GASIFICATION**

A. Steiner /In Von Karman Inst. for Fluid Dyn. Combined Cycles

for Power Generation, Vol. 1 1978 43 p refs (For primary document see N79-28732 19-44)

Avail: NTIS HC A14/MF A01

Available processes for solid fuel gasification and subsequent gas desulfuration are described as they are especially suitable GT/ST cycles. Economic arguments and environmental protection regulations are discussed. Coal gasification is analyzed both as fixed bed generators and fluid bed generators. Purification alternatives such as physical washing, chemical washing, physical-chemical washing and absorption are described. A 170 MW coal gasification combined power plant located at Luner, Germany, is described as an example. A Westinghouse combined cycle plant with 'U-gas' fluidized-bed gasification is also discussed. Author (ESA)

79N11498# ISSUE 2 PAGE 202 CATEGORY 44 RPT#:  
EPRI-AF-753 78/04/00 126 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Economics of Texaco gasification: Combined cycle systems. Economic studies of coal gasification combined cycle systems for electric power generation

AUTH: A/MCELMURRY, B.; B/SMELSER, S.  
CORP: Fluor Engineers and Constructors, Inc., Irvine, Calif.  
AVAIL:NTIS SAP: HC A07/MF A01

MAJS: /\*COAL GASIFICATION/\*ECONOMIC ANALYSIS/\*ELECTRIC  
GENERATORS/\*ENERGY TECHNOLOGY

MINS: / AIR/ COAL UTILIZATION/ COST ESTIMATES/ ENERGY  
CONSERVATION/ OXYGEN/ UTILITIES

ABA: DOE

ABS: Air blown coal gasification coupled with combined cycle power generation was investigated to determine whether an air blown gasifier had economic incentives greater than oxygen blown gasification. Gasification processes were integrated with combined cycle plants based on advanced gas turbine technology (2,400 F combustion outlet) estimated to be available in the 1981-1985 time period. The evaluations were based on complete grass-roots facilities sized to conform to the present electric utility practice of building units of approximately 1,000 MW capacity. Results show that the process with air blown gasification is economically equivalent to oxygen blow gasification. Also, development emphasis should be placed on power generation, rotating machinery, heat transfer equipment, and further gasification pilot plant experiments to maximize the overall thermal efficiency of air blown gasification. Both processes have the potential for commercialization in the mid to late 1980's.

79V33746 1978 ISS: 00 TP759.U54 1978 665.7 LC-  
79-601236

UTTL: National gas survey : TLSP: report to the Federal Energy Regulatory Commission / by the Technical Advisory Task Force on Synthesized Gaseous Hydrocarbon Fuels.

United States. Technical Advisory Task Force on Synthesized Gaseous Hydrocarbon Fuels.

U.S. Dept. of Energy, Federal Energy Regulatory Commission : for sale by the Supt. of Docs., U.S. Govt. Print. Off., Washington : xiv, 291 p. : ill. : 27 cm.

"DOE-FERC-008. Uc-13." Includes bibliographical references.

LC: Synthesis gas. Coal gasification. Oil gasification.

ADDED: United States. Federal Energy Regulatory Commission.

MAIN-CORP TRACE-CORP\*TI TL\* CATLG BY-LC

79A10246 ISSUE 1 PAGE 44 CATEGORY 23 CNT#: E(49-18)-2369 78/00/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Catalytic gasification predevelopment research  
AUTH: A/NAHAS, N. C.; B/GALLAGHER, J. E., JR. PAA: B/(Exxon Research and Engineering Co., Florham Park, N.J.)

In: Intersociety Energy Conversion Engineering Conference, 13th, San Diego, Calif., August 20-25, 1978, Proceedings, Volume 3. (A79-10001 01-44) Warrendale, Pa., Society of Automotive Engineers, Inc., 1978, p. 2143-2147.

MAJS: /\*CATALYSIS/\*COAL GASIFICATION/\*POTASSIUM/\*REACTION KINETICS

MINS: / DATA CORRELATION/ ENERGY TECHNOLOGY/ HIGH TEMPERATURE/ IGNEOUS ROCKS/ MATERIALS RECOVERY

ABA: (Author)

ABS: Significant progress has been made in the predevelopment research phase of catalytic coal gasification for the production of substitute natural gas (SNG). The potassium catalyst and the processing sequence permit the direct reaction of steam and coal to form methane and carbon dioxide, a reaction which is thermally neutral and does not require oxygen for heat balance or downstream methanation of synthesis gas. A model of the reaction kinetics has been developed and a preferred approach has been identified to recover about 90 percent of the potassium catalyst for reuse.

A79-46321 A steam process for coal gasification. S. L. Soo and R. T. Gibbs (Illinois, University, Urbana, Ill.). (University of Illinois and U.S. Department of Energy, Midwest Energy Conference, Chicago, Ill., Nov. 19-21, 1978). *Energy* (UK), vol. 4, Apr. 1979, p. 357-364, 14 refs. Research supported by Pullman Kellogg.

The paper studies a gasification process which uses steam as a reactant as well as a heat source to generate hydrogen, carbon monoxide, and methane by using carbon in coal as a reducing agent. It is shown that economical operation can be maintained by using a large excess in steam at 1300 C level (more than 4 mole of H<sub>2</sub>O to 1 mole C). The steam is produced by burning a fraction of the product gas in a pebble-heater system. A high percentage of H<sub>2</sub> can be produced in the product gas without the need for shift conversion. Other components are CO, CH<sub>4</sub>, with CO<sub>2</sub> and H<sub>2</sub>S removed by absorption; with excess H<sub>2</sub>O removed by condensation, of varying percentages dependent on reactor temperature and pressure. Charcoal and Illinois No. 6 coal were gasified in the experimental facility at pressures up to 10 atm. It is noted that a steam temperature of 1300 C or higher can be achieved via a pebble bed heater with cored bricks or a silicon carbide tubular heat exchanger. (Author)

79A33380# ISSUE 13 PAGE 2342 CATEGORY 25 CNT#: EF-77-C-01-2519 78/00/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Mechanistic modeling of pulverized coal combustion ... in MHD generators

AUTH: A/STICKLER, D. B.; B/UBHAYAKAR, S. K. PAA: B/(Avco Everett Research Laboratory, Inc., Everett, Mass.)

In: Symposium on the Engineering Aspects of Magneto-hydrodynamics, 17th, Stanford, Calif., March 27-29, 1978, Proceedings. (A79-33379 13-31) Stanford, Calif., Stanford University, 1978, p. A.1.1-A.1.7.

MAJS: /\*COAL GASIFICATION/\*COMBUSTION CHAMBERS/\*FUEL COMBUSTION/\*MAGNETOHYDRODYNAMIC GENERATORS/\* MATHEMATICAL MODELS

MINS: / CARBON DIOXIDE/ CARBON MONOXIDE/ GAS DYNAMICS/ GAS TEMPERATURE/ HEAT OF COMBUSTION/ OXIDIZERS/ PARTICLE SIZE DISTRIBUTION/ PERFORMANCE PREDICTION/ STOICHIOMETRY

ABA: B.J.

ABS: An analytical model developed to simulate an MHD coal combustor is presented which highlights the various physicochemical mechanisms of importance in this particular type of combustion process. The model, which breaks down into three major conceptual blocks (fluid dynamics, particle processes, and gas

chemistry), is compared with experimental data from recent combustor tests. The versatility of the model in predicting behavior under different conditions is exemplified by a parametric study involving air preheat temperature, vitiated air temperature, size vs. burnout, etc.

79A34156 ISSUE 13 PAGE 2427 CATEGORY 44 78/00/00 21 PAGES UNCLASSIFIED DOCUMENT

UTTL: A coal gasification-gas cleaning pilot plant at North Carolina State University

AUTH: A/FERRILL, J. K.; B/FELDER, R. M.; C/ROUSSEAU, R. W.; D/ALEXANDER, D. W. PAA: D/(North Carolina State University, Raleigh, N.C.)

In: Alternative energy sources; Proceedings of the Miami International Conference, Miami Beach, Fla., December 5-7, 1977, Volume 9. (A79-34131 13-44) Washington, D.C., Hemisphere Publishing Corp., 1978, p. 4395-4415.

MAJS: /\*CLEAN ENERGY/\*COAL GASIFICATION/\*PILOT PLANTS/\* UNIVERSITY PROGRAM

MINS: / ENERGY TECHNOLOGY/ SYSTEMS ANALYSIS

79A34089 ISSUE 13 PAGE 2421 CATEGORY 44  
78/00/00 35 PAGES UNCLASSIFIED DOCUMENT

UTTL: The Synthane process - A technical and economic assessment --- of coal gasification

AUTH: A/WEISS, A. J.; B/LUMMUS, C. E.  
In: Alternative energy sources; Proceedings of the Miami International Conference, Miami Beach, Fla., December 5-7, 1977. Volume 7 (A79-34086 13-44) Washington, D.C., Hemisphere Publishing Corp., 1978. p. 3021-3055.

MAJS: /\*COAL GASIFICATION/\*ECONOMIC ANALYSIS/\*ENERGY TECHNOLOGY/\*PILOT PLANTS/\*SYNTANE

MINS: / BITUMENS/ ENVIRONMENT EFFECTS/ FEASIBILITY ANALYSIS/ GAS COOLING/ OXYGEN/ PIPELINES/ TECHNOLOGICAL FORECASTING

ABA: B. J.

ABS: The Synthane coal gasification process for the production of pipeline quality gas is evaluated. The evaluation is based on data obtained from the Synthane pilot plant at Bruceton, Pennsylvania during operations conducted in February and August, 1977. The operation was carried out with Montana Rosebud coal at a pressure of 600 psig and a bed temperature of 1500 F. The data were used as a basis for the conceptual design of a commercial coal gasification plant with a capacity of 250 x 10 to the 9th Btu/day of pipeline quality gas.

79A26466 ISSUE 9 PAGE 1617 CATEGORY 44  
78/10/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Coal gasification studies. I - Single stage complete gasification of coal using water as the hydrogen source

AUTH: A/BUTLER, R.; B/SNELSON, A. FAA: B/(IIT Research Institute, Chicago, Ill.)  
Fuel Processing Technology, vol. 1, Oct. 1978, p. 297-304. Research supported by the Consolidated

Natural Gas Service Co.

MAJS: /\*CATALYSIS/\*COAL GASIFICATION/\*HYDROCARBON FUEL PRODUCTION/\*PROCESS CONTROL (INDUSTRY)/\*WATER

MINS: / ENERGY CONVERSION EFFICIENCY/ ENERGY TECHNOLOGY/ HYDROGENATION/ IODIDES/ IRON COMPOUNDS

ABA: (Author)

ABS: The complete gasification of coal to low molecular weight hydrocarbons has been achieved in a single stage process using water as the source of hydrogen. Reaction times of one hour, and a temperature of 500 C were required. The reactions were carried out in a stainless steel reactor with iodine or FeI2 as a catalyst. It is shown that FeI2 is a catalyst for the reaction stainless steel + H2O yields H2 + metal oxide and also for the coal hydrogenation reaction. The apparent excellent reduction efficiency is probably a consequence of the good contact between the coal sample and the catalyst, which at the reaction temperature has a significant vapor pressure.

79A15904 ISSUE 4 PAGE 646 CATEGORY 44 78/00/00  
18 PAGES UNCLASSIFIED DOCUMENT

UTTL: Incentives and requirements for gasification based power systems

AUTH: A/HOLT, N. A. PAA: A/(Electric Power Research Institute, Palo Alto, Calif.)  
In: Energy technology V: Challenges to technology: Proceedings of the Fifth Conference, Washington, D.C., February 27-March 1, 1978. (A79-15879 04-44) Washington, D.C., Government Institutes, Inc., 1978. p. 588-605.

MAJS: /\*COAL GASIFICATION/\*COST INCENTIVES/\*ELECTRIC POWER PLANTS/\*ENERGY CONVERSION EFFICIENCY/\*SYSTEM EFFECTIVENESS

MINS: / AIR POLLUTION/ CLEAN ENERGY/ COST EFFECTIVENESS/ ECONOMIC ANALYSIS/ ENERGY TECHNOLOGY/ EXHAUST GASES/ FUEL CELLS/ PILOT PLANTS/ THERMODYNAMIC CYCLES

ABA: V. P.

ABS: The main incentives for the use of gasification based power systems over other coal based generating systems such as direct coal firing with stack gas scrubbing are markedly reduced emissions, better resource utilization, competitive capital cost, and cost of power. The present analysis leads to the conclusion that the integrated gasification fuel cell combined cycle is superior to other gasification based power systems. Its principal advantages are: attractive economics and resource utilization, high potential for future improvement, and advanced status of the subsystem technology.

79N29374# ISSUE 20 PAGE 2661 CATEGORY 28 RPT#:  
UCRL-13968 CNT#: W-7405-ENG-48 78/00/00 223 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Triaxial tests of coal gasification samples TLSP. Final Report

AUTH: A/BRANDT, H.  
CORP: California Univ., Davis. CSS: (Dept. of Mechanical Engineering.) AVAIL. NTIS SAP: HC A10/MF A01

MAJS: /\*COAL GASIFICATION/\*CORE SAMPLING/\*TRIAxIAL STRESSES  
MINS: / APPLICATIONS OF MATHEMATICS/ COMPRESSION TESTS/ STRESS ANALYSIS/ WYOMING

ABA: DOE

ABS: Samples were obtained from core borings at Hoe Creek In-Situ coal gasification site at Campbell County, Wyoming. A total of forty-five triaxial tests were made in which overburden and interstitial pressures were kept constant. Data analysis such as geological grouping of the samples, determination of mathematical functions for stress and strain and development of failure envelopes was also performed.

79N32394# ISSUE 23 PAGE 3071 CATEGORY 28 RPT#:  
BMFT-FB-1-78-29 CNT#: BMFT-03E-1399-A/ETS-0004-1  
78/12/00 93 PAGES In GERMAN; ENGLISH summary  
UNCLASSIFIED DOCUMENT DCAF E002631

UTTL: Research and development concerning steam gasification  
of coal: Report on the concept of a prototype plant  
using nuclear processing heat TLSP: Final Report

AUTH: A/VANHEEK, K. H.

CORP: Bergbau-Forschung G.m.b.H., Essen (West Germany).  
CSS: (Abt. Physikalische Chemie.) AVAIL.NTIS SAP:  
HC A05/MF A01; Fachinformationszentrum;

MAJS: /\*COAL GASIFICATION/\*GAS GENERATORS/\*NUCLEAR HEAT/\*  
STEAM/\*WASTE ENERGY UTILIZATION

MINS: / COAL LIQUEFACTION/ CONVECTIVE HEAT TRANSFER/  
FLUIDIZED BED PROCESSORS/ HEAT RESISTANT ALLOYS/  
HELIUM/ TUBE HEAT EXCHANGERS

ABA: Author (ESA)

ABS: The development of a coal gasification process using a  
high temperature nuclear reactor to meet the energy  
requirements of the process is described. A key point  
in the development is the gas generator in which the  
nuclear heat is transferred into a fluidized bed of  
coal and steam via an intermediate loop and a heat  
exchanger immersed in the bed. On the basis of former  
results concerning reaction kinetics and heat  
transfer, further experiments with different devices  
were performed and the program for the testing and the  
development of new alloys to be used was continued. A  
pilot plant (0.2 T/hr) using an electrically heated  
helium loop was constructed and is now in operation.  
The data gathered confirm the feasibility of the gas  
generator as well as the process and are being used  
for the design of bigger plants.

79N27619# ISSUE 18 PAGE 2426 CATEGORY 28  
78/08/15 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Methanol from coal

AUTH: A/MILLER, D. R.

CORP: Vulcan-Cincinnati, Inc., Ohio. AVAIL.NTIS SAP: HC  
A23/MF A01

In JPL Proc. of the Conf. on Coal Use for California  
p 273-277 (SEE N79-27597 18-42)

MAJS: /\*CATALYSIS/\*COAL GASIFICATION/\*ENERGY CONVERSION/\*  
METHYL ALCOHOLS/\*SYNTHETIC FUELS

MINS: / CALIFORNIA/ COAL UTILIZATION/ ENERGY POLICY/ ENERGY  
TECHNOLOGY/ ENVIRONMENT PROTECTION

ABA: J.M.S.

ABS: Economic feasibility of methanol or methyl fuel  
produced from coal using existing technology is  
discussed. Other factors considered include  
environmental, safety, toxicity, transportation, so  
storage, ease of burning, and retrofitting of present  
boilers. Demonstrations of its uses as a boiler fuel  
and as a turbine fuel are cited.

79N31383# ISSUE 22 PAGE 2930 CATEGORY 26 RPT#:  
SAND-78-8277 CNT#: EY-76-C-04-0789 78/09/30 100  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Formation of protective layers on alloys developed for  
use in coal gasification environments TLSP: Final  
Report

AUTH: A/BRADSHAW, R. W.; B/STOLTZ, R. E.; C/ADOLPHSON, D.  
R.

CORP: Sandia Labs., Livermore, Calif. AVAIL.NTIS SAP:  
HC A05/MF A01

MAJS: /\*COAL GASIFICATION/\*IRON ALLOYS/\*NICKEL ALLOYS/\*  
PROTECTIVE COATINGS

MINS: / CHROMIUM/ CORROSION RESISTANCE/ HIGH TEMPERATURE  
ENVIRONMENTS/ STAINLESS STEELS/ TITANIUM

ABA: DOE

ABS: Improvement in high temperature compatibility of iron  
and nickel based alloys in coal gasification  
environments was investigated. The addition of a few  
weight percent titanium to 310 stainless steel and  
Ni-30Cr was very effective in both isothermal and  
cyclic high temperature atmospheres which simulated  
the corrosion potential existing in the 1800 F high  
Btu coal gasification process. Alloy fabrication  
practices were unaffected and standard welding  
processes did not alter mechanical behavior or  
compatibility. Further work on 310 revealed that the  
as-received mechanical properties were unaffected by  
the Ti additions; that the normal levels of impurities  
and minimum specification level of chromium did not  
alter the beneficial effects of Ti; and that the  
mechanism by which Ti improves compatibility is linked  
to microstructural or chemical changes in the surface

CR203 coating.

79N29373# ISSUE 20 PAGE 2661 CATEGORY 28 RPT#:  
LETC/BL-71316-1 78/10/00 137 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Bibliography of subsidence and related topics for in  
situ coal gasification

AUTH: A/MCKEE, C. R.; B/SERAFINI, A.

CORP: Insitu Consulting, Laramie, Wyo. AVAIL.NTIS SAP:  
HC A07/MF A01

MAJS: /\*BIBLIOGRAPHIES/\*COAL GASIFICATION/\*FRACTURES  
(MATERIALS)/\*HYDROLOGY/\*SUBSIDENCE

MINS: / COMPUTERIZED SIMULATION/ CORES/ FRACTURE MECHANICS/  
FRACTURE STRENGTH/ MATHEMATICAL MODELS

ABA: D.O.E.

ABS: The topics included are subsidence, subsidence models,  
material properties and in situ measurements, and  
hydrology of fractured media. Each topic is indexed by  
year and then alphabetically by author within each  
year. Abstracts of each article are included when  
available.

79N32393# ISSUE 23 PAGE 3071 CATEGORY 28 RPT#:  
BMFT-FB-T-78-25 CNT#: BMFT-PL-ET-1399-C 78/11/00  
120 PAGES In GERMAN: ENGLISH summary UNCLASSIFIED  
DOCUMENT DCAF E002631

UTTL: Research and development work for hydrogasification of coal with nuclear processing heat done in the framework of the prototype nuclear processing heater project TLSP: Final Report

AUTH: A/SCHRADER, L.

CORP: Rheinische Braunkohlenwerke A.G., Cologne (West Germany). CSS: (Abt. Forschung und Entwicklung.)  
AVAIL.NTIS SAP: HC A06/MF A01:  
Fachinformationszentrum, Eggenstein-Leopoldshafen,  
West Germany DM 25.20

MAJS: Bonn Bundesmin. fuer Forsch. u. Technol.  
/\*COAL GASIFICATION/\*ENERGY POLICY/\*GAS GENERATORS/\*  
NUCLEAR HEAT/\*WASTE ENERGY UTILIZATION

MINS: / CARBON MONOXIDE/ COAL LIQUEFACTION/ FLUIDIZED BED  
PROCESSORS/ HYDROGEN/ STEAM/ SYNTHANE

ABA: Author (ESA)

ABS: A technique for coal gasification using nuclear processing heat was developed, then studied following the construction of a pilot plant for hydrogasification in a fluidized bed with an input of 100 kg coal/hr. This process for the production of synthetic natural gas or carbon monoxide and hydrogen gas containing mixtures is shown to have the advantages of saving fired coal, improving efficiency, reducing emissions, and stabilizing energy costs. The design, construction, and operation of the pilot plant are described. Components have been proven for the hydrogasification of brown coal and rock coal. Results demonstrate the suitability of this unit as a part of a large scale gasification plant.

79A10077 ISSUE 1 PAGE 109 CATEGORY 44 CNT#:  
EX-76-C-01-2336 78/00/00 6 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Low-Btu gas from the IGT ash-agglomeration gasification process

AUTH: A/REHMAT, A.; B/VORA, M. K.; C/SANDSTROM, W. A.  
PAA: C/(Institute of Gas Technology, Chicago, Ill.)  
In: Intersociety Energy Conversion Engineering Conference, 13th, San Diego, Calif., August 20-25, 1978, Proceedings, Volume 1. (A79-10001 01-44)  
Warrendale, Pa., Society of Automotive Engineers, Inc., 1978, p. 622-627.

ABA: B.J.

ABS: The Institute of Gas Technology (IGT) currently operates a single-stage fluidized-bed gasification pilot plant which produces low-Btu gas. A prime objective has been to achieve up to 95% carbon conversion through selective removal of high-ash-bearing material. This paper presents ash-agglomeration test results which show conclusively that raw subbituminous and bituminous coals can be successfully gasified to produce low-Btu gas. The process can achieve 90% carbon conversions.

79A34094 ISSUE 13 PAGE 2421 CATEGORY 44  
78/00/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: An evaluation of integrated coal gasification/water-splitting processes

AUTH: A/FOH, S. E.; B/GAHIMER, J. S. PAA: B/(Institute of Gas Technology, Chicago, Ill.)  
In: Alternative energy sources: Proceedings of the Miami International Conference, Miami Beach, Fla., December 5-7, 1977, Volume 7. (A79-34086 13-44)  
Washington, D.C., Hemisphere Publishing Corp., 1978, p. 3133-3144.

MAJS: /\*COAL GASIFICATION/\*ECONOMIC ANALYSIS/\*ENERGY  
CONVERSION EFFICIENCY/\*FEASIBILITY ANALYSIS/\*  
HYDROLYSIS/\*SYSTEMS ENGINEERING

MINS: / DESIGN ANALYSIS/ ELECTROLYSIS/ ENERGY TECHNOLOGY/  
HYDROGEN PRODUCTION/ WATER TREATMENT

ABA: (Author)

ABS: Conceptual designs for combining an electrolytic water-splitting process with two coal gasification processes are presented, and relevant techno-economic parameters are calculated and compared. Analysis indicates that integrated coal gasification plus water electrolysis can produce a completely gaseous product at prices comparable to the cost of fuel products from the gasification process alone. The prices are close enough that several variable factors in the conceptual designs and marketing assumptions could determine the relative advantage of a given process for a specific application.

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OF POOR QUALITY

78N30367# ISSUE 21 PAGE 2792 CATEGORY 37  
78/02/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Development of a compact gas generator for fuel  
gasification aboard a motor vehicle

AUTH: A/MICHEL, A.

CORP: Siemens A.G., Erlangen (West Germany). CSS: (Research Labs.)  
AVAIL.NTIS SAP: HC A23/MF A01  
In NATO Proc. of the 4th Intern. Symp. on Automotive  
Propulsion Systems, Vol. 1 p 488-501 (SEE N78-30332  
21-31)

MAJS: /\*CONFERENCES/\*GAS GENERATORS/\*GASIFICATION/\*MOTOR  
VEHICLES

MINS: / CATALYTIC ACTIVITY/ COST ANALYSIS/ FUEL-AIR RATIO/  
HYDROCARBON FUELS/ OXIDATION

ABA: G.Y.

ABS: The use of gaseous fuels in internal combustion  
engines represents a suitable means to reduce the  
specific pollutant emission and the specific fuel  
consumption when compared with conventional carburetor  
operations. Gas engines can be operated far into the  
lean region due to the homogeneous miscibility of fuel  
gas cylinders. This gives rise to supply problems and  
makes it difficult to apply this technique to motor  
vehicles. It is more favorable to generate the low  
molecular fuel gas from easily storable liquid  
hydrocarbons within a gas generator aboard the motor  
vehicle. Requirements for a gas generator are  
presented. The requirements may be realized through  
the catalytic partial oxidation of hydrocarbons with  
air at low air/fuel (A/F) mass ratios. A suitable  
catalytic process, operating with an A/F ratio of 0.7  
to 1.7 at about 820 C was developed.

78N29275# ISSUE 20 PAGE 2649 CATEGORY 28 RPT#:  
PB-279641/5 EPA-600/7-78-061 CNT#: EPA-68-02-2147  
EPA-68-02-2149 78/03/00 95 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Low- and medium-Btu gasification systems: Technology  
overview TLSP: Final Task Report, Sep. 1977 - Jan.  
1978

AUTH: A/SPAITE, P. W.; B/PAGE, G. C.

CORP: Radian Corp., Austin, Tex.; Spalte (Paul W.) Co.,  
Cincinnati, Ohio. AVAIL.NTIS SAP: HC A05/MF A01  
Prepared in cooperation with Spalte (Paul W.) Co.,  
Cincinnati)

ABA: GRA

ABS: Systems or combinations of processes are described  
which are likely to be used for production of low- and

medium-Btu gas from coal. This involved making  
judgements as to types of coals that would be  
processed, types of gasifiers (and auxiliary  
processes) which would be employed, and markets which  
would develop for gas from coal. Three main sections  
are discussed: (1) status of technology gives a  
relatively broad definition of future prospects for  
coal gasification; (2) description of technology gives  
more specific information on processes that are likely  
to be used commercially; and (3) environmental impacts  
discusses the kinds of pollutant discharges that must  
be anticipated.

79N11238# ISSUE 2 PAGE 167 CATEGORY 28 RPT#:  
EPRI-AF-782 CNT#: EPRI PROJ. 239 78/05/00 100  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Economics of fuel gas from coal: An update including  
the British Gas Corporation's slagging gasifier  
TLSP: Final Report

AUTH: A/CHANDRA, K.; B/MCELMURRY, B.; C/SMELSER, S.

CORP: Fluor Engineers and Constructors, Inc., Irvine, Calif.  
AVAIL.NTIS SAP: HC A05/MF A01

MAJS: /\*COAL GASIFICATION/\*ECONOMIC FACTORS/\*ENERGY  
CONVERSION EFFICIENCY/\*FLUIDIZED BED PROCESSORS

MINS: / COMMERCIAL ENERGY/ ECONOMIC ANALYSIS/ FOSSIL FUELS/  
POWER PLANTS

ABA: DOE

ABS: The results of an economic screening study for oxygen  
blown, slagging, coal gasification process to produce  
intermediate Btu fuel gas are presented. All of the  
processes investigated produce fuel gas which could be  
used in fossil fired power plants. The evaluation was  
based on a complete grass roots facility sized to  
conform to electric utility practice of building units  
of approximately 1000 MW capacity. The conclusion  
reached is that, within the accuracy of the study,  
fuel gas costs projected for the moving bed process,  
using the BGC slagging gasifier, are competitive with  
costs projected based on fluidized bed and entrained  
processes. The major assumption underlying the  
conclusion is that the BGC slagging gasifier operates  
successfully on a commercial scale in exactly the same  
manner as is represented by the performance estimates  
used.

79N16345 ISSUE 7 PAGE 869 CATEGORY 44 78/00/00  
182 PAGES UNCLASSIFIED DOCUMENT

UTTL: Modelling and control of a fluidized bed gasifier  
TLSP: Ph.D. Thesis  
AUTH: A/KUTTEN, M.  
CORP: City Univ. of New York, N. Y. SAP: Avail: Univ.  
Microfilms Order No. 7900791  
MAJS: /\*COAL GASIFICATION/\*CONTROLLABILITY/\*DYNAMIC MODELS/\*  
FLUIDIZED BED PROCESSORS  
MINS: / DYNAMIC RESPONSE/ PRODUCTION ENGINEERING/ STEADY  
STATE/ SYSTEMS ANALYSIS/ SYSTEMS ENGINEERING  
ABA: Dissert. Abstr.  
ABS: An evaluation of the steady state and the dynamic  
behavior of an air blown fluidized bed coal gasifier  
to producing low BTU gas is presented. A simplified  
model of such a gasifier is presented. It is shown  
that the steady state range of control can be  
sometimes considerably smaller than indicated by  
purely hydrodynamic consideration, as lower flow rates  
can lead to higher conversions. The dynamic behavior  
shows a short time response dominated by the thermal  
inertia of the coal bed and a long time response,  
which is a function of the adjustment of the bed ash  
content to different flow rates. Both the dynamic and  
steady state features of the system strongly depend on  
the design of the system. The results of the thesis  
illustrates the type of problems that may be  
encountered and suggests some potential solutions.

79A10247 ISSUE 1 PAGE 44 CATEGORY 23 78/00/00  
5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Catalytic coal gasification exploratory research  
program  
AUTH: A/WOODCOCK, K. E. PAA: A/(U.S. Department of Energy,  
Div. of Coal Conversion, Washington, D.C.)  
In: Intersociety Energy Conversion Engineering  
Conference, 13th, San Diego, Calif., August 20-25,  
1978, Proceedings, Volume 3, (A79-10001 01-44)  
Warrendale, Pa., Society of Automotive Engineers,  
Inc., 1978, p. 2148-2152.  
MAJS: /\*ALKALIES/\*CATALYSTS/\*COAL GASIFICATION/\*REACTION  
KINETICS  
MINS: / BORATES/ CARBONATES/ CHARCOAL/ ENERGY TECHNOLOGY/  
GAS COMPOSITION/ HALIDES/ HYDROXIDES/ MATERIALS  
RECOVERY/ OXIDES/ SULFATES  
ABA: M.L.  
ABS: Catalytic coal gasification research programs are  
surveyed, and favorable effects of catalysis on rate,  
gas composition, and reduction of the free swelling  
index are examined. Economic feasibility is  
considered, and it is suggested that catalytic coal  
gasification may offer significant economic incentives  
over alternate approaches. Bench scale experiments  
with coal feed rates up to 10-20 pounds per hour are  
described.

79N16135 ISSUE 7 PAGE 842 CATEGORY 28 78/00/00  
250 PAGES UNCLASSIFIED DOCUMENT

UTTL: Thermoelastic solutions for in-situ gasification of  
coal TLSP: Ph.D. Thesis  
AUTH: A/WANG, H. F.  
CORP: West Virginia Univ., Morgantown. SAP: Avail: Univ.  
Microfilms Order No. 7900893  
MAJS: /\*COAL GASIFICATION/\*STRUCTURAL ANALYSIS/\*

THERMOELASTICITY

MINS: / CAVITIES/ CRACKING (FRACTURING)/ MECHANICAL  
PROPERTIES/ MODELS/ STEADY STATE CREEP/ STRESS  
CONCENTRATION/ THERMOMECHANICAL TREATMENT  
ABA: Dissert. Abstr.  
ABS: Linear thermoelastic analyses of structural models  
associated with underground coal gasification (UCG)  
are conducted. Idealized crack and cavity  
configurations simulating the Longwall Generator  
concept and linked vertical wells concept of UCG are  
studied by deriving closed form solutions. The  
relevance of the proposed models and their general  
applications are provided. Four different isotropic,  
homogeneous thermoelastic models with steady-state  
heat conduction and prescribed constant temperature  
boundary conditions at the crack or cavity surface are  
investigated. The results provide fundamental data for  
the possible interpretation of cavity configurations,  
roof stability and related information. Research  
indicates that the thermomechanical responses are  
important in the consideration of UCG processes.

78A38200 ISSUE 16 PAGE 2944 CATEGORY 44  
78/05/00 6 PAGES In GERMAN UNCLASSIFIED DOCUMENT

UTTL: Study of the thermodynamics of coal gasification  
AUTH: A/NEUMANN, K.-K. PAA: A/(Uhde GmbH, Dortmund, West  
Germany)  
Erdöl und Kohle Erdgas Petrochemie vereinigt mit  
Brennstoff-Chemie, vol. 31, May 1978, p. 228-233. In  
German.  
MAJS: /\*COAL GASIFICATION/\*GAS MIXTURES/\*METHANE/\*  
THERMODYNAMICS/\*WATER VAPOR  
MINS: / CHEMICAL EQUILIBRIUM/ ENERGY TECHNOLOGY/ ENTHALPY/  
GAS PRESSURE/ GAS TEMPERATURE  
ABA: (Author)  
ABS: The paper presents a method for estimating with a  
fairly simple thermodynamic model the  
process-variables for certain gas-producing-processes

and processes for the treatment of such gas-mixtures.  
The mathematical model is based on a calculation of  
the simultaneous chemical equilibria. For coal  
gasification and methanization, equilibrium  
compositions and the temperature-dependence of the  
enthalpy are given for temperatures between 200 and  
1200 C for 1 bar and for 40 bar.

79N22950 ISSUE 13 PAGE 1784 CATEGORY 77  
78/00/00 408 PAGES UNCLASSIFIED DOCUMENT  
UTTL: The thermodynamic performance of two combined cycle power plants integrated with two coal gasification systems TLSP: Ph.D. Thesis  
AUTH: A/STASA, F. L.  
CORP: Carnegie-Mellon Univ., Pittsburgh, Pa. SAP: Avail: Univ. Microfilms Order No. 7904883  
MAJS: /\*BRAYTON CYCLE/\*COAL GASIFICATION/\*POWER PLANTS/\*RANKINE CYCLE/\*THERMODYNAMIC CYCLES/\*THERMODYNAMIC EFFICIENCY  
MINS: / CLEAN FUELS/ COMPUTER PROGRAMS/ DESULFURIZING/ FORTRAN/ GAS TURBINES  
ABA: Dissert. Abstr.  
ABS: Thermodynamic models of both an adiabatic and an endothermic coal gasifier integrated with either a waste heat combined cycle or a supercharged boiler combined cycle are developed and incorporated into a FORTRAN computer program. Certain components are added to each configuration in an effort to improve thermodynamic performance, with the effect of each clearly noted. With consideration of the criteria, the station efficiencies for each configuration are within 1 percentage point of each other when flue gas recirculation is used as a means to control the amount of nitric oxide which enters the atmosphere. With a gas turbine inlet temperature of 2000 F and with consideration of the pollution criteria, the configuration employing an adiabatic gasifier and a waste heat system is marginally the best with a station efficiency of only 37 percent.

78N16431\*# ISSUE 7 PAGE 895 CATEGORY 44 RPT#:  
NASA-TM-75233 78/01/00 34 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Considerations on coal gasification  
AUTH: A/FRANZEN, J. E.  
CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS SAP: HC A03/MF A01  
Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original Doc. Prep. by Tech. Mitt. Krupp, Forschungsberichte Transl. into ENGLISH from "Einige Ueberlegungen zur Kohlevergasung" (West Germany), v. 35, Jan. 1977 p 83-94  
MAJS: /\*COAL GASIFICATION/\*COAL UTILIZATION/\*ENERGY TECHNOLOGY  
MINS: / COAL/ EARTH RESOURCES/ ENERGY REQUIREMENTS/ ENTRAINMENT/ FLUIDIZED BED PROCESSORS/ FORECASTING  
ABA: Author  
ABS: Commercial processes for the gasification of coal with oxygen are discussed. The Koppers-Totzek process for the gasification of coal dust entrained in a stream of gasifying agents is described in particular detail. The outlook for future applications of coal gasification is presented.

79A14679# ISSUE 3 PAGE 419 CATEGORY 44  
78/00/00 10 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Coal gasification and its alternatives  
AUTH: A/HUFFMAN, R. L. PAA: A/(Cities Service Gas Co., Oklahoma City, Okla.)  
In: Annual Conference on Energy, 4th, Rolla, Mo., October 11-13, 1977, Proceedings. (A79-14676 03-44) Rolla, Mo., University of Missouri-Rolla, 1978, p. 46-55.  
MAJS: /\*ALTERNATIVES/\*COAL GASIFICATION/\*COST ESTIMATES/\*ENERGY POLICY  
MINS: / ECONOMIC ANALYSIS/ ENERGY TECHNOLOGY/ SYNTHETIC FUELS  
ABA: S.C.S.  
ABS: The paper discusses six groups planning Lurgi coal gasification plants with capacities of about 250 MMCFD of synthetic gas. The present efficiencies and costs of natural gas and electricity are given in terms of production efficiency, transmission and distribution, and delivered energy efficiency. Estimates of the cost of space heating and cooling equipment are presented for a typical home having 1,800 square feet of living space. In contrast to nuclear energy, it is shown that coal has direct applications to industry, for the generation of electric power, and for the production of synthetic fuels. It is demonstrated that synthetic gas from coal is less costly and more efficient than electricity made from the same coal from the point of view of the residential consumer.

79N24188# ISSUE 15 PAGE 1965 CATEGORY 28 RPT#:  
ORNL/ENG/TM-13-VOL-1 CNT#: W-7405-ENG-26 78/11/00  
140 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Low Btu coal gasification processes. Volume 1: Summary, screening, and comparisons  
AUTH: A/HARTMAN, H. F.; B/BELK, J. P.; C/REAGAN, D. E.  
CORP: Oak Ridge National Lab., Tenn. AVAIL.NTIS SAP: HC A07/MF A01  
MAJS: /\*COAL GASIFICATION/\*ENERGY SOURCES  
MINS: / ECONOMICS/ ENERGY TECHNOLOGY/ ENVIRONMENT EFFECTS  
ABA: DOE  
ABS: A survey was made of 102 reported processes that produce low and intermediate Btu gas from coal. Concise summaries were provided for 47 processes and include status, operating conditions, and a description of the gasifier. Characteristics of different types of gasification processes were compared, and specific comparisons were made for the processes that were investigated in depth. Other process considerations such as potential applications, problem areas, economics, and environmental considerations are discussed.

79N24186# ISSUE 15 PAGE 1964 CATEGORY 28 RPT#:  
FE-2340-7 QR-7 CNT#: EX-76-S-01-2340 78/04/00 65  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Improved techniques for gasifying coal TLSP:  
Quarterly Report, 1 Jan. - 31 Mar. 1978  
AUTH: A/GRAFF, R. A.; B/YERUSHALMI, J.; C/LACAVA, A.  
CORP: City Coll. of the City Univ. of New York.  
AVAIL.NTIS SAP: HC A04/MF A01  
MAJS: /\*CHOKES (RESTRICTIONS)/\*COAL GASIFICATION/\*FLUIDIZED  
BED PROCESSORS/\*TRANSPORT PROPERTIES  
MINS: / GAS DYNAMICS/ HYDROCARBONS/ HYDROGENATION/ NITROGEN/  
SULFUR

ABA: DOE  
ABS: Experiments were conducted in the modified 6-inch system to delineate the boundary between the turbulent regime and the transport states, including the fast fluidized bed regime. The results throw light on the phenomenon of choking. Fluidization experiments in the fast bed regime with a relatively coarse solid confirm that to achieve stable and smooth fast fluidization of a coarse solid requires correspondingly higher gas velocities and associated solid rates. The yields of light hydrocarbon are not affected by their continued contact with char in the vapor residence zone. Sixty-nine to 85% of the nitrogen and 84 to 91% of the sulfur in Ireland Mine coal are converted to volatile species during flash hydrogenation at 100 atm. The method of injecting tracer gas to serve as an internal standard was validated against the standard technique in which the tracer is premixed with the reaction gas.

79N27331# ISSUE 18 PAGE 2390 CATEGORY 28 RPT#:  
FE-2240-100 CNT#: EX-76-C-01-2240 78/08/00 40  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Coal gasification, commercial concepts, gas cost guidelines, revision 1 TLSP: Final Report  
AUTH: A/SKAMSER, R.  
CORP: Braun (C. F.) and Co., Alhambra, Calif. AVAIL.NTIS  
SAP: HC A03/MF A01  
MAJS: /\*COAL GASIFICATION/\*COST ESTIMATES/\*ENERGY POLICY/\*  
GASOLINE

MINS: / ENERGY TECHNOLOGY/ HANDBOOKS/ INDUSTRIAL PLANTS  
ABA: DOE  
ABS: The guidelines contain all the information and procedures that are required to calculate, on a consistent basis, the cost of producing high Btu pipeline quality gas from coal. The design basis for coal gasification plants is presented. Coal analyses, environmental requirements, plant size, equipment design guides, and equations for gas costs were included using either utility or private investor financing. The cost of gas was determined primarily by the plant investment which is obtained from estimates of the installed cost of equipment.

79N26127 ISSUE 17 PAGE 2232 CATEGORY 25  
78/00/00 268 PAGES UNCLASSIFIED DOCUMENT

UTTL: A pore model for gasification reactions: An application to the system C-CO<sub>2</sub>-CO-N<sub>2</sub> TLSP: Ph D. Thesis  
AUTH: A/DEMATOS, M.  
CORP: Colorado School of Mines, Golden. SAP: Avail: Univ. Microfilms Order No. 79:2222  
MAJS: /\*CARBON DIOXIDE/\*GASIFICATION/\*GRAPHITE/\*MATHEMATICAL MODELS/\*NITROGEN/\*POROSITY  
MINS: / GAS MIXTURES/ GAS PRESSURE/ PELLETS/ REACTION KINETICS/ SURFACE REACTIONS  
ABA: Dissert. Abstr.  
ABS: A model is described which accounts for structural changes in a pellet (porosity, radius of pore, size of the pellet) as reaction proceeds. The equation describing the model was cast in dimensionless form which allows for study of the system in terms of dimensionless groups rather than individual parameters. The theoretical predictions of experimental runs indicates that the model can be used to describe the behavior of spherical pellets of electrode graphite when reacted with CO<sub>2</sub> or CO<sub>2</sub>/N<sub>2</sub> mixtures, in the temperature range 970 to 1000 C.

79A10057 ISSUE 1 PAGE 107 CATEGORY 44 78/00/00  
3 PAGES UNCLASSIFIED DOCUMENT

UTTL: Synthane - A process for the gasification of caking and noncaking coals  
AUTH: A/WEISS, A. J. PAA: A/(CE Lummus Co., Bloomfield, N.J.)  
In: Intersociety Energy Conversion Engineering Conference, 13th, San Diego, Calif., August 20-25, 1978. Proceedings, Volume 1. (A79-10001 01-44)  
Warrendale, Pa., Society of Automotive Engineers, Inc., 1978, p. 414-421.  
VAJS: /\*COAL GASIFICATION/\*ENERGY TECHNOLOGY/\*PILOT PLANTS/\*  
SYNTHANE  
MINS: / DOMESTIC ENERGY/ ECONOMIC FACTORS/ ENERGY REQUIREMENTS/ TECHNOLOGY ASSESSMENT  
ABA: S.C.S.  
ABS: The paper discusses the synthane process of producing pipeline-quality gas from caking and noncaking coals. The process basically consists of coal preparation (crushing, drying, screening), feeding, pretreatment, gasification, gas cooling, and char processing. Operating data from a pilot plant are presented for two types of coal. Problem areas are identified as the coal feed system, gasification, the entrainment of fines, and char disposal.

78N33525 ISSUE 24 PAGE 3233 CATEGORY 44  
78/00/00 312 PAGES UNCLASSIFIED DOCUMENT

UTTL: Significance of process variables on liquid effluent production in coal gasification TLSP: Ph.D. Thesis

AUTH: A/NAKLES, D. V.

CORP: Carnegie-Mellon Univ., Pittsburgh, Pa. SAP: Avail: Univ. Microfilms Order No. 7814230

MAJS: /\*COAL GASIFICATION/\*EFFLUENTS/\*ENERGY TECHNOLOGY/\* WASTE DISPOSAL/\*WATER POLLUTION

MINS: / ENVIRONMENT PROTECTION/ HYDROCARBON FUELS/ INDUSTRIAL WASTES/ SYNTHANE/ VARIABILITY

ABA: Dissert. Abstr.

ABS: The production of liquid effluents, condensable hydrocarbons, and water soluble contaminants, was investigated. Significant variations in tar, phenol, chemical oxygen demand, and total organic carbon production occur during transient operating periods, i.e., start-up or shutdown, and between steady state operations at different gasifier operating conditions. In particular, changes in conditions which enhance the approach of effluent species to chemical equilibrium dramatically influence steady state liquid effluent production. Increasing gas-solid contacting, the final reaction temperature, and residence time of the devolatilized species in the hot zone of the reactor reduce organic liquid effluent production significantly. Near complete extinction of these compounds is possible by providing the appropriate combination of coal devolatilization conditions and product gas residence time.

79N28363# ISSUE 19 PAGE 2530 CATEGORY 28 RPT#:  
FE-2006-9 CNT#: EX-76-C-01-2006 78/04/00 102  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Applied research and evaluation of process concepts for liquefaction and gasification of western coals TLSP: Quarterly Progress Report, Jul. - Sep. 1977

AUTH: A/WISER, W. H.

CORP: Utah Univ., Salt Lake City. CSS: (Dept. of Mining, Metallurgical and Fuels Engineering.) AVAIL.NTIS  
SAP: HC A06/MF A01

ABA: DOE

ABS: Studies on the extraction of coal with tetralin show that high volatile bituminous coal is converted to oil and benzene and pyridine solubles in less than 2 minutes. The products show systematic changes in hydroaromatic and aliphatic structures as the reaction proceeds. The presence of aromatic ring structures increases with reaction time. The molecular weight of liquid products decreases with reaction time. Mild hydrolysis appears to be a very interesting technique for upgrading coal-derived liquids to a lighter liquid. Hydrogen consumption in this process is low. Zinc chloride impregnated on coal was found to have hydrogen exchange properties of a Bronsted acid. A coal sample without ZnCl<sub>2</sub> has similar exchange properties, but the rate is much less. The acidic oil fraction obtained by catalytic hydrogenation of coal was separated by gel permeation chromatography and gradient elution liquid chromatography. Function group content was found to be independent of molecular size.

79N28737# ISSUE 19 PAGE 2573 CATEGORY 44  
78/00/00 43 PAGES UNCLASSIFIED DOCUMENT DCAF  
E002628

UTTL: The gas turbine/steam turbine cycle with coal gasification

AUTH: A/STEINER, A.

CORP: Sulzer Bros. Ltd., Winterthur (Switzerland).  
AVAIL.NTIS SAP: HC A14/MF A01  
In Von Karman Inst. for Fluid Dyn. Combined Cycles for Power Generation, Vol. 1 43 p (SEE N79-28732 19-44)

MAJS: /\*COAL GASIFICATION/\*ENERGY POLICY/\*GAS TURBINE ENGINES/\*PURIFICATION/\*STEAM TURBINES/\*SULFUR

MINS: / EARTH RESOURCES/ ENVIRONMENT PROTECTION/ FUELS/ THERMODYNAMIC CYCLES/ THERMODYNAMIC EFFICIENCY

ABA: Author (ESA)

ABS: Available processes for solid fuel gasification and subsequent gas desulfuration are described as they are especially suitable GT/ST cycles. Economic arguments and environmental protection regulations are discussed. Coal gasification is analyzed both as fixed bed generators and fluid bed generators. Purification alternatives such as physical washing, chemical washing, physical-chemical washing and absorption are described. A 170 Mw coal gasification combined power

plant located at Luner, Germany, is described as an example. A Westinghouse combined cycle plant with "U-gas" fluidized-bed gasification is also discussed.

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OF POOR QUALITY

79A50882 ISSUE 22 PAGE 4193 CATEGORY 45  
78/00/00 18 PAGES UNCLASSIFIED DOCUMENT

UTTL: Environmental aspects of the Department of Energy's underground coal conversion program

AUTH: A/ZUKOR, S. H.; B/BURWELL, E. L. FAA: B/(U.S. Department of Energy, Washington, D.C.)  
In: Conference on Environmental Aspects of Non-Conventional Energy Resources - II, Denver, Colo., September 26-29, 1978, Proceedings. (A79-50876 22-45) La Grange Park, Ill., American Nuclear Society, 1978, p. 16-3 to 16-20.

MAJS: /\*COAL GASIFICATION/\*ENERGY TECHNOLOGY/\*ENVIRONMENT EFFECTS

MINS: / AQUIFERS/ ECONOMIC FACTORS/ ENVIRONMENTAL CONTROL/ GASEOUS FUELS/ GRAPHS (CHARTS)/ SUBSIDENCE/ WATER POLLUTION

ABA: (Author)

ABS: The Department of Energy's Underground Coal Conversion Program is described, with emphasis on environmental activities. The basic underground coal gasification (UCG) process is explained, along with potential advantages and problem areas. Results to date indicate that the environmental impacts of UCG will be minimal and well within the capability of current environmental control technology. When compared to alternate uses of coal, UCG may offer significant environmental advantages, especially in areas of the country where high-quality water is in short supply.

79N27615\*# ISSUE 18 PAGE 2426 CATEGORY 28  
78/08/15 4 PAGES UNCLASSIFIED DOCUMENT

UTTL: Synthetic natural gas in California: When and why --- from coal

AUTH: A/WOOD, W. B.

CORP: Southern California Gas Co., Los Angeles.  
AVAIL. NTIS SAP: HC A23/MF A01  
In JPL Proc. of the Conf. on Coal Use for California p 249-252 (SEE N79-27597 18-42)

MAJS: /\*COAL GASIFICATION/\*ENERGY CONVERSION/\*NATURAL GAS/\*SYNTHANE

MINS: / CALIFORNIA/ COAL UTILIZATION/ ECONOMIC FACTORS/

ENERGY POLICY/ ENERGY TECHNOLOGY

ABA: J.M.S.

ABS: A coal gasification plant planned for northwestern New Mexico to produce 250 MMCFD of pipeline quality gas (SNG) using the German Lurgi process is discussed. The SNG will be commingled with natural gas in existing pipelines for delivery to southern California and the Midwest. Cost of the plant is figured at more than \$1.4 billion in January 1978 dollars with a current inflation rate of \$255,000 for each day of delay. Plant start-up is now scheduled for 1984.

79N27614\*# ISSUE 18 PAGE 2426 CATEGORY 44  
78/08/15 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: The Texaco coal gasification process for manufacture of medium BTU gas

AUTH: A/SCHLINGER, W. G.

CORP: Texaco, Inc., Montebello, Calif. AVAIL. NTIS SAP: HC A23/MF A01  
In JPL Proc. of the Conf. on Coal Use for California 243-247 (SEE N79-27597 18-42)

MAJS: /\*COAL GASIFICATION/\*ELECTRIC POWER PLANTS/\*ENERGY CONVERSION/\*SYNTHANE

MINS: / CALIFORNIA/ COAL UTILIZATION/ ENERGY POLICY/ NITROGEN OXIDES/ PARTICLE SIZE DISTRIBUTION/ POLLUTION CONTROL/ SULFUR DIOXIDES

ABA: J.M.S.

ABS: The development of the Texaco coal gasification process is discussed with particular emphasis on its close relationship to the fully commercialized Texaco synthesis gas generation process for residual oil gasification. The end uses of the product gas are covered, with special attention to electric power generation via combined cycle technology. Control of SO<sub>2</sub>, NO<sub>x</sub>, and particulate emissions in the power generating mode is also covered. The application of this technology in a proposed Texaco-Southern California Edison demonstration project is mentioned. Investment information released for a 1000-megawatt advanced combined cycle gasification facility, is also reviewed.

A79-45587

Developmental hydrogen via coal gasification

processes. P. B. Tarman (Institute of Gas Technology, Chicago, Ill.). In: Hydrogen for energy distribution: Proceedings of the Symposium, Chicago, Ill., July 24-28, 1978. (A79-45576 20-44) Chicago, Institute of Gas Technology, 1979, p. 239-252.

Commercially available and developmental technologies for producing hydrogen from coal are summarized. The Winkler process operates as a fluidized bed and uses noncaking coals, the Koppers-Totzek process operates as an entrained bed and can use any coal type, the Lurgi process uses a moving bed and noncaking coals, and the Wellman-Galusha process utilizes a fixed bed gasifier at near atmospheric pressure and temperatures of 1000 to 2000 F. The new technologies include the Texaco process using partial oxidation of coal with steam and oxygen at elevated pressure, the U-Gas process based on single stage, nonslagging, fluidized bed, the steam-iron process using air instead of oxygen and producing large amounts of electrical power in addition to high-purity hydrogen. It is concluded that as the demand for hydrogen increases a wide choice of processes for producing high purity hydrogen from coal will be available. A.T.

77A18583 ISSUE 6 PAGE 797 CATEGORY 23 CNT#: 7  
NSF G1-38974 77/01/00 7 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Differential scanning calorimetry studies on coal. II  
- Hydrogenation of coals

AUTH: A/MAHAJAN, O. P.; B/TOMITA, A.; C/NELSON, J. R.;  
D/WALKER, P. L., JR. PAA: D/(Pennsylvania State  
University, University Park, Pa.)  
Fuel, vol. 55, Jan. 1977, p. 33-39.

MAJS: /\*CALORIMETERS/\*COAL GASIFICATION/\*EXOTHERMIC  
REACTIONS/\*HYDROGENATION

MINS: / CHEMICAL COMPOSITION/ DEMINERALIZING/ ENERGY  
TECHNOLOGY/ PYRITES/ TRANSITION TEMPERATURE/ WEIGHT  
REDUCTION

ABA: (Author)

ABS: Results of exothermic heats involved during  
hydrogenation of twenty U.S. raw coals of varying rank  
at 5.6 MPa (gauge) and temperatures up to 570 C are  
reported. The heat evolved during hydrogenation up to

the total heat released during hydrogenation of coals  
appears to be due to the exothermic reaction between  
H<sub>2</sub> and surface carbon-oxygen complexes removed during  
the reaction. The transition temperature  
(corresponding to the onset of exotherms) is markedly  
dependent on coal rank. A sharp increase in the  
transition temperature occurs for coals having a  
carbon content, on a dry-ash-free basis, in the 75-80%  
range. Demineralization of coals lower in rank than  
high-volatile-A bituminous decreases the heat of  
hydrogenation: for higher-rank coals, exothermic heats  
increase upon demineralization. The presence of pyrite  
has a beneficial catalytic effect on coal  
hydrogenation.

78N25604# ISSUE 16 PAGE 2143 CATEGORY 44 RPT#: 68  
FE-2229-6 CNT#: EX-76-C-01-2229 77/10/00 68 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Surface structure and mechanisms of gasification  
catalyst deactivation TLSP: Quarterly Report, May -  
Jul. 1977

AUTH: A/REUCROFT, P. J.; B/BRADLEY, E. B.; C/DEANGELIS, R.  
J.; D/SARGENT, G. A.

CORP: Kentucky Univ., Lexington. AVAIL-NTIS SAP: HC  
A04/MF A01

ABA: ERA

ABS: The ESCA instrument was moved into a new facility and  
extensive modifications for safety purposes were made.  
The electron flood gun was tested with mixed results.  
NiSO<sub>4</sub> was observed to have a significantly different  
ESCA spectrum from NiS. It was observed that silica  
supported NiO was easily reduced by the standard Argon  
ion etching procedure while alumina supported NiO was  
much more resistant to reduction. Infrared spectra of  
NiO/MgSiO<sub>3</sub> catalysts show that CO<sub>3</sub>/sup equals/ is  
adsorbed as was observed for  
alumina-and-silica-support catalysts. The MgSiO<sub>3</sub>  
support produces infrared absorption which is almost  
identical to NiSiO<sub>3</sub> except for some doublet structure.  
Adsorption studies of C<sub>2</sub>H<sub>2</sub> over NiO/Al<sub>2</sub>O<sub>3</sub> indicate  
that CH<sub>2</sub> and CH<sub>3</sub> species are formed in the 300 C

temperature region. Suitable procedures were developed  
to stabilize the reduced nickel catalysts and prevent  
the spontaneous re-oxidation by passivation during  
examination by X-ray diffraction. The chemisorption of  
air and CO on a sulfided catalyst surface was  
investigated at room temperature.

77A36337 ISSUE 16 PAGE 2728 CATEGORY 44  
77/00/00 35 PAGES UNCLASSIFIED DOCUMENT

UTTL: Winkler technology for clean fuels from coal

AUTH: A/MARTEN, J. H.; B/BANCHIK, I. N.; C/SUBRAMANIAN, T.  
K. PAA: C/(Davy Powergas, Inc., Lakeland, Fla.)  
In: Synthetic fuels processing: Comparative economics;  
Proceedings of the Symposium, New York, N.Y., April  
4-9, 1976. (A77-36326 16-44) New York, Marcel Dekker,  
Inc., 1977, p. 251-285.

MAJS: /\*CLEAN ENERGY/\*COAL GASIFICATION/\*ENERGY TECHNOLOGY/\*  
FLUIDIZED BED PROCESSORS/\*GAS GENERATORS

MINS: / CHEMICAL REACTORS/ COMPRESSED GAS/ DESULFURIZING/  
EXHAUST GASES/ GAS MIXTURES/ PRESSURIZING

ABA: G.R.

ABS: The Winkler process for the gasification of coal has  
been in successful commercial operation since the  
middle 1920s. In the fluid bed of the gasifier coal  
reacts with a mixture of air or oxygen and steam. The  
gas leaving the gasifier is only a mixture of H<sub>2</sub>, CO,  
CO<sub>2</sub>, N<sub>2</sub>, and CH<sub>4</sub>. The basic process is discussed along  
with the heat and material balances and the advantages  
of the Winkler system. A description is provided of  
the pressurization of the Winkler process for the  
production of clean fuel from coal. Attention is given  
to the necessity for process pressurization, the  
processing steps, aspects of gas cooling and  
particulate removal, desulfurization, and sulfur  
recovery.

77A48176 ISSUE 23 PAGE 3978 CATEGORY 44 CNT#: E(49-18)-2030 77/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Kinetics of gasification in a combustion pot - A comparison of theory and experiment  
AUTH: A/EAPEN, T.; B/BLACKADAR, R.; C/ESSENHIGH, R. H. PAA: C/(Pennsylvania State University, University Park, Pa.)  
In: Symposium on Combustion (International), 16th, Cambridge, Mass., August 15-20, 1976, Proceedings, (A77-4815B 23-25) Pittsburgh, Pa., Combustion Institute, 1977, p. 515-522. Research supported by the Pennsylvania Science and Engineering Foundation  
MAJS: /\*COAL GASIFICATION/\*COMBUSTION CONTROL/\*ENERGY TECHNOLOGY/\*REACTION KINETICS  
MINS: / REFS (PROCESS ENGINEERING)/ COMBUSTION CHAMBERS/

COMBUSTION TEMPERATURE/ DIFFUSION FLAMES

ABA: J.M.B.

ABS: The reaction of carbon with air in a fixed fuel bed was investigated through analysis of rate equations and through data obtained from experiments involving a combustion pot. The combustion pot, a refractory box accommodating bed depths up to 18 inches, was fueled with various grades of coke or coal; experiments were carried out at air intake and gasification rates comparable to those employed by commercial gasifiers. Kinetic coefficients were obtained from slopes of log/linear plots of gas composition (O<sub>2</sub>, CO<sub>2</sub> and CO were studied) with time. It was found that the carbon-air reaction is diffusion-controlled in the combustion region of the fuel bed, but chemically-controlled in the gasification region with a temperature coefficient equivalent to 50 kcal activation energy. Possible application of these results to mathematical models of shaft reactors, the Lurgi process, or underground gasification is also mentioned.

77N83678# CATEGORY 28 RPT#: UCRL-52227 CNT#: W-7405-ENG-48 77/02/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Electrical conductivity of Kemmerer coal  
AUTH: A/DUBA, A. G.; B/HO, P. S.  
CORP: California Univ., Livermore. Lawrence Livermore Lab. AVAIL NTIS  
MAJS: /\*COAL GASIFICATION/\*ELECTRICAL RESISTIVITY/\*SODIUM CHLORIDES  
MINS: / CHEMICAL ENGINEERING/ ELECTROCONDUCTIVITY/ FOSSIL FUELS

77A37000# ISSUE 16 PAGE 2734 CATEGORY 44 77/06/00 4 PAGES UNCLASSIFIED DOCUMENT

UTTL: Coal gasification power generation  
AUTH: A/HOLMGREN, J. PAA: A/(Westinghouse Research and Development Center, Pittsburgh, Pa.)  
Aware, June 1977, p. 11-14.  
MAJS: /\*COAL GASIFICATION/\*ELECTRIC POWER PLANTS/\*FLUIDIZED BED PROCESSORS/\*GAS TURBINES/\*PILOT PLANTS/\*STEAM TURBINES  
MINS: / AIR FLOW/ COMPRESSED GAS/ ENERGY TECHNOLOGY/ GAS TEMPERATURE/ GAS TURBINE ENGINES/ SYSTEMS ENGINEERING  
ABA: G.R.  
ABS: A description is presented of a fluidized bed coal gasification system for a combined-cycle gas turbine and steam turbine power generating plant and of investigations which are conducted to evaluate this system. A two-stage fluidized bed process gasifies coal using air and steam at temperatures in the range from 1600 to 2100 F and pressures from 15 to 20 atm. Limestone or dolomite sorbent can be used to remove sulfur from the gases at temperatures from 1400 to 1700 F. Attention is given to the coal gasification power generation process, the coal gasification process, and the coal gasification program.

77A20292 ISSUE 10 PAGE 1673 CATEGORY 44 77/04/00 3 PAGES UNCLASSIFIED DOCUMENT

UTTL: Underground gasification offers clean safe route to coal energy  
AUTH: A/JENKINS, N.  
Energy International, vol. 14, Apr. 1977, p. 28-30.  
MAJS: /\*CLEAN ENERGY/\*COAL GASIFICATION/\*ENERGY TECHNOLOGY/\*MINES (EXCAVATIONS)  
MINS: / COMBUSTION PHYSICS/ COST EFFECTIVENESS/ DIAGRAMS/ FLOW CHARTS/ GAS FLOW  
ABA: R.D.V.  
ABS: Prospects for low-cost efficient extraction of energy from coal beds in situ via underground gasification are weighed, with discussion of some new processes reported. The heating value of the product, efficiency of the process, how much coal would be left in the seam unextracted, and exploitation of seams recalcitrant to mining by conventional techniques are considered. Energy transportation costs (of gas by pipeline, of solid coal via road/rail/barge, of electricity generated on site) have to be compared. A packed-bed process, explosive fracturing of coal seams prior to burning, use of hydrogen in place of oxygen to supply reaction heat, and utilization of gasification process residual heat are touched upon.

77A38790 ISSUE 17 PAGE 2911 CATEGORY 44  
77/06/00 21 PAGES UNCLASSIFIED DOCUMENT

UTTL: A review of gasification for power generation  
AUTH: A/ROBSON, B. PAA: A/(Coal Research Establishment,  
Cheltenham, Glos., England)  
International Journal of Energy Research, vol. 1,  
Apr.-June 1977, p. 157-177.  
MAJS: /\*COAL GASIFICATION/\*ENERGY TECHNOLOGY/\*TECHNOLOGY  
ASSESSMENT  
MINS: / ELECTRIC POWER PLANTS/ FLUIDIZED BED PROCESSORS/  
UTILITIES

ABA: (Author)

ABS: The paper is a review of the state of the art of  
gasification of coal for power generation. The major  
part of the review is a description, under the  
headings of fixed-bed gasification, fluidized-bed  
gasification, entrained gasification and molten-bath  
gasification, of the work currently in progress. The  
only large-scale operational plant is the Steag plant  
at Lünen in the Federal Republic of Germany, which is  
based on Lurgi fixed-bed technology. Another  
large-scale plant which seems certain to be built is  
the Commonwealth Edison plant at Pekin, and this too  
is to use Lurgi gasifiers. All other work is still in  
the development stage and unlikely to reach commercial  
scale for several years. Hopefully, this will roughly  
coincide with the time when gas turbines can withstand  
inlet temperatures of 1200 C or higher. The review  
briefly describes the current conventional methods of  
power generation, outlines the three basic types of  
combined cycle, and then explains why the juncture of  
gasification and a combined cycle is attractive. This  
is followed by a section on the quality of gas  
required for firing gas turbines, and a short outline  
of equipment available for gasification of coal.

78N77855 CATEGORY 44 RPI#: BMFT-FB-T-77-34  
77/12/00 249 PAGES UNCLASSIFIED DOCUMENT DCAF  
F002631

UTTL: Project study coal pressure gasification TLSP: Final  
Report  
AUTH: A/HARJUNG, J.; B/WENNING, H. P.; C/BLAUM, E.;  
D/ENGLER, D.; E/HAFKE, C.; F/REIMERT, R.  
CORP: Veba-Chemie, A.G., Gelsenkirchen-Buer (West Germany),  
AVAILNTIS  
MAJS: /\*COAL GASIFICATION/\*FOSSIL FUELS/\*PRESSURE GRADIENTS  
MINS: / COAL UTILIZATION/ ECONOMIC FACTORS/ ENERGY  
CONSUMPTION/ HYDROCARBON FUELS

77A41448 ISSUE 19 PAGE 3243 CATEGORY 44  
77/00/00 37 PAGES UNCLASSIFIED DOCUMENT

UTTL: Gasification - Theory and application --- of coal  
AUTH: A/LITTLEWOOD, K. PAA: A/(Sheffield, University,  
Sheffield, England)  
Progress in Energy and Combustion Science, vol. 3, no.  
1, 1977, p. 35-71.  
MAJS: /\*COAL GASIFICATION/\*ENERGY TECHNOLOGY/\*GASEOUS FUELS  
/\*HYDROCARBON FUEL PRODUCTION  
MINS: / BIBLIOGRAPHIES/ GAS COMPOSITION/ HEAT MEASUREMENT/  
HYDROCARBON COMBUSTION/ SALT BATHS/ SHALE OIL/  
STOICHIOMETRY/ SYNTHANE

ABA: G.R.

ABS: The chemical aspects of the gasification of coal are  
examined, taking into account stoichiometry, gas  
composition, and thermodynamic and kinetic data. The  
physical aspects of gasification are considered and a  
description is provided of the gasification processes.  
Attention is given to gaseous fuels of low caloric  
value, producer gas, water-gas reactions, methane  
synthesis reactions, fundamental reactions, the use of  
steam, the blast saturation temperature, blast furnace  
gas, and gaseous fuels of medium caloric value.  
Methods for the production of synthesis gas are also  
discussed and developments in the production of  
substitute natural gas from coal are explored.

77A28778 ISSUE 12 PAGE 2038 CATEGORY 44  
77/04/00 4 PAGES UNCLASSIFIED DOCUMENT

UTTL: Gasification of coals treated with non-aqueous  
solvents. I - Liquid ammonia treatment of a bituminous  
coal  
AUTH: A/MATIDA, M.; B/NISHIYAMA, Y.; C/TAMAI, Y. PAA:  
C/(Tohoku University, Sendai, Japan)  
Fuel, vol. 56, Apr. 1977, p. 177-180.  
MAJS: /\*COAL GASIFICATION/\*LIQUID AMMONIA/\*SOLVENT  
EXTRACTION

MINS: / BENZENE/ BITUMENS/ CATALYSTS/ CHEMICAL REACTIONS/  
ETHYL ALCOHOL/ NICKEL/ TEMPERATURE DISTRIBUTION

ABA: (Author)

ABS: A Japanese bituminous coal was treated with liquid  
ammonia at temperatures up to 120 C. Extract was  
separated from the treated coal by washing with  
benzene-ethanol mixture. The amount of extract was  
about 2% in a single treatment at 120 C and some  
additional extract was obtained by successive  
treatments. Particles of the residue had cracks and  
showed an increase in surface area. The  
ammonia-treated coal was found highly reactive toward  
gasification with hydrogen at high temperature when  
catalysed by nickel.

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OF POOR QUALITY

77A36329 ISSUE 16 PAGE 2779 CATEGORY B3  
77/00/00 26 PAGES UNCLASSIFIED DOCUMENT

UTTL: Economic comparison of synthetic fuels - Gasification and Liquefaction  
AUTH: A/KATELL, S.; B/WHITE, L. G. PAA: B/(U.S. Bureau of Mines, Process Evaluation Group, Morgantown, W. Va.)  
In: Synthetic fuels processing: Comparative economics: Proceedings of the Symposium, New York, N.Y., April 4-9, 1976. (A77-36326 16-44) New York, Marcel Dekker, Inc., 1977, p. 39-64.  
MAJS: /\*COAL GASIFICATION/\*COAL LIQUEFACTION/\*ECONOMIC ANALYSIS/\*ENERGY TECHNOLOGY/\*FLUIDIZED BED PROCESSORS/\*SYNTHETIC FUELS  
MINS: / CARBONIZATION/ CATALYTIC ACTIVITY/ COST EFFECTIVENESS/ FREE FALL/ HYDROGENATION/ METHANE/ PILOT PLANTS/ SYNTHANE  
ABA: G.R.  
ABS: One of the processes considered in the reported investigation is the Synthane process. Synthane is a process to convert bituminous and subbituminous coal and lignite to a high-Btu substitute pipeline gas. Free-fall carbonization plus steam-oxygen gasification of the pretreated coal in a fluidized bed is employed. Another process step involves the shift conversion of the gasifier synthesis gas to a H<sub>2</sub>:CO ratio of 3:1. The ultimate step is concerned with the catalytic methanation of the gas. A second process, called the Synthoil process, involves a fluid-phase hydrogenation of coal for the production of a low-sulfur heavy fuel oil. The Synthoil system can handle any type of coal and is being developed for the pilot plant phase. The economic analysis conducted shows that the costs for producing synthetic fuels are high in comparison with present energy prices.

78N79523# CATEGORY 26 RPT#: CONF-771092-4 CNT#: EY-76-C-02-2907 77/00/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Status of the HYGAS program  
AUTH: A/BAIR, W. G.  
CORP: Institute of Gas Technology, Chicago, Ill.  
AVAIL.NTIS  
Presented at 9th Synthetic Pipeline Gas Symp., Chicago, Ill. 31 Oct. 1977  
MAJS: /\*COAL GASIFICATION/\*EQUIPMENT SPECIFICATIONS/\*PILOT PLANTS  
MINS: / ENERGY POLICY/ MAINTENANCE/ STRUCTURAL DESIGN/ TECHNOLOGY ASSESSMENT

77A23716\* ISSUE 9 PAGE 1441 CATEGORY 44  
77/01/20 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: The thermal efficiency and cost of producing hydrogen and other synthetic aircraft fuels from coal  
AUTH: A/WITCOFSKI, R. D. PAA: A/(NASA, Langley Research Center, Hampton, Va.)  
CORP: National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.  
(Energy Research and Development Administration, World Hydrogen Energy Conference, 1st, Miami Beach, Fla., Mar. 1-3, 1976.) International Journal of Hydrogen Energy, vol. 1, Jan. 20, 1977, p. 365-377.  
MAJS: /\*AIRCRAFT FUELS/\*COAL GASIFICATION/\*COAL LIQUEFACTION/\*COST ANALYSIS/\*HYDROGEN FUELS/\*SYNTHETIC FUELS/\*THERMODYNAMIC EFFICIENCY  
MINS: / COST EFFECTIVENESS/ KEROSENE/ LIQUID HYDROGEN/ METHANE  
ABA: (Author)  
ABS: A comparison is made of the cost and thermal efficiency of producing liquid hydrogen, liquid

methane and synthetic aviation kerosene from coal. These results are combined with estimates of the cost and energy losses associated with transporting, storing, and transferring the fuels to aircraft. The results of hydrogen-fueled and kerosene-fueled aircraft performance studies are utilized to compare the economic viability and efficiency of coal resource utilization of synthetic aviation fuels.

78A43420 ISSUE 19 PAGE 3432 CATEGORY 23  
77/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fluid bed processing of agglomerating coals  
AUTH: A/YERUSHALMI, J. PAA: A/(New York, City University, New York, N.Y.)  
In: Coal processing technology. Volume 3. (A78-43403 19-44) New York, American Institute of Chemical Engineers, 1977, p. 156-165.  
MAJS: /\*CARBONIZATION/\*COAL GASIFICATION/\*FLUIDIZED BED PROCESSORS/\*PYROLYSIS  
MINS: / AGGLOMERATION/ DISPERSING/ PILOT PLANTS/ SYNTHANE  
ABA: V.P.  
ABS: Fluid bed technologies for processing coal may benefit substantially if a caking coal could be fed directly to the bed without pretreatment. In the present paper, a number of techniques that might be employed to process a caking coal in fluidized beds are discussed, and a technical basis for each of the techniques is developed. Particular attention is given to means of achieving effective dispersal of raw particles of coal in the dry char that comprises the bed.

78A14399# ISSUE 3 PAGE 349 CATEGORY 23  
77/10/00 7 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Current progress in materials development for coal conversion  
AUTH: A/SAMANS, C. H.; B/HULSIZER, W. R. PAA:  
B/(International Nickel Co., Inc., New York, N.Y.)  
ASME, Transactions, Series H - Journal of Engineering  
Materials and Technology, vol. 99, Oct. 1977, p.  
372-378.  
MAJS: /\*COAL GASIFICATION/\*CORROSION RESISTANCE/\*ENVIRONMENT  
SIMULATION/\*MATERIALS TESTS/\*PILOT PLANTS  
MINS: / CONTROLLED ATMOSPHERES/ CORROSION TESTS/ EROSION/  
HIGH TEMPERATURE TESTS/ PRESSURIZING  
ABA: (Author)  
ABS: A coal gasification materials program directed at  
developing engineering data on materials is described.  
Included are initial results on materials exposed in  
6.9 MPa simulated gasifier atmospheres at 755 K, 1089  
K, and 1255 K; a 6 MPa simulated regenerator  
atmosphere at 1285 K; and in pressurized aqueous  
environments simulating gasifier quench towers.  
Erosion/corrosion tests, scheduled to begin in the  
near future, are also described. Comparison of  
simulated exposure results with data from early

interrupted exposures in two operating pilot plants  
are reported indicating reasonable agreement except  
for a few pilot plant specimens which appeared to  
deteriorate rapidly because of operating conditions  
not thought previously to be corrosive.

78A13625 ISSUE 3 PAGE 424 CATEGORY 44 77/11/00  
7 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Energy - Fluid fuels from solids  
AUTH: A/OTHMER, D. F. PAA: A/(New York, Polytechnic  
Institute, Brooklyn, N.Y.)  
Mechanical Engineering, vol. 99, Nov. 1977, p. 29-35.  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*COAL GASIFICATION/\*  
GASEOUS FUELS/\*HYDROCARBON FUEL PRODUCTION/\*SHALE OIL  
MINS: / ENERGY TECHNOLOGY/ FUEL OILS/ LIQUEFACTION/ SOLIDS/  
TAR SANDS  
ABA: M.L.  
ABS: A survey of processes that produce gas or liquid fuels  
from solid fuels is presented. Approaches considered  
include gasification of coal, liquid fuels from coal,  
and oil and gas from oil shales. Additional sources  
considered include tar sands and bio-solids or  
biomass. The costs of various processes are examined.  
Overall, it is thought that more than \$1 trillion will  
be required to build energy plants in the U.S. alone  
in the near future.

78A12604 ISSUE 2 PAGE 252 CATEGORY 44 77/10/00  
9 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Clean fuels from coal - Finding the right combination  
AUTH: A/RITTENHOUSE, R. C.  
Power Engineering, vol. 81, Oct. 1977, p. 36-44.  
MAJS: /\*CLEAN ENERGY/\*COAL GASIFICATION/\*COAL UTILIZATION/\*  
COST EFFECTIVENESS/\*DEGASSING/\*FLUIDIZED BED  
PROCESSORS  
MINS: / ENVIRONMENT PROTECTION/ FUEL COMBUSTION/ PILOT  
PLANTS/ POLLUTION CONTROL/ THERMODYNAMIC CYCLES  
ABA: S.C.S.  
ABS: Attention is given to various current and projected  
coal degasification procedures for low and medium-Btu  
gas noting advanced gasification combined cycle  
systems and low-Btu gasifier integrated systems having  
combined cycle and solvent-refined coal subsystems.  
Studies of comparative fuel costs are reviewed for  
various alternatives. The Lurgi gasifier system is  
described in terms of projected development and design  
improvement. The solvent-refining coal (SRC) and  
fluidized bed combustion processes are discussed  
noting expected costs and the recently developed  
atmospheric fluidized bed pilot plant in West  
Virginia. Environmental considerations are treated  
briefly, comparing the impacts of various fuels and  
techniques.

78N16446# ISSUE 7 PAGE 897 CATEGORY 44 RPT#:  
ERDA-77-51 77/03/00 32 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Underground coal gasification program  
CORP: Energy Research and Development Administration,  
Washington, D. C. AVAIL:NTIS SAP: HC A03/MF A01  
MAJS: /\*COAL GASIFICATION/\*ENERGY TECHNOLOGY/\*UNDERGROUND  
STRUCTURES  
MINS: / COAL/ COAL UTILIZATION/ COMMERCIAL ENERGY  
ABA: ERA  
ABS: A brief overview of the ERDA program to develop  
underground coal gasification (UCG) technology is  
provided. The UCG program is part of ERDA's overall  
strategy to create energy choices for the future.  
General descriptions of the concept and its potential  
applications are included. The objective of the UCG  
program is to develop commercially viable, underground  
gasification processes for extracting energy from  
coal. Through government and industry joint  
participation, the technology will be developed,  
proved on a large scale, and transferred to the  
private sector; data will be provided to predict the  
economics of a commercial operation. ERDA's objectives  
and its support of national energy goals are shown.

77N33615# ISSUE 24 PAGE 3237 CATEGORY 44 RPT#:  
AD-A041860 EL-CR-77.013 CNT#: N68305-76-C-0009  
ZF57571001 77/04/00 114 PAGES UNCLASSIFIED  
DOCUMENT

JTTL: Coal gasification study TLSP: Final Report  
CORP: Bechtel Corp., San Francisco, Calif. AVAIL.NTIS

SAP: HC A06/MF A01  
MAJS: /\*COAL GASIFICATION/\*COST ANALYSIS/\*POLLUTION  
MONITORING

MINS: / AIR POLLUTION/ COAL/ ECONOMICS/ FUELS

ABA: Author (GRA)

ABS: The general problem of providing fuel gas for Navy base facilities is studied. The intent is: first, to provide designs of a coal gasification plant producing 6x 10 to the 9th power Btu/day reactor output, based on two types of reactors; second, to conduct parametric studies leading to means for the costing of similar plants operating on different feedstocks; and third, to provide a method for estimating the change in boiler rating which must follow the substitution of fuel gas for either oil or coal firing. The performance and economics given are based on conceptual design methods. The economic results allow comparison of fuel-gas and fuel-oil costs on the basis of the Navy's method of analyzing costs using the 'Economic Analysis Handbook,' NAVFAC P-442, 1975. The costs are the sum of all future outlays discounted to the present but allowing escalation at different rates for utilities and feedstock over a 25-year production period.

77A36763 ISSUE 16 PAGE 2731 CATEGORY 44  
77/00/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Coal gasification update

AUTH: A/FERRETTI, E. J.; B/KASPER, S. PAA: B/(Dravo Corp., Pittsburgh, Pa.)  
Energy Communications, vol. 3, no. 3, 1977, p. 203-211.

MAJS: /\*CHARCOAL/\*COAL GASIFICATION/\*COAL UTILIZATION/\*  
ENERGY POLICY/\*ENERGY TECHNOLOGY

MINS: / BEDS (PROCESS ENGINEERING)/ DOMESTIC ENERGY/  
HYDROCARBON FUELS/ SYNTHANE

ABA: C.K.D.

ABS: Recent advances in coal gasification projects are summarized. Commercial ventures using the Lurgi, Winkler, and Koppers processes are briefly described, and progress in research and development projects involving new gasification processes is outlined. Possible reasons for the sharp upswing in projected capital cost of high BTU commercial scale plants are examined.

78N10561# ISSUE 1 PAGE 82 CATEGORY 44 RPT#:  
AD-A042385 CNT#: N68305-76-C-0009 77/04/00 102  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Coal gasification study handbook TLSP: Final Report  
CORP: Bechtel Corp., San Francisco, Calif. AVAIL.NTIS

SAP: HC A06/MF A01

MAJS: /\*COAL/\*COAL GASIFICATION/\*HANDBOOKS

MINS: / BOILERS/ COST ANALYSIS/ ENVIRONMENT PROTECTION/  
SULFUR

ABA: Author (GRA)

ABS: The purpose of this handbook is to provide: first, a procedure for evaluating the costs of a coal gasification plant in terms of the capital investment and operating costs. These are to be sensitive to several parameters defining coal, fuel gas, and sulfur emissions; second, a procedure for the derating of Navy base boilers, to reflect the change in performance resulting from introduction of fuel gas in place of coal or oil. The gas plant analysis is based in part on a detailed analysis of the gas treatment section of the plant. The remaining part of the plant performance is based on conventional stoichiometry and near approach to equilibrium in the gas production section. The boiler derating method is based on observations of the relative contribution to heat transfer made by radiation and convection, and on conventional relations describing these transfer processes.

78N13241\*# ISSUE 4 PAGE 456 CATEGORY 31 RPT#:  
NASA-CR-155331 JPL-PUB-77-55 CNT#: NAS7-100  
77/09/15 726 PAGES UNCLASSIFIED DOCUMENT

UTTL: Proceedings of the conference on Coal Feeding Systems  
CORP: Jet Propulsion Lab., California Inst. of Tech.,  
Pasadena. AVAIL.NTIS SAP: HC A99/MF A01

Sponsored by ERDA Proc. held at Pasadena, Calif.,  
21-23 Jun. 1977

MAJS: /\*COAL GASIFICATION/\*CONFERENCES/\*ENERGY CONVERSION/\*  
ENERGY TECHNOLOGY/\*FEED SYSTEMS

MINS: / ECONOMIC FACTORS/ ENVIRONMENT EFFECTS/ FLUIDIZED BED  
PROCESSORS/ MAGNETOHYDRODYNAMICS/ PRODUCTION  
ENGINEERING

ANN: Development of coal feed systems for coal gasification, fluidized bed combustion, and magnetohydrodynamic applications is discussed. Process operations experience, energy conversion efficiency, and environment effects are among the factors considered.

78N25575# ISSUE 16 PAGE 2140 CATEGORY 44 RPT#:  
ANL/CEN/FE-77-2 CNT#: W-31-109-ENG-38 77/06/00 20  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Laboratory support for in situ gasification reaction kinetics TLSP: Quarterly Report, Jan. - Mar. 1977  
AUTH: A/FISCHER, J.; B/YOUNG, J. E.; C/JOHNSON, J. E.;  
D/BOWYER, D. C.; E/JONKE, A. A.  
CORP: Argonne National Lab., Ill. AVAIL.NTIS SAP: HC  
A02/MF A01

MAJS: /\*CHARRING/\*COAL GASIFICATION/\*REACTION KINETICS  
MINS: / HYDROGENATION/ PHASE TRANSFORMATIONS/ PYROLYSIS/  
TEMPERATURE EFFECTS

ABA: ERA

ABS: Support studies for the national endeavor on in-situ coal gasification are reported. The objective is to determine the reaction-controlling variables and reaction kinetics for gasification of chars resulting when coal is pyrolyzed in underground gasification. The reactions to be studied include steam-char, CO<sub>2</sub>-char, H<sub>2</sub>-char, and the water-gas shift reaction. Kinetic data related to the reaction of steam with Wyodak subbituminous coal are presented. The temperature dependence of the reaction, the apparent reaction order with respect to steam, and inhibitory effects of hydrogen are discussed.

78N26007# ISSUE 16 PAGE 2197 CATEGORY 85 CNT#:  
NSF ENG-75-10251 77/00/00 14 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Ultrafiltration and hyperfiltration of phenolic compounds in coal gasification wastewater streams

AUTH: A/KLEMETSON, S. L.; B/SCHARBOW, M. D.  
CORP: North Dakota State Univ., Fargo. CSS: (Dept. of Civil Engineering.) AVAIL.NTIS SAP: HC A02/MF A01  
Sponsored in part by DOE Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater

MAJS: /\*COAL GASIFICATION/\*FILTRATION/\*PHENOLS/\*WASTE WATER  
MINS: / MEMBRANES/ REVERSE OSMOSIS/ WATER TREATMENT/  
ZIRCONIUM OXIDES

ABA: Author

ABS: The treatment of phenolic compounds from coal gasification plants using ultrafiltration and hyperfiltration is presented. Dynamically formed hydrous zirconium (IV) oxide membranes on several types of supports were the focus of the investigation. The pH variations of 6.5 to 11, pressure variations of 250 to 1000 psig (1724 to 6895 kPa), and concentration variations of 1 to 400 mg/l were examined. Phenol reductions greater than 95 percent were obtained with several membranes, and flux rates were greater than 100 gpd/sq ft (4.08 cu m/day/sq m).

77A48177 ISSUE 23 PAGE 3978 CATEGORY 44  
77/00/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Reaction rate analysis of borehole 'in-situ' gasification systems

AUTH: A/STEWART, I. MCC.; B/WALL, T. F. PAA:  
B/(Newcastle University, Newcastle, New South Wales, Australia)

In: Symposium on Combustion (International), 16th, Cambridge, Mass., August 15-20, 1976, Proceedings, (A77-48158 23-25) Pittsburgh, Pa., Combustion Institute, 1977, p. 525-533. Research supported by the National Coal Research Advisory Committee.

MAJS: /\*COAL GASIFICATION/\*COMPUTERIZED SIMULATION/\*ENERGY TECHNOLOGY/\*REACTION KINETICS

MINS: / BURNING RATE/ EVAPORATION/ MATHEMATICAL MODELS/  
OXIDATION

ABA: J.M.B.

ABS: Two methods of in situ borehole coal gasification, the plug-flow reduction system and the well-stirred oxidation system, are studied. In particular, carbon gasification, strata losses and gas and surface temperatures for a range of coal properties, bed and moisture contents and blast conditions are investigated, and the relative influence of mass transfer and chemical reaction rate on the combustion processes is assessed. Computations describing the combustion reactions suggest that a plug-flow tapering reduction zone is dominated by mass-transfer effects and that a high gasification efficiency may be possible with an oxygen-steam blast and elevated combustion zone exit temperatures. For the well-stirred reactor model, a notable influence of moisture balance on ignition stability is found; in addition, it is concluded that an oxygen-steam blast with preheat could produce synthesis gas at high efficiency in a jet-stirred reactor.

79N78979# CATEGORY 28 RPT#: FE-2276-15 CNT#:  
EX-76-C-01-2276 77/10/00 105 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Development studies of selected conversion of synthesis gas from coal to high octane gasoline TLSP: Quarterly Report, Jul. - Sep. 1977

AUTH: A/BRENNAN, J. A.  
CORP: Mobil Research and Development Corp., Paulsboro, N. J. AVAIL.NTIS

MAJS: /\*COAL GASIFICATION/\*COAL UTILIZATION/\*ENERGY TECHNOLOGY/\*SYNTHETIC FUELS

MINS: / CATALYSTS/ ENERGY CONVERSION/ GASOLINE/ REACTOR TECHNOLOGY

77A48473 ISSUE 23 PAGE 3978 CATEGORY 44

77/09/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Underground coal gasification - A status report  
AUTH: A/SCHRIDER, L. A.; B/WHIELDON, C. E. PAA:  
B/(Morgantown Energy Research Center, Morgantown, W.  
Va.)

(American Institute of Mining, Metallurgical and  
Petroleum Engineers, Eastern Regional Meeting,  
Columbus, Ohio, Nov. 18-19, 1976.) Journal of  
Petroleum Technology, vol. 29, Sept. 1977, p.  
1179-1185.

MAJS: /\*BEDS (PROCESS ENGINEERING)/\*COAL GASIFICATION/\*  
ENERGY TECHNOLOGY/\*PILOT PLANTS/\*UNDERGROUND  
STRUCTURES/\*WELLS

MINS: / ENERGY POLICY/ GRAPHS (CHARTS)/ PRODUCTION PLANNING/  
TECHNOLOGY ASSESSMENT

ABA: W.L.

ABS: Three in situ coal gasification techniques, the packed  
bed reactor approach for thick seams (50 ft or  
greater), the longwall generator concept for thin  
seams (15 ft or less), and the linked vertical well

method for intermediate seams (15 to 50 ft), are  
described. The second Hanna experiment, which tested  
the linked well method, is discussed, with attention  
to the instrumentation techniques used. The results of  
the Hanna experiments show a marked improvement with  
each successive test as a result of higher injection  
rates and the backpressuring of the formation. These  
procedures have produced a favorable air/water ratio  
for in situ coal gasification. Phases 2 and 3 of Hanna  
experiment are compared.

78V47964 1977 ISS: 00 TP759.596 1976 665.772 LC-  
78-313616

UTTL: Proceedings of Eighth Synthetic Pipeline Gas  
Symposium, Ramada O'Hare Inn, O'Hare Airport, Chicago,  
Illinois, October 18-20, 1976 / sponsored by American  
Gas Association, Energy Research and Development  
Administration, and International Gas Union.  
8th, Synthetic Pipeline Gas Symposium, Chicago, 1976.  
AGA. (Arlington, Va.): 559 p. : ill. : 29 cm.  
\$50.00 Includes bibliographical references.  
LC: Coal gasification -- Congresses.  
ADDED: American Gas Association, United States, Energy  
Research and Development Administration, International  
Gas Union.

MAIN-MEET TRACE-CORP\* CATLG BY-LC

78N21318# ISSUE 12 PAGE 1559 CATEGORY 28 RPT#:  
ERHO-0015 77/08/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Low-Btu coal gasification

CORP: Energy Research and Development Administration,  
Washington, D. C. AVAIL.NTIS SAP: HC A02/MF A01  
MAJS: /\*COAL GASIFICATION/\*COAL UTILIZATION/\*ENERGY POLICY  
MINS: / BITUMENS/ ENERGY CONVERSION/ FEASIBILITY ANALYSIS/  
LOW COST/ SULFUR

ABA: ERA

ABS: The evaluation of technical and economical integration  
of low Btu coal gasification technology in various  
operational environments was studied. The projects  
were to be limited to 8 t/hr capacity and only state  
of the art technologies were to be used. Projects were  
selected on the basis of overall technical  
feasibility, financial contribution by the  
participants, qualifications of the offerer and  
partners, ability to finance, total cost of the  
projects, application, and type of gasifiers. The

projects include the use of anthracite coal as well as  
low and high sulfur bituminous coals. Also included  
were one and two stage gasifiers, oil, and tar removal  
and reuse, and secondary systems for sulfur removal  
from the product gas.

78A33148# ISSUE 13 PAGE 2361 CATEGORY 37 RPT#:  
ASME PAPER 77-WA/ENER-10 77/11/00 9 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: A low-risk approach to the high-temperature turbine

AUTH: A/CARLSON, N. G.; B/ROBSON, F. L.; C/WESTMORELAND,  
J. S. PAA: B/(United Technologies Research Center,  
East Hartford, Conn.); C/(United Technologies Corp.,  
Pratt and Whitney Aircraft Group, East Hartford,  
Conn.) SAP: MEMBERS, \$1.50; NONMEMBERS, \$3.00  
American Society of Mechanical Engineers, Winter  
Annual Meeting, Atlanta, Ga., Nov. 27-Dec. 2, 1977, 9  
p.

MAJS: /\*COAL GASIFICATION/\*COOLING SYSTEMS/\*ENGINE DESIGN/\*  
GAS TURBINE ENGINES/\*HIGH TEMPERATURE GASES/\*  
TURBOGENERATORS

MINS: / AIR COOLING/ COMBUSTION CHAMBERS/ ENERGY CONVERSION  
EFFICIENCY/ ENERGY TECHNOLOGY/ LIQUID COOLING/  
MAINTENANCE/ TURBINE BLADES/ VANES

ABA: J.M.B.

ABS: An ERDA-sponsored program to develop high-temperature  
turbines for electrical power generation contemplates  
a nominal 100-MW frame size operating at 1425 C in a  
combined steam and gas turbine cycle. Water-cooled and  
air-cooled designs are considered; internal cooling of  
the high- and low-pressure vanes by subcooled boiling  
water is described. Emission control measures and  
combustor durability at high firing temperatures also  
receives attention.

78A27788 ISSUE 10 PAGE 1790 CATEGORY 44  
77/09/00 14 PAGES UNCLASSIFIED DOCUMENT  
UTTL: The gasification of coal  
AUTH: A/GAUSSSENS, P. PAA: A/(Gaz de France, Paris, France)  
(Conference Mondiale de l'Energie, 10th, Istanbul,  
Turkey, Sept. 19-23, 1977.) Revue de l'Energie, vol.  
28, Aug.-Sept. 1977, p. Sp. 162-Sp. 175. In English  
and French.  
MAJS: /\*COAL GASIFICATION/\*NATURAL GAS/\*SYNTHANE  
MINS: / CARBON/ CHEMICAL REACTORS/ ENERGY TECHNOLOGY/  
HYDROGEN/ INTERNATIONAL COOPERATION/ NUCLEAR HEAT/  
PILOT PLANTS  
ABA: S.C.S.  
ABS: A technique for producing synthetic natural gases  
(SNG) from coal at maximum grid system pressures is  
proposed. The method basically consists of: (1)  
adjusting the carbon-to-hydrogen weight ratio of the  
reacting mixture, (2) causing the major part of the  
coal's carbon to react with the hydrogen, and (3)  
eliminating impurities. The Lurgi process is the most  
common method for producing SNG from solid fuels, and  
several large plants utilizing Lurgi reactors are  
presently being developed. In addition, various second  
generation processes are in the pilot stage, and it is  
estimated that by 1995 approximately 30 industrial  
plants may be fully operational. Third generation  
processes for producing SNG from coal with the aid of  
nuclear heat are being considered along with the  
underground gasification of coal in situ at depths to  
300 m.

77V37133 1977 ISS: 00 TP759.L33 0-815506-70-8 665.772  
LC-77-77022  
AUTH: A/Lamb, George H.  
UTTL: Underground coal gasification / George H. Lamb,  
Noyes Data Corp., Park Ridge, N.J. : xii, 255 p. :  
iii. : 25 cm.  
Energy technology review : no. 14 \$36.00 Bibliography:  
p. 251-255.  
LC: Coal gasification, Underground.  
NASA: / CHEMICAL REACTIONS/ COAL GASIFICATION/ ENERGY  
POLICY/ ENERGY TECHNOLOGY/ FOSSIL FUELS/ MINES  
(EXCAVATIONS)/ PRODUCTION ENGINEERING  
MAIN-AUTH TRACE-SERS\*TITL\* CATLG BY-LC  
/ / AVAIL: / LANGLEY

77A51156 ISSUE 24 PAGE 4187 CATEGORY 44  
77/09/00 6 PAGES In GERMAN UNCLASSIFIED DOCUMENT  
UTTL: The future production of liquid and gaseous  
hydrocarbons through coal gasification and the  
long-term prospects of a hydrogen technology  
AUTH: A/PETERS, W.: B/SCHULTEN, R.: C/SPEICH, P. PAA:  
A/(Steinkohlenbergbauverein, Essen, West Germany);  
B/(Kernforschungsanlage Juelich GmbH, Juelich, West  
Germany); C/(Rheinische Braunkohlenwerke AG, Cologne,  
West Germany)  
Brennstoff-Waerme-Kraft, vol. 29, Sept. 1977, p.  
371-376. In German.  
MAJS: /\*COAL GASIFICATION/\*ENERGY TECHNOLOGY/\*HYDROCARBON  
FUEL PRODUCTION/\*HYDROGEN-BASED ENERGY  
MINS: / GERMANY/ HIGH TEMPERATURE NUCLEAR REACTORS/ HYDROGEN  
PRODUCTION/ METHANE

79N79204# CATEGORY 28 RPT#: DOE/ET-0024/1 CNT#:  
EX-76-C-01-2297 77/12/00 71 PAGES UNCLASSIFIED  
DOCUMENT  
UTTL: Coal gasification TLSP: Quarterly Report, Jan. -  
Mar. 1977  
CORP: Department of Energy, Washington, D. C. CSS: (Coal  
Conversion Div.) AVAIL:NTIS  
MAJS: /\*COAL GASIFICATION/\*ENERGY POLICY/\*ENERGY TECHNOLOGY  
MINS: / ELECTRICITY/ HYDROGEN PRODUCTION/ MATHEMATICAL  
MODELS/ METHANE/ PILOT PLANTS/ PRODUCTION ENGINEERING/  
SYNTHANE

77V30752 1977 ISS: 42 TP315.A512 VOL.22 NO.1  
UTTL: Symposium on coal gasification kinetics; TLSP:  
symposium on gasification of coal to produce low BTU  
gas. Preprints of papers presented at the 173rd  
national meeting, New Orleans, March 21-25, 1977,  
American Chemical Society, Division of Fuel  
Chemistry,  
Pittsburgh 198 p.  
Its Preprints, v. 22, no. 1  
LC: Coal.  
NASA: / COAL GASIFICATION/ CONFERENCES/ KINETICS  
MAIN-CORP TRACE-TITL\* CATLG BY-JPL  
77/06/10 AVAIL: / JPL

77A23392# ISSUE 9 PAGE 1437 CATEGORY 44  
76/07/01 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: Coal - The fossil energy source for the transition period

AUTH: A/WU, Y.-C.  
Energy Quarterly, vol. 6, July 1, 1976, p. 1-15.

MAJS: /\*COAL GASIFICATION/\*COAL LIQUEFACTION/\*COAL UTILIZATION

MINS: / AIR POLLUTION/ CHEMICAL REACTIONS/ FUEL COMBUSTION/ MINING/ PYROLYSIS

ABA: S.D.

ABS: Coal is the one fossil energy source that can play a substantial role as a transitional energy source as one moves from the petroleum and natural gas based economic system to the future economic system based on nondepletable or renewable energy systems. The discussion is centered around classification of coal, problems related to the use of coal, and techniques of coal conversion and associated technologies. The basic chemistry of coal gasification is outlined along with the Lurgi gasification and related synthesis processes and the Garrett flash pyrolysis process. Great efforts are still necessary before commercialization is possible.

77A27286# ISSUE 11 PAGE 1859 CATEGORY 44  
76/08/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: The SYNTHANE process - Current status --- coal gasification

AUTH: A/HAYNES, W. P.; B/STRAKEY, J. P.; C/LEWIS, R.  
PAA: C/(ERDA, Pittsburgh, Pa.)  
University of Pittsburgh, Annual International Conference on Coal Gasification and Liquefaction, 3rd, Pittsburgh, Pa., Aug. 3-5, 1976, Paper, 14 p.

MAJS: /\*COAL GASIFICATION/\*ENERGY TECHNOLOGY/\*PILOT PLANTS/\* SYNTHANE

MINS: / FLOW CHARTS/ THERMODYNAMIC EFFICIENCY

ABA: B.J.

ABS: The SYNTHANE process is a fairly simple coal gasification process with no major recycle streams and therefore has the potential of operating with a high on-stream factor. It is designed to operate at pressures up to 1000 psi with any of the coals or lignites available in the U.S. and its thermal efficiency has been calculated to be 65-70%. The paper reviews shakedown and orientation tests completed on the gasifier section of the 72 ton per day SYNTHANE pilot plant, along with initial gasification tests with Rosebud subbituminous coal.

77A27300# ISSUE 11 PAGE 1860 CATEGORY 44 CNT#:  
E(49-18)-1207 76/08/00 20 PAGES UNCLASSIFIED DOCUMENT

UTTL: Current status of the BI-GAS process

AUTH: A/YOUNG, R. K. PAA: A/(Bituminous Coal Research, Inc., Monroeville, Pa.)  
University of Pittsburgh, Annual International Conference on Coal Gasification and Liquefaction, 3rd, Pittsburgh, Pa., Aug. 3-5, 1976, Paper, 20 p.  
Research supported by the American Gas Association;

MAJS: /\*COAL GASIFICATION/\*ENERGY TECHNOLOGY/\*METHANE/\* PRESSURE EFFECTS/\*TECHNOLOGY ASSESSMENT

MINS: / COAL UTILIZATION/ FLUIDIZED BED PROCESSORS/ HYDROGEN / PARTIAL PRESSURE/ PILOT PLANTS/ SYNTHETIC FUELS/ SYSTEMS ENGINEERING/ TEMPERATURE EFFECTS

ABA: B.J.

ABS: In the BI-GAS coal gasification process, coal is introduced into the upper section of the gasifier at pressures of 1000-1500 psi. The coal comes in contact with a stream of hot synthesis gas produced in the lower section of the gasifier and is partially converted into methane and an additional synthesis gas. Experimental results on the stage 2 process equipment development unit show the following conclusions: methane yield depends upon coal rank and processing conditions such as temperature and partial pressure of hydrogen; the direct methanation process is applicable to several different types of coal; yield of methane expressed as percent conversion of carbon in coal increases with coal rank.

77V22537 1976 ISS: 10 TP579.U74 665.772: 662.66

AUTH: A/Thompson, P. N.; B/Mann, J. R.; C/Williams, F.  
UTTL: Underground gasification of coal, TLSP: a National Coal Board reappraisal 1976.

National Coal Board.  
National Coal Board, n.p. 72 p. : ill. : 30 cm.  
Bibliography: p. 70. Prepared for the National Coal Board by the Operational Research Executive Coal House...

LC: Coal gasification, Underground.  
NASA: / CARBON MONOXIDE/ COAL/ COAL GASIFICATION/ COAL UTILIZATION/ COST ANALYSIS/ COSTS/ DRILLING/ ENVIRONMENT EFFECTS/ GASES/ HEATING/ HYDROGEN/ INDUSTRIAL SAFETY/ LAND USE/ MINING/ NOISE (SOUND)/ OXYGEN

LA: / TP759.T56 STIF: / TP759.T56  
MAIN-TITL TRACE-CORP-AUTH\* CATLG BY-LC  
77/03/08 AVAIL: / LANGLEY/ LEWIS

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OF POOR QUALITY

77N26631\*# ISSUE 17 PAGE 2285 CATEGORY 44  
RPT#: NASA-CR-134949-VOL-1 SRD-76-054-1-VOL-1 CNT#: 1  
NAS3-19406 E(49-18)-1751 NSF AG-551 75/12/00 54  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy Conversion Alternatives Study (ECAS), phase 2.  
Volume 1: Executive summary TLSP: Final Report  
AUTH: A/CORMAN, J. C.; B/FOX, G. R.  
CORP: General Electric Co., Schenectady, N. Y. AVAIL:NTIS  
SAP: HC A04/MF A01  
MAJS: /\*COAL GASIFICATION/\*ELECTRIC POWER PLANTS/\*ENERGY  
CONVERSION EFFICIENCY/\*UTILITIES  
MINS: / COST ESTIMATES/ ELECTRIC GENERATORS/ ELECTRICITY  
ABA: Author  
ABS: A data base for the comparison of advanced energy  
conversion systems for electric utility baseload  
applications using coal or coal-derived fuels was

developed. Conceptual designs were developed for seven systems to permit estimates of power plant efficiency, capital cost, environmental intrusion characteristics, natural resource requirements, and cost of electricity at an assumed capacity factor of 65%. The systems studied were advanced steam with atmospheric fluidized bed (AFB) and pressurized fluidized bed (PFB) heat input subsystems, a closed helium gas turbine (organic bottoming) with an AFB, a potassium topping cycle with a PFB, a combined cycle gas turbine-water cooled-burning a coal-derived liquid fuel, a combined cycle gas turbine-air cooled-integrated with LBtu gasification, and an open cycle MHD system. An emissions limit target was specified for the power plant conceptual designs. A steam power plant (3,500 psig/1000 F/1000 F) with a coal-burning radiant furnace and a wet lime stack gas scrubber (stack reheat to 250 F), analyzed in a study using the same groundrules as ECAS, were used as references for comparison. All of the systems exhibited an estimated efficiency better than the 32% reference case. Five of the systems showed a lower cost of electricity than the 39.8 mills/kwh reference case. Development plans and cost estimates were prepared for the energy conversion portion of the respective systems. An implementation assessment was performed to estimate the potential applicability of the advanced energy conversion systems in electric utility generation systems.

77A40029 ISSUE 18 PAGE 3017 CATEGORY 26  
76/00/00 18 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Corrosion behavior of materials for coal-gasification applications  
AUTH: A/NATESAN, K.; B/CHOPRA, O. K. PAA: B/(Argonne National Laboratory, Argonne, Ill.)  
In: Symposium on Properties of High Temperature Alloys with Emphasis on Environmental Effects, Las Vegas, Nev., October 17-22, 1976, Proceedings, (A77-40012 18-26) Princeton, N.J., Electrochemical Society, Inc., 1976, p. 493-510. ERDA-supported research.  
MAJS: /\*COAL GASIFICATION/\*CORROSION RESISTANCE/\*STAINLESS STEELS  
MINS: / CORROSION TESTS/ ELECTRON MICROSCOPES/ HIGH TEMPERATURE TESTS/ INCONEL (TRADEMARK)/ IRON ALLOYS/ OXIDATION RESISTANCE  
ABA: M. L.  
ABS: The paper reports a thermodynamic analysis of phase stability in commercial alloys such as Type 304 stainless steel, Incoloy 800, and Inconel 671 upon exposure to gas environments anticipated in different coal-gasification processes. The analysis showed that a high chromium content in the alloy is beneficial for corrosion resistance in these environments, while nickel limits this trait. Scanning-electron micrographs of alloy samples which have been exposed to the gases are presented. The results indicate that under oxidizing conditions the alloys can develop a protective chromium-rich oxide layer which prevents both sulfidation and carburization. However, under marginally oxidizing and reducing conditions, the alloys exhibited extensive sulfidation and carburization.

78V26112 1976 ISS: 00 IP759.F78 0-842272-66-6  
665.77208 LC-74-26745  
AUTH: A/Schora, Frank C.; B/Berkowitz, Norbert.; C/Hegarty, W. P. B/1923-  
UTTL: Fuel gases from coal : TLSP: papers / by C. F. Schora Jr., N. Berkowitz, W. P. Hegarty, et al.  
MSS Information Corp., New York : 202 p. : ill. : 23 cm.  
MSS series on energy-related technology \$17.50  
Includes bibliographical references and indexes.  
LC: Coal gasification -- Addresses, essays, lectures.  
Liquid fuels -- Addresses, essays, lectures.  
MAIN-AUTH TRACE-SERS\*AUTH\* CATLG BY-LC  
/ /

77A12685 ISSUE 2 PAGE 233 CATEGORY 44 76/00/00  
7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Solids gasification for gas turbine fuel 100 and 300 Btu gas

AUTH: A/CROUCH, W. B.; B/KLAPATCH, R. D. PAA: A/(Texaco, Inc., Montebello, Calif.); B/(Turbo Power and Marine Systems, Inc., Farmington, Conn.)

In: Intersociety Energy Conversion Engineering Conference, 11th, State Line, Nev., September 12-17, 1976, Proceedings, Volume 1. (A77-12662 02-44) New York, American Institute of Chemical Engineers, 1976, p. 268-274.

MAJS: /\*CLEAN ENERGY/\*ENERGY TECHNOLOGY/\*GAS TURBINES/\*GASIFICATION/\*TURBOGENERATORS

MINS: / COAL GASIFICATION/ COMBUSTION PRODUCTS/ ENERGY CONVERSION EFFICIENCY/ NITROGEN OXIDES

ABA: S.D.

ABS: A development program has demonstrated that low and medium Btu gas can be burned efficiently in a gas turbine. Experimental operation and typical results of gasification of a variety of solid and liquid materials by the Texaco synthesis gas generation process and Texaco coal gasification process are described. Operating performance data for a gas turbine combustor fired on both 100 and 300 Btu/scf fuel gas produced by Texaco gasification technology are reported, including NOx and CO emissions data. The effect of steam injection for NOx reduction when burning low-Btu gas is assessed. A method is described for efficient conversion of fuels with a high nitrogen content to electrical power with minimal NOx emissions.

78V56256 1976 ISS: 00 TP759.G72 1976 665.772 LC-78-317763

AUTH: A/Thompson, P. N.; B/Mann, J. R.; C/Williams, F.

UTTL: Underground gasification of coal : TLSP: a National Coal Board reappraisal, 1976 / prepared for the National Coal Board by the Operational Research Executive ... (written by) P. N. Thompson, J. R. Mann, F. Williams.

Great Britain. National Coal Board. Operational Research Executive.

N.C.B., London : 70 p. : ill. : 30 cm.

5.00

LC: Coal gasification, Underground.

MAIN-CORP TRACE-TITL\*AUTH\* CATLG BY-LC

/ / Publ In UNITED KINGDOM

77A43931# ISSUE 20 PAGE 3385 CATEGORY 25  
76/00/00 10 PAGES In RUSSIAN UNCLASSIFIED  
DOCUMENT

UTTL: Theoretical investigation of heat and mass transfer between reacting components, separated by a gas layer

AUTH: A/RYSBANIN, S. S.; B/STRUNIN, V. A.  
In: Heat and mass transfer - V: All-Union Conference on Heat and Mass Transfer, 5th, Minsk, Belorussian SSR, May 17-20, 1976, Proceedings, Volume 2.

(A77-43880 20-34) Minsk, AN BSSR Institut Teplo- i Massobmena, 1976, p. 30-39. In Russian.

MAJS: /\*AEROTHERMOCHEMISTRY/\*CHEMICAL REACTIONS/\*GASIFICATION/\*HEAT TRANSFER/\*MASS TRANSFER/\*SURFACE REACTIONS

MINS: / CONTINUITY EQUATION/ EQUATIONS OF MOTION/ HYDRODYNAMIC EQUATIONS/ LAMINAR FLOW/ NUSSELT NUMBER/ REYNOLDS NUMBER

ABA: B.J.

ABS: The paper examines heat and mass transfer in a heterogeneous condensed system, when the chemical reactions that lead to gasification occur on the surface of the components; the components are separated by a gas layer of reaction products through which the heat and mass transfer occurs. The problem is reduced to the solution of equations of hydrodynamics and heat and mass transfer in the gas layer with boundary conditions which depend on the surface reactions.

78V52392 1976 ISS: 00 TP759.I44 1976 665.772 LC-78-622080

UTTL: Commonwealth Edison gasification combined cycle test facility : TLSP: technical and economic review : proposal for funding : prepared for Illinois Energy Resources Commission / prepared by Division of Energy, with the assistance of Research and Development Department, Amoco Oil Company.

Illinois, Division of Energy.  
The Division, (Springfield) : vii, 80 p. : ill. : 28 cm.

Cover title. Includes bibliographical references.

LC: Coal gasification.

ADDED: Illinois. Energy Resources Commission. Amoco Oil Company. Research and Development Dept.

Gasification combined cycle test facility..

MAIN-CORP TRACE-CORP\*TITL\* CATLG BY-LC

/ /

77A20074# ISSUE 7 PAGE 1064 CATEGORY 44  
76/11/00 7 PAGES In HUNGARIAN UNCLASSIFIED  
DOCUMENT

UTTL: Coal gasification and its relation to tested power plants

AUTH: A/GERGELY, B. PAA: A/(Budapesti Muszaki Egyetem, Budapest, Hungary)  
Energia es Atomtechnika, vol. 29, Nov. 1976, p. 481-487. In Hungarian.

MAJS: /\*COAL GASIFICATION/\*ELECTRIC POWER PLANTS/\*ENERGY TECHNOLOGY/\*HIGH TEMPERATURE NUCLEAR REACTORS

MINS: / BLOCK DIAGRAMS/ ENERGY CONVERSION EFFICIENCY/ GAS TRANSPORT

ABA: R.D.V.

ABS: Coal gasification (CG) processes, both autothermic and with nuclear power backup, are described, with

flowsheets, along with dual-power plants based on combined gas and steam use, and combined nuclear and CG plants. Gasification of coal with the aid of heat from high-temperature reactors (HTR) is given close attention, along with the transportation of gas from combined HTR-CG plants to distant users, as part of a regional energy utilities system. Flowsheets using lignite or bituminous coals, with slag, methane, coke, tar, CO<sub>2</sub>, H<sub>2</sub>S product streams, are presented. The outlook for profitable combined HTR-CG plants under present Hungarian conditions is examined, along with gas-heating and water-heating applications, with cautious optimism.

77N26637\*# ISSUE 17 PAGE 2287 CATEGORY 44  
RPT#: NASA-CR-134955 FCR-0237 CNT#: NAS3-19586  
76/10/19 171 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy Conversion Alternatives Study (ECAS), phase 2. Integrated coal gasifier/molten carbonate fuel cell powerplant conceptual design and implementation assessment TLSP: Final Report

AUTH: A/KING, J. M., JR.

CORP: United Technologies Corp., South Windsor, Conn.; Burns and Roe, Inc., New York.; Institute of Gas Technology, Chicago, Ill. AVAIL.NTIS SAP: HC AOB/MF A01

Prepared in cooperation with Burns and Roe, Inc. and the Inst. of Gas Technol.

MAJS: /\*COAL GASIFICATION/\*ELECTRIC POWER PLANTS/\*ENERGY CONVERSION EFFICIENCY/\*UTILITIES

MINS: / COST ESTIMATES/ ELECTRIC GENERATORS/ ELECTRICITY/ FUEL CELLS

ABS: For abstract, see . 77N 26631

77A12683 ISSUE 2 PAGE 233 CATEGORY 44 76/00/00  
5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Catalytic coal gasification for SNG production --- Synthetic Natural Gas

AUTH: A/EPPERLY, W. R.; B/SIEGEL, H. M. PAA: B/(Exxon Research and Engineering Co., Baytown, Tex.)  
In: Intersociety Energy Conversion Engineering Conference, 11th, State Line, Nev., September 12-17, 1976, Proceedings, Volume 1. (A77-12662 02-44) New York, American Institute of Chemical Engineers, 1976, p. 249-253.

MAJS: /\*CATALYSIS/\*COAL GASIFICATION/\*NATURAL GAS/\*SYNTHANE  
MINS: / ALKALI METALS/ CHEMICAL ANALYSIS/ RESEARCH AND DEVELOPMENT/ THERMODYNAMICS/ VAPOR PHASES

ABA: B.J.

ABS: The catalytic coal gasification process of Exxon for the production of substitute natural gas (SNG) is described. The alkali carbonate catalyst increases the rate of steam gasification, prevents agglomeration when gasifying caking coals, and promotes gas phase methanation equilibrium. The process uses a low gasifier temperature of 650-750 C along with separation of synthesis gas (CO and H<sub>2</sub>) from the product methane and recycling of the synthesis gas to the gasifier. The only net products of gasification are CH<sub>4</sub>, CO<sub>2</sub>, and small quantities of H<sub>2</sub>S and NH<sub>3</sub>, and the overall gasification step is essentially thermoneutral.

77N80153# CATEGORY 44 RPT#: CONF-760838-2 CNT#:  
E(49-18)-2434 76/00/00 13 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: HYGAS process update

AUTH: A/VORRES, K. S.

CORP: Institute of Gas Technology, Chicago, Ill. AVAIL.NTIS

Paper presented at 3rd Ann. Conf. on Coal Gasification and Liquefaction, Pittsburgh, 3-5 Aug. 1976

MAJS: /\*COAL GASIFICATION/\*ENERGY TECHNOLOGY/\*INDUSTRIAL PLANTS

MINS: / ENERGY POLICY/ HYDROGEN-BASED ENERGY/ TECHNOLOGY

79N77539# CATEGORY 28 RPT#: PB-291912/4  
NSF/RA-76166B CNT#: NSF GI-34286 76/00/00 303  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Studies toward improved techniques for gasifying coal TLSP: Final Report, 1 Jun. 1972 - 31 Jul. 1976

AUTH: A/GRAFF, R. A.; B/YERUSHALMI, J.; C/SQUIRES, A. M.  
CORP: City Coll. of the City Univ. of New York. CSS: (Dept. of Chemical Engineering.) AVAIL.NTIS

MAJS: /\*COAL GASIFICATION/\*FLUIDIZED BED PROCESSORS/\* HYDROGENATION/\*TECHNOLOGY ASSESSMENT

MINS: / AGGLOMERATION/ HYDROGEN PRODUCTION/ IMPROVEMENT/ PERFORMANCE

77N21627\*# ISSUE 12 PAGE 1616 CATEGORY 44  
76/03/00 3 VOLS 28 PAGES UNCLASSIFIED DOCUMENT  
UTTL: The thermal efficiency and cost of producing hydrogen  
and other synthetic aircraft fuels from coal  
AUTH: A/WITCOFSKI, R. D.  
CORP: National Aeronautics and Space Administration, Langley  
Research Center, Hampton, Va. AVAIL.NTIS SAP: HC  
A99/MF A01  
In Miami Univ. First World Hydrogen Energy Conf.  
Proc., Vol. 3 28 p (SEE N77-21625 12-44)  
MAJS: /\*AIRCRAFT FUELS/\*COAL GASIFICATION/\*ENERGY POLICY/\*  
HYDROGEN FUELS/\*SYNTHETIC FUELS/\*THERMODYNAMIC  
EFFICIENCY  
MINS: / COAL UTILIZATION/ ENERGY TECHNOLOGY/ LIQUID HYDROGEN  
/ METHANE  
ABA: Author  
ABS: A comparison is made of the cost and thermal  
efficiency of producing liquid hydrogen, liquid  
methane and synthetic aviation kerosene from coal.  
These results are combined with estimates of the cost  
and energy losses associated with transporting,  
storing, and transferring the fuels to aircraft. The  
results of hydrogen-fueled and kerosene-fueled  
aircraft performance studies are utilized to compare  
the economic viability and efficiency of coal resource  
utilization of synthetic aviation fuels.

78V35024 1975 ISS: 60 TP325.U6 1975 PT.1 770354: S  
77-013571C.1

UTTL: Coal: gasification: TLSP: quarterly report,  
July-September 1975 (part 1)  
United States. Energy Research and Development  
Administration. Office of Fossil Energy.  
Energy Research and Development Administration,  
Washington. 35 p.  
ERDA 76-30-3  
LC: Coal. Coal gasification.  
ADDED: Series: United States. Energy Research and  
Development Administration. ERDA 76-30-3  
NASA: / COAL GASIFICATION/ COAL UTILIZATION  
MAIN-CORP TRACE-SERS\* CATLG BY-GODDARD  
75/10/06 AVAIL: / GODDARD

79N77270# CATEGORY 44 RPT#: PB-289474/9 74/07/00  
70 PAGES UNCLASSIFIED DOCUMENT

UTTL: The gasification of coal  
AUTH: A/MUDGE, L. K.; B/SCHIEFELBEIN, G. F.; C/LI, C. T.;  
D/MOORE, R. H.  
CORP: Battelle Pacific Northwest Labs., Richland, Wash.  
AVAIL.NTIS  
MAJS: /\*COAL GASIFICATION/\*ECONOMIC ANALYSIS/\*RESEARCH AND  
DEVELOPMENT  
MINS: / METHODOLOGY/ SYNTHANE/ TECHNOLOGY ASSESSMENT

77A24212 ISSUE 9 PAGE 1444 CATEGORY 44  
76/00/00 11 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Analysis of coal particles undergoing rapid pyrolysis  
-- in gasification and liquefaction processes  
AUTH: A/MILLS, A. F.; B/ANTONIUK, D.; C/JAMES, R. K.  
PAA: B/(California, University, Los Angeles, Calif.);  
C/(Science Applications, Inc., El Segundo, Calif.)  
In: Future energy production systems: Heat and mass  
transfer processes. Volume 2. (A77-24201 09-44) New  
York, Academic Press, Inc.; Washington, D.C.,  
Hemisphere Publishing Corp., 1976. p. 537-547.  
MAJS: /\*COAL GASIFICATION/\*COAL LIQUEFACTION/\*PYROLYSIS  
MINS: / CHEMICAL REACTIONS/ CONSERVATION EQUATIONS/ ENERGY  
CONSERVATION/ FINITE DIFFERENCE THEORY/ GAS EVOLUTION/  
MATHEMATICAL MODELS/ PARTICLE SIZE DISTRIBUTION/  
SURFACE TEMPERATURE/ TEMPERATURE EFFECTS  
ABA: G.R.  
ABS: Rapid pyrolysis is achieved through the use of  
pulverized coal in entrained bed gasifiers. An  
analysis is presented of the thermal response of coal  
particles undergoing rapid pyrolysis. A reaction  
scheme is derived from work reported by Chermin and  
van Krevelen (1956) and the corresponding equations  
are obtained. The porosity of a particle is governed  
by a foaming law and the particle can swell or shrink  
accordingly. The numerical solution procedure for the  
equation systems is briefly described. Attention is  
given to the effects of particle size and the heats of  
reaction.

79V35694 1969 ISS: 80 TN23.U43 7284

AUTH: A/Konchesky, James L.  
UTTL: Influence of residence time, temperature, and steam  
concentration on coal-steam gasification reactions,  
by J. L. Konchesky and R. F. Stewart.  
U. S. Dept. of the Interior, Washington, 19 p.  
illus.  
U. S. Bureau of Mines. Report of investigations 7284  
LC: Coal gasification.  
NASA: / COAL GASIFICATION/ STEAM/ TEMPERATURE EFFECTS  
MAIN-AUTH TRACE-SERS\*TITL\* CATLG BY-JOHNSON  
79/06/28 AVAIL: / JOHNSON

79V35820 1972 ISS: 81 TN23.U43 7644

AUTH: A/Lewis, Paul S.  
UTTL: Strongly caking coal gasified in a stirred-bed  
producer, by P. S. Lewis and others.  
U. S. Bureau of Mines, Washington, 11 p. illus.  
U. S. Bureau of Mines. Report of investigations 7644  
LC: Coal gasification.  
NASA: / BEDS (PROCESS ENGINEERING)/ COAL GASIFICATION  
MAIN-AUTH TRACE-SERS\*TITL\* CATLG BY-JOHNSON  
79/06/06 AVAIL: / JOHNSON

## COAL - LIQUEFACTION

79A38434 ISSUE 16 PAGE 3022 CATEGORY 44

79/03/00 3 PAGES UNCLASSIFIED DOCUMENT

UTTL: Enhancement of magnetic separability in coal  
liquefaction residual solids

AUTH: A/JACOBS, I. S.; B/LEVINSON, L. M. PAA: B/(General  
Electric Co., Schenectady, N.Y.)  
(American Institute of Physics and Institute of

Electrical and Electronics Engineers, Annual  
Conference on Magnetism and Magnetic Materials, 24th,  
Cleveland, Ohio, Nov. 14-18, 1978.) Journal of Applied  
Physics, vol. 50, Mar. 1979, pt. 2, p. 2422-2424.  
Research supported by the Electric Power Research  
Institute.

MAJS: /\*COAL LIQUEFACTION/\*HYDROGENATION/\*INORGANIC SULFIDES  
/\*MAGNETIC EFFECTS/\*SEPARATION/\*SOLID PHASES

MINS: / IMPURITIES/ ISOTHERMAL PROCESSES/ MAGNETIZATION/  
MOSSBAUER EFFECT/ PYRRHOTITE/ REACTION KINETICS/  
RESIDUES/ THERMAL DECOMPOSITION/ THERMOMAGNETIC  
EFFECTS

ABA: (Author)

ABS: The conversion of coal to a clean fuel through  
liquefaction requires the physical separation of  
undissolved sulfur-rich mineral matter. The  
hydrogenation-liquefaction reaction produces residual  
solids in which the original coal impurity pyrite,  
FeS<sub>2</sub>, has largely been converted to pyrrhotite,  
Fe(1-x)S, which is a complex nonstoichiometric  
sulfide. By using thermomagnetic analysis and  
Mossbauer spectroscopy it is shown that the iron  
sulfide in coal liquefaction residues corresponds to  
an intermediate pyrrhotite. Striking transformations  
between various magnetic and nonmagnetic states are  
induced by thermal treatments in inert or sulfidation  
atmospheres. The kinetics of the transformations are  
strongly influenced by prior thermal and atmosphere  
history. Transformation to a high magnetization state  
has practical application wherein magnetic separation  
techniques become attractive for the liquid solids  
separation step in coal liquefaction.

79A31913# ISSUE 12 PAGE 2182 CATEGORY 28

79/00/00 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: Aviation fuels from coal

AUTH: A/CIBSON, J. PAA: A/(National Coal Board, London,  
England)

In: Energy and aerospace; Proceedings of the  
Anglo/American Conference, London, England, December  
5-7, 1978. (A79-31908 12-44) London, Royal

Aeronautical Society, 1979. 16 p.

MAJS: /\*COAL LIQUEFACTION/\*COAL UTILIZATION/\*HYDROCARBON  
FUEL PRODUCTION/\*JET ENGINE FUELS

MINS: / ENERGY TECHNOLOGY/ FOSSIL FUELS/ HYDROGEN PRODUCTION  
/ HYDROGEN-BASED ENERGY/ KEROSENE/ PETROLEUM PRODUCTS/  
SOLVENT EXTRACTION/ SYNTHETIC FUELS

ABA: G.R.

ABS: Although the ultimate aviation fuel may prove to be  
liquid hydrogen produced from water by electrolysis  
using nuclear power, there are powerful arguments to  
continue to use hydrocarbon fuels and as much as  
possible of the infrastructure associated with them.  
In effect, the objective must be to bridge the gap  
until reliance can shift to nuclear-based fuel and  
that is still far off. Attention is given to the world  
fuel reserves, the demand for aviation fuel, the  
principles of coal liquefaction, conventional and  
unconventional aviation fuels from coal, coal  
liquefaction processes, and possible alternative  
strategies. The current status and potential for  
aviation fuels from coal are considered and the UK  
program on coal liquefaction is discussed.

OXYGEN, NITROGEN, AND SULFUR REMOVAL REACTIONS IN  
DONOR SOLVENT COAL LIQUEFACTION. Y. T. Shah.

Catalysis Reviews Science and Engineering, vol 20,  
no 2, 1979, p. 209-301.

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OF POOR QUALITY

79A40455 ISSUE 17 PAGE 3153 CATEGORY 23 CNT#:  
EX-76-C-01-1517 79/07/00 12 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Coal liquefaction and deashing studies. I - Consol  
Synthetic Fuel process. II - Solvent Refined Coal  
process

AUTH: A/KLEINPETER, J. A.; B/JONES, D. C.; C/DUDT, P. J.;  
D/BURKE, F. P. PAA: D/(Conoco Coal Development Co.,  
Library, Pa.)  
(American Institute of Chemical Engineers, National  
Meeting, 85th, Philadelphia, Pa., June 4-8, 1978.) I &  
EC - Industrial and Engineering Chemistry, Process  
Design and Development, vol. 18, July 1979, p.  
535-546.

MAJS: /\*COAL LIQUEFACTION/\*PILOT PLANTS/\*REFINING/\*SOLVENTS  
/\*SYNTHETIC FUELS

MINS: / ENERGY SOURCES/ ENERGY TECHNOLOGY/ GRAVITATIONAL  
EFFECTS/ HYDROGEN/ MASS SPECTROSCOPY/ NUCLEAR MAGNETIC  
RESONANCE/ PYRENES/ STEADY STATE

ABA: A.T.

ABS: Pittsburgh Seam B coal was liquefied by the Consol  
Synthetic Fuel (CSF) donor solvent process and deashed  
via gravity settling at 600 F with and without an  
anti-solvent. These continuous 10 lb/hr tests were  
done to provide guidance for the 20 TPD Cresap CSF  
Pilot Plant. Mass spectral and NMR analyses showed  
that the CSF solvent closely approached steady state  
operation and that tetralins, hydrophenanthrones and  
hydropyrenes were the predominant hydrogen donors.  
Integrated gravity settling produced 0.22 wt % ash  
extract, and the settler upflow velocity of 0.3  
in./min translates to 34 40-ft diameter settlers for a  
25,000 TPD commercial plant. Using paraffinic  
anti-solvent to precipitate a fraction of the coal  
extract to enhance settling gave little improvement in  
solids removal and massive agglomerates formed at a  
moderate anti-solvent rate and forced shutdown of the  
rake-equipped settler. Settler performance improved as  
the liquefaction solvent approached steady-state  
composition and with increasing liquefaction  
solvent/coal ratio. Earlier CSF liquefaction and  
gravity settling deashing studies achieved four times  
the ash removal rate and a lower ash content which may  
have resulted from the use of the liquefaction solvent  
which was further from steady state than in this  
experiment. The Ft. Lewis Solvent Refined Coal (SRC)  
Pilot Plant was simulated in a 10 lb coal/hr unit  
using equilibrium pilot plant solvent and Kentucky  
9.14 coal, with integrated gravity settling deashing  
producing 0.1 wt % ash SRC for  
anti-solvent/liquefaction ratios of 0.3-0.5.

79N32383# ISSUE 23 PAGE 3070 CATEGORY 28 RPT#:  
CONF-790213-5 CNT#: W-7405-ENG-26 79/02/26 38  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Recent developments in coal liquefaction in the United  
States --- Conferences

AUTH: A/MCH-EESE, L. E.; B/SALMON, L. E.; C/COCHRAN, H. D.,  
JR.

CORP: Oak Ridge National Lab., Tenn. AVAIL.NTIS SAP: HC  
A03/MF A01

Presented at 6th Energy Technol. Conf. and Exposition,  
Washington, D. C., 26 Feb. 1979

MAJS: /\*COAL LIQUEFACTION/\*CONFERENCES/\*ENERGY POLICY/\*  
PRODUCTION ENGINEERING/\*SYNTHETIC FUELS

MINS: / CHEMICAL REACTIONS/ ECONOMIC FACTORS/ MANAGEMENT  
PLANNING/ RESEARCH AND DEVELOPMENT

ABA: DOE

ABS: The mechanisms by which the synthetic fuels industry  
developed were considered. It is not at all clear that  
natural marketplace forces are able to build the  
industry rapidly enough to meet the demands expected  
in the next 20 to 30 years. The need for government  
initiative was widely discussed. The need for careful  
consideration of the demand-time curve for synthetic  
liquid fuels and of the length of time required to  
build an industry of the size needed was emphasized.

79N30398# ISSUE 21 PAGE 2796 CATEGORY 28 RPT#:  
ORNL/FE-2 CNT#: W-7405-ENG-26 79/02/00 51 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Coal liquefaction advanced research digest

AUTH: A/OHARA, F. M., JR.

CORP: Oak Ridge National Lab., Tenn. AVAIL.NTIS SAP: HC  
A04/MF A01

MAJS: /\*COAL LIQUEFACTION/\*ENERGY POLICY/\*ENERGY TECHNOLOGY  
/\*HYDROCARBON FUEL PRODUCTION/\*SOLVENT EXTRACTION/\*  
SYNTHETIC FUELS

MINS: / CATALYSTS/ CHEMICAL REACTIONS/ DISSOLVING/  
ENVIRONMENT EFFECTS/ HYDROGENATION/ INDUSTRIAL PLANTS/  
MULTIPHASE FLOW/ REACTION KINETICS/ TEST FACILITIES/  
THERMODYNAMICS

ABA: K.L.

ABS: The solvent refined coal-2 (SRC-2) process, the consol  
synthetic fuel (CSF) process, and the Fischer-Tropsch  
synthesis are reviewed. The histories of the chemical  
processes are traced and present states of knowledge  
are detailed. The SRC-2 process combines dissolution  
and hydrogenation to produce hydrocarbon fuels. The  
CSF process splits dissolution and hydrogenation into  
two distinct steps and employs indirect hydrogenation.  
The Fischer-Tropsch synthesis catalytically produces  
hydrocarbons from carbon monoxide and hydrogen.

79N33344# ISSUE 24 PAGE 3197 CATEGORY 28 RPT#:  
EPRI-AF-913 CNT#: EPRI PROJ. 713-1 79/03/00 245  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Investigation of mechanism of reactions involving oxygen-containing compounds in coal hydrogenation  
TLSP: Final Report, Mar. 1979  
AUTH: A/CRONAUER, D. C.; B/RUBERTO, R. G.  
CORP: Gulf Research and Development Co., Chestwick, Pa.  
AVAIL.NTIS SAP: HC A11/MF A01  
Prepared for EPRI  
MAJS: /\*COAL LIQUEFACTION/\*HYDROGENATION/\*OXYGEN COMPOUNDS/\*  
REACTION KINETICS  
MINS: / ORGANIC COMPOUNDS/ SOLVENTS/ TEMPERATURE  
ABA: DOE  
ABS: Reactions involving oxygen during hydrogenative liquefaction are presented as well as the establishment of a kinetic model to describe coal liquefaction. Emphasis was directed toward the liquefaction of Belle Ayr subbituminous coal with

subsequent test runs made with Burning Star bituminous coal. The liquefaction experiments were made in a CFSTR bench-scale unit operated at temperatures between 400 and 470 C, space times between 5 and 60 minutes and a fixed total pressure of 2000 psig. It was shown that between 70% and 85% of the coal organic oxygen is removed as carbon oxides and water. Carboxylic, carbonylic, and etheric functionalities of coal are essentially removed during the liquefaction reaction. The most abundant oxygen-containing group in the reaction product is hydroxylic, a portion of which is necessarily formed by a reduction of other groups. The results of liquefying Belle Ayr coal were correlated by a kinetic model.

CONVERTING COAL TO LIQUID/GASEOUS FUELS, J. T. Stewart  
and M.G. Klett

Mechanical Eng., v.101, no.6, June 1979, p.34

Coal converted to synthetic oil and gas will have to help take up the slack as world oil production inevitably levels off and falls. Here's a review of the current state of development of coal gasification and liquefaction processes and the outlook for the future.

79N2H343 ISSUE 19 PAGE 2528 CATEGORY 28  
79/03/00 165 PAGES UNCLASSIFIED DOCUMENT

UTTL: Some aspects of the mechanism and kinetics of coal liquefaction TLSP: Ph.D. Thesis  
AUTH: A/SZLADOW, A. J.  
CORP: Pennsylvania State Univ., University Park. SAP:  
Avail: Univ. Microfilms Order No. 7915743  
MAJS: /\*COAL LIQUEFACTION/\*ENERGY POLICY/\*ENERGY TECHNOLOGY  
/\*REACTION KINETICS  
MINS: / ACTIVATION ENERGY/ SOLUBILITY/ TEMPERATURE EFFECTS  
ABA: Dissert. Abstr.  
ABS: The relationships between the generation of materials of different solubilities and the removal of oxygen functional groups for coal/tetralin interactions, at temperatures 340-400 C and relatively short times, were studied to provide quantitative information helpful in assessing various hypotheses about the role of oxygen functional groups in the early stages of liquefaction. Studies of the effect of temperature on

rates of conversion were performed with the object of shedding additional light on the reactions taking place during short contact times. Mathematical treatment of the kinetics of complex reaction mixtures, specifically the analysis of activation energies were extended from what was known from the literature in order to apply it to coal liquefaction.

79N29365# ISSUE 20 PAGE 2660 CATEGORY 28 RPT#:  
SAND-79-7027 CNT#: EY 76-C-04-0785 79/03/00 48  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Viscosity reduction of coal liquids by dissolved carbon dioxide  
AUTH: A/YU, A. D.; B/ORR, F. M., JR.  
CORP: Sandia Labs., Albuquerque, N. Mex. AVAIL.NTIS  
SAP: HC A03/MF A01  
MAJS: /\*CARBON DIOXIDE/\*COAL LIQUEFACTION/\*HYDROCARBONS/\*  
REDUCTION (CHEMISTRY)/\*SOLUBILITY/\*VISCOSITY  
MINS: / CONCENTRATION (COMPOSITION)/ GAS-LIQUID INTERACTIONS  
/ MIXTURES/ PRECIPITATION (CHEMISTRY)  
ABA: DOE  
ABS: The solubility of carbon dioxide in coal liquids and the viscosities of mixtures of coal liquids with CO2 were measured. Carbon dioxide in coal liquids was found to be comparable to its solubility in crude oils. It is sufficiently soluble to provide substantial viscosity reductions at concentrations below 10 weight percent. Significant precipitation of heavy hydrocarbon materials was observed during the viscosity measurements.

PRINT 15/2/1-474 TERMINAL=33  
79A53781 ISSUE 24 PAGE 4554 CATEGORY 44  
79/00/00 116 PAGES UNCLASSIFIED DOCUMENT

UTTL: Coal liquefaction

AUTH: A/LEE, E. S. PAA: A/(Kansas State University of  
Agriculture and Applied Science, Manhattan, Kan.)  
In: Coal conversion technology. (A79-53776 24-44)  
Reading, Mass.: Addison-Wesley Publishing Co., Inc.,  
1979. p. 428-545.

MAJS: /\*CATALYSIS/\*COAL LIQUEFACTION/\*HYDROGENATION/\*  
REACTION KINETICS/\*SOLVENT EXTRACTION

MINS: / CARBON MONOXIDE/ CATALYSTS/ CHEMICAL COMPOSITION/  
CHEMICAL PROPERTIES/ ENVIRONMENT POLLUTION/ HYDROGEN/  
ORGANIC COMPOUNDS/ PYROLYSIS/ RANK TESTS/ SOLVENTS/  
TEMPERATURE EFFECTS/ TRANSITION METALS

ABA: B.U.

ABS: After a brief review of the historical development of  
liquefaction, attention is given to various aspects  
and characteristics of the coal liquefaction process,  
including direct liquefaction, hydrodesulfurization of  
coal and hydrogen requirement, pyrolysis, and indirect  
liquefaction. Consideration is also given to the  
effect of coal properties on liquefaction, solvent  
extraction or dissolution, kinetics or solvent  
extraction, catalytic hydrogenation, and properties  
and purifications of liquefaction products.

**PREDICTING THERMODYNAMIC PROPERTIES FOR FOSSIL-FUEL  
CHEMICALS.** M. R. Brule, Lloyd L. Lee, K. E. Starling.

Chemical Engineering, vol 86, no 25, November 1979, p.  
155-163.

Knowledge of the thermodynamic properties of hydrocarbons  
is important for much chemical engineering design.  
Presently, it is of particular importance for coal-  
liquefaction processes. Here is a technique for predict-  
ing these important properties.

**APPLICATION OF LIQUEFACTION PROCESSES TO LOW-RNAK  
COALS.** W. G. Wilson, C. L. Knudson.

Industrial Engineering Chemistry, vol 18, no 4,  
December 1979, p. 297-311.

79N31411# ISSUE 22 PAGE 2934 CATEGORY 28 RPT#:  
FE-2202-39 CNT#: EX-76-C-01-2202 79/03/12 33  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Homogeneous catalytic hydrocracking processes for  
conversion of coal to liquid fuels: Basic and  
exploratory research TLSP: Quarterly Report. 16 Sep.  
- 15 Dec. 1978

CORP: SRI International Corp., Menlo Park, Calif.  
AVAIL:NTIS SAP: HC A03/MF A01

MAJS: /\*CATALYSTS/\*COAL LIQUEFACTION/\*ENERGY TECHNOLOGY/\*  
HYDROGENATION/\*REACTION KINETICS

MINS: / BITUMENS/ LIGNITE/ LITHIUM ALUMINUM HYDRIDES/  
OXIDATION/ POTASSIUM HYDROXIDES/ TRANSITION METALS

ABA: DOE

ABS: The role of base in both coal and lignite liquefaction  
in the CO-H<sub>2</sub>O system was explored as well as the  
catalysis of coal conversion in tetralin by KOH, and  
the effects of LiAlH<sub>4</sub> pretreatment of coal on its  
subsequent upgradability. Results suggest that,  
although KOH is important for obtaining high  
conversion yields from bituminous coal in CO-H<sub>2</sub>O, its  
importance is largely indirect, serving to leach  
transition metals from the autoclave. Lignite  
conversion is little affected by the presence or  
absence of KOH in the system. The addition of KOH and  
H<sub>2</sub>O to tetralin had no effect on bituminous coal  
conversion: the action of tetralin was not catalyzed.  
Pretreatment of a bituminous coal with LiAlH<sub>4</sub> to  
reduce any quinones present had a small but measurably  
favorable effect on its solubility compared with that  
of untreated coal. This difference remained even after  
heating under vacuum, but disappeared upon heating in  
H<sub>2</sub> or tetralin.

**UPGRADING COAL LIQUIDS TO TURBINE FUELS.** T. R. Stein,  
R. H. Heck.

Coal Processing Technology, vol 5, 1979, p. 197-  
198.

Although both physical properties and chemical compositions of coal  
liquids differ significantly from petroleum fuels, petroleum technology  
can make them useful in petroleum markets.

79A51100#W ISSUE 23 PAGE 4305 CATEGORY 2B  
79/09/00 37 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Comparison of alternate fuels for aircraft  
AUTH: A/WITCOFSKI, R. D. PAA: A/(NASA, Langley Research  
Center, Hampton, Va.)  
CORP: National Aeronautics and Space Administration, Langley  
Research Center, Hampton, Va.  
Deutsche Gesellschaft fuer Luft- und Raumfahrt and  
Deutsche Forschungs- und Versuchsanstalt fuer Luft-  
und Raumfahrt, International Symposium on Hydrogen in  
Air Transportation, Stuttgart, West Germany, Sept.  
11-14, 1979, Paper, 37 p.  
MAJS: /\*AIRCRAFT FUEL SYSTEMS/\*AIRPORTS/\*HYDROGEN FUELS/\*JET  
ENGINE FUELS/\*LIQUEFIED GASES/\*SYNTHANE  
MINS: / AIRCRAFT FUELS/ COST ESTIMATES/ HYDROCARBON FUELS/  
LIQUID HYDROGEN/ SYNTHETIC FUELS/ TECHNOLOGY  
ASSESSMENT  
ABA: V.T.  
ABS: A comparison of candidate alternate fuels for aircraft  
is presented. The fuels discussed include liquid  
hydrogen, liquid methane, and synthetic aviation  
kerosene. Each fuel is evaluated from the standpoint  
of production, transmission, airport storage and  
distribution facilities, and use in aircraft.  
Technology deficient areas for cryogenic fuels, which  
should be advanced prior to the introduction of the  
fuels into the aviation industry, are identified, as  
are the cost and energy penalties associated with not  
achieving those advances. Environmental emissions and  
safety aspects of fuel selection are discussed. A  
detailed description of the various fuel production  
and liquefaction processes and their efficiencies and  
economics is given.

79V23492 1979 ISS: 00 TP352.N68 0-815507-56-9 662.6622  
LC-79-14384

AUTH: A/Nowacki, Perry.  
UTTL: Coal liquefaction processes / Perry Nowacki.  
Noyes Data Corp., Park Ridge, N.J. : xii, 339 p. :  
ill. : 25 cm.  
Chemical technology review ; no. 131 Energy technology  
review ; no. 45 \$48.00 Includes index. Bibliography:  
p.  
LC: Coal liquefaction.  
MAIN-AUTH TRACE-SERS-TITL\* CATLG BY-LC  
/ /

COAL LIQUEFACTION SUCCEEDS WITHOUT ADDED CATALYST.  
S. E. Rogers.

Coal Processing Technology, vol 5, 1979, p. 9-18.

COAL CONVERSION TECHNOLOGIES: SOME HEALTH AND  
ENVIRONMENTAL EFFECTS. S. C. Morris, P. D.  
Moskowitz, W. A. Sevian.

Science, vol 206, no 4419, November 9, 1979, p. 654-  
662.

Summary: Several technologies to convert coal to liquid and gaseous fuels are being developed in the United States, some with support from the Department of Energy. Substitution of these technologies for those currently being used will produce different health and environmental hazards. In this article, selected health and environmental effects of four coal conversion and four existing technologies are compared. For each technology, the emission estimates for complete fuel cycles, including all steps in fuel use from extraction to the end use of space and water heating by electricity or direct combustion, were prepared by means of the Brookhaven Energy System Network Simulator model. Quantitative occupational health and safety estimates are presented for the extraction, transportation, distribution, processing, and conversion activities associated with each technology; also included are some public health damage estimates arising from fuel transportation and air pollution impacts. Qualitative estimates of health damage due to polycyclic organic matter and reduced sulfur are discussed. In general, energy inefficiencies, environmental residuals, and hence implied environmental effects and health damage increase in the order: (i) direct combustion of natural gas and oil, (ii) direct combustion of synthetic gas and oil, (iii) central-station electric power produced from synthetic gas, (iv) central-station electric power produced from coal, and (v) central-station electric power produced by the combustion of synthetic liquid fuels. The compliance and conflict of these technologies with the amendments of the Clean Air Act and other legislation are discussed.

79N79656# CATEGORY 2b RPT#: NTIS/PS-79/0375/0  
NTIS/PS-77/0305 79/05/00 129 PAGES UNCLASSIFIED  
DOCUMENT

Supersedes NTIS/PS-77/0305  
UTTL: Coal liquefaction technology. A bibliography with  
abstracts TLSP: Report, May 1978 - 1979  
AUTH: A/CAVAGNARO, D. M.  
CORP: National Technical Information Service, Springfield,  
Va. AVAIL. NTIS SAP: HC \$28.00/MF \$28.00  
MAJS: /\*AIR POLLUTION/\*BIBLIOGRAPHIES/\*COAL LIQUEFACTION/\*  
POLLUTION CONTROL  
MINS: / ABSTRACTS/ CONTROL EQUIPMENT/ COST ANALYSIS/  
DESULFURIZING/ PREPARATION

79N29366# ISSUE 20 PAGE 2660 CATEGORY 28 RPT#:  
SAND-79-0017 CNT#: EY-76-C-04-0789 79/02/00 28  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Coal liquefaction catalyst tags  
AUTH: A/SAMPLE, D. G.; B/THOMAS, M. G.  
CORP: Sandia Labs., Albuquerque, N. Mex. AVAIL:NTIS  
SAP: HC A03/MF A01  
MAJS: /\*CATALYSTS/\*CHEMICAL ANALYSIS/\*COAL LIQUEFACTION/\*  
IDENTIFYING/\*MARKING  
MINS: / CHEMICAL REACTORS/ METAL COATINGS/ NEUTRON  
ACTIVATION ANALYSIS/ VAPOR DEPOSITION  
ABA: DOE  
ABS: The identification and analysis of tagged catalysts  
from catalytic and liquefaction reactors that employ  
addition and withdrawal of catalysts can provide  
mixing characteristics and deactivation rates. Several  
methods for tagging coal liquefaction catalysts which  
were developed and evaluated include physical  
alternation, metals addition, and nuclear activation.  
Sputtering (vapor deposition) and painting (metal  
paints) are methods used for doping catalysts with  
metal tags which can be identified using radiographic  
techniques. Machining and filling catalysts, and  
altering extrusion dies can provide physical tags  
identified optically and by radiographic techniques.  
Neutron activation provides tags identified by a  
standard radiation counting method. The tags are  
evaluated on the bases of preparation, integrity, and  
detection. The use of the tags is considered for use  
in an H-Coal process demonstration unit.

EVALUATION OF USE OF SYNGAS FOR COAL LIQUEFACTION.  
R. F. Batchelder and Y. C. Fu.

Process Design and Development, vol 18, no 4, October  
1979, p. 594-598.

#### THE DOW COAL LIQUEFACTION PROCESS

N. G. Moll and G. J. Quarderer

Chemical Engineering Progress, vol. 75, no. 11,  
Nov. 1979, pp. 46-50.

79A26469 ISSUE 9 PAGE 1548 CATEGORY 23  
79/02/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Bituminous coal extraction in terms of electron-donor  
and -acceptor interactions in the solvent/coal system  
AUTH: A/MARZEC, A.; B/JUZWA, M.; C/BETLEJ, K.;  
D/SOBKOWIAK, M. PAA: D/(Polish Academy of Sciences,  
Dept. of Petroleum and Coal Chemistry, Gliwice,  
Poland)  
Fuel Processing Technology, vol. 2, Feb. 1979, p.  
35-44.  
MAJS: /\*BITUMENS/\*COAL LIQUEFACTION/\*ELECTRON ATTACHMENT/\*  
SOLVENT EXTRACTION  
MINS: / CHEMICAL REACTIONS/ ENERGY TECHNOLOGY/ HYDROCARBON  
FUEL PRODUCTION/ MOLECULAR INTERACTIONS  
ABA: (Author)  
ABS: Experiments on high volatile bituminous coal  
extraction at ambient temperature have been carried  
out by means of 18 solvents having their  
electron-donor and -acceptor properties quantitatively  
determined (DN and AN numbers) by Gutmann's method. A  
model for coal extraction, based on the assumption  
that donor-acceptor bonds occur in coal and are  
responsible for binding together macromolecular  
networks and extractable substances filling the pores  
of a network, has been worked out and verified on the  
basis of experimental data. The results lead to the  
conclusion that extraction is, in principle, a  
substitution reaction: pore substances are replaced by  
a solvent molecule in their donor (network)-acceptor  
(pore substance) or donor (pore  
substance)-acceptor(network) bonds. Solvents capable  
of substitution are characterized by specific DN and  
AN values.

A80-11964 Coal liquefaction - An international perspec-  
tive. A. Baker and M. D. Taper (International Energy Agency,  
London, England). In: Energy technology VI: Achievements in  
perspective; Proceedings of the Sixth Conference, Washington, D.C.,  
February 26-28, 1979. (A80-11953 02-44) Washington, D.C., Gov-  
ernment Institutes, Inc., 1979, p. 639-656. 18 refs.

The Coal Research Program of the International Energy Agency  
is briefly described. This is followed by a discussion of liquefaction  
processes and their development, some preliminary considerations on  
liquefaction economics, and some considerations on the future of  
coal liquefaction. B.J.

CATALYTIC LIQUEFACTION OF COAL. M. J. O'Leary,  
D. C. Stetson, V. K. Mathur

Coal Processing Technology, vol 5, 1979, p. 85-93.

79A25124 ISSUE 9 PAGE 1551 CATEGORY 25  
79/03/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Evaluation of commercial catalysts for the Fischer-Tropsch reaction --- for coal conversion to liquid fuel or chemical feedstock  
AUTH: A/BORCHARD, W. G.; B/BENNETT, C. O. PAA:  
B/(Connecticut, University, Storrs, Conn.)  
I & EC - Industrial and Engineering Chemistry, Product Research and Development, vol. 18, Mar. 1979, p. 18-26. Research supported by the Electric Power Research Institute.

MAJS: /\*CARBON MONOXIDE/\*CATALYSTS/\*COAL LIQUEFACTION/\*  
HYDROCARBON FUEL PRODUCTION/\*HYDROGENATION

MINS: / AMMONIA/ COBALT COMPOUNDS/ ENERGY TECHNOLOGY/ IRON  
COMPOUNDS/ REACTION KINETICS

AEA: (Author)

ABS: The hydrogenation of carbon monoxide was investigated at 20 atm (2.0 MPa) and 250 C (523 K) in tubular reactors. Four commercial iron catalysts, one commercial cobalt catalyst, and an iron (a) turning catalyst were tested at three hydrogen to carbon monoxide feed ratios. At a relatively constant space velocity the overall rates of reaction gave a good indication of activity. The cobalt catalyst appeared to be the best. Its selectivity favored saturated hydrocarbons. A nitrated ammonia synthesis catalyst attained a similar activity. An optimal feed ratio of 2:1 H<sub>2</sub>/CO was observed. The highest activities occurred with a 2:1 feed ratio and the production of water.

79N27618\*# ISSUE 18 PAGE 2426 CATEGORY 28  
78/08/15 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: EXXON donor solvent coal liquefaction process  
AUTH: A/EPPERLY, W. R.; B/SWABB, L. E., JR.; C/TAUTON, J.  
W.

CORP: Exxon Research and Engineering Co., Florham Park, N.  
J. AVAIL:NTIS SAP: HC A23/MF A01  
In JPL Proc. of the Conf. on Coal Use for California  
p 268-272 (SEE N79-27597 18-42)

MAJS: /\*CATALYSIS/\*COAL LIQUEFACTION/\*ENERGY CONVERSION/\*  
HYDROCARBON FUELS/\*HYDROGENATION/\*SOLVENT EXTRACTION

MINS: / CALIFORNIA/ COAL UTILIZATION/ ENERGY POLICY/ ENERGY  
TECHNOLOGY

ABA: J.M.S.

ABS: A solvent coal liquefaction process to produce low-sulfur liquid products from a wide range of coals is described. An integrated program of laboratory and engineering research and development in conjunction with operation of a 250 T/D pilot plant is discussed.

79N27320 ISSUE 18 PAGE 2389 CATEGORY 28  
78/00/00 168 PAGES UNCLASSIFIED DOCUMENT

UTTL: Kinetics of coal liquefaction to preasphaltenes,  
asphaltenes and oils TLSP: Ph.D. Thesis

AUTH: A/SHALABY, M. A.

CORP: Colorado School of Mines, Golden. SAP: Avail: Univ.  
Microfilms Order No. 7912231

MAJS: /\*ASPHALT/\*COAL LIQUEFACTION/\*OILS/\*REACTION KINETICS

MINS: / ACTIVATION ENERGY/ CHEMICAL REACTORS/ ESTIMATING/  
VAPOR PHASES

ABA: Dissert. Abstr.

ABS: The kinetics and mechanism of coal liquefaction was studied in a 300 cc magnedrive autoclave batch reactor. The reactions were conducted with a ratio of coal to solvent (tetralin) of 1:10 and under a hydrogen blanket at a total pressure of 2000 psi. Three temperatures were investigated; 350, 375 and 400 C. Three models involving first order irreversible series/parallel reactions were discriminated for the raw data using a non-linear parameter estimation technique. The model that exhibited the lowest value of the determinant of moment matrix of residuals was considered the best in explaining the mechanism of coal dissolution. Arrhenius activation energies were calculated for each rate constant. The values ranged between 10-50 K cal/g mole. The high activation energies implied that the reactions of coal hydroliquefaction are kinetically controlled and not controlled by interfacial mass transfer.

79N27617\*# ISSUE 18 PAGE 2426 CATEGORY 28  
78/08/15 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: The H-Coal processes: A status report

AUTH: A/VOLS, W. C.

CORP: Ashland Oil and Refining Co., Ky. AVAIL:NTIS SAP:  
HC A23/MF A01

In JPL Proc. of the Conf. on Coal Use for California  
p 262-267 (SEE N79-27597 18-42)

MAJS: /\*CATALYSIS/\*COAL LIQUEFACTION/\*ENERGY CONVERSION/\*  
HYDROCARBON FUEL PRODUCTION/\*HYDROGENATION

MINS: / CALIFORNIA/ COAL UTILIZATION/ ENERGY POLICY/ ENERGY  
TECHNOLOGY/ PILOT PLANTS

ABA: J.M.S.

ABS: A catalytic process (H-Coal) involving the direct hydrogenation of coal to produce hydrocarbon liquids is described. Bench-scale and pilot plant development of the H-Coal process is reported. Emphasis is placed on a proposed pilot plant which will be the largest coal liquefaction plant on-line in the U.S., processing up to 600 tpd of coal. Economic considerations are given.

79N03997 ISSUE 17 PAGE 2344 CATEGORY 77  
78/00/00 183 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Enthalpy measurements for coal-derived liquids TLSP:  
Ph.D. Thesis  
AUTH: A/OMID, G. H.  
CORP: Colorado School of Mines, Golden. SAP: Avail: Univ.  
Microfilms Order No. 7912225  
MAJS: /\*BY-PRODUCTS/\*COAL LIQUEFACTION/\*ENERGY TECHNOLOGY/\*  
ENTHALPY/\*HYDROCARBONS/\*LIQUIDS  
MINS: / CARBON/ HYDROGEN/ NITROGEN/ REFRACTIVITY/ SULFUR  
ABA: Dissert. Abstr.  
ABS: Experimental enthalpy measurements were made on a  
liquid derived from a Western Kentucky coal by the  
char-oil-energy-development process, over the range of  
100 to 1500 psia and 122 to 705 F, and also on a  
distillate derived from this liquid over the range of  
119 to 756 F and 60 to 500 psia. The following  
analyses were made to characterize the coal-liquids:  
coal-liquids characterization (PERC) method, total  
carbon-hydrogen-nitrogen analysis, total sulfur  
analysis, refractive index, PONA analysis,  
heteroatomic content, and aromatic content. Enthalpy  
correlations already developed were used to predict  
the enthalpies of the coal-liquid samples. The results  
compared better with experimental enthalpies at lower  
temperatures (approximately 300 F) than at higher  
temperatures (approximately 700 F). A factor was  
incorporated in one of the correlations to correct the  
presence of the heteroatomic compounds in the samples.  
With this modification, the predicted enthalpies were  
within the experimental accuracy.

79N27282# ISSUE 18 PAGE 2384 CATEGORY 25 RPT#  
FE-2035-12 CNT#: EX-76-C-01-2035 78/08/01 18  
PAGES UNCLASSIFIED DOCUMENT  
UTTL: Enthalpy measurement of coal-derived liquids TLSP:  
Quarterly Technical Progress Report, Apr. - Jun. 1978  
AUTH: A/KIDNAY, A. J.; B/YESAVAGE, V. F.  
CORP: Colorado School of Mines, Golden. CSS: (Dept. of  
Chemical and Petroleum Refining Engineering.)  
AVAIL.NTIS SAP: HC A02/MF A01  
MAJS: /\*COAL LIQUEFACTION/\*DISTILLATION/\*ENERGY POLICY/\*  
ENTHALPY  
MINS: / ENERGY TECHNOLOGY/ HEAT MEASUREMENT  
ABA: DOE  
ABS: Experimental measurements were completed on a middle  
distillate. A total of 52 enthalpy measurements were  
made covering the ranges 157 to 675 F and 130 to 1000  
psia.

79N10595# ISSUE 1 PAGE 79 CATEGORY 45 RPT#:  
PB-283028/9 EPA-600/7-78-091 CNT#: EPA-66-02-2162  
78/06/00 372 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Standards of Practice Manual for the solvent refined  
coal liquefaction process TLSP: Final Report, Apr. -  
Nov. 1977  
AUTH: A/ROGOSHEWSKI, P. J.; B/KOESTER, P. A.; C/KORALEK,  
C. S.; D/WETZEL, R. S.; E/SHIELDS, K. J.  
CORP: Hittman Associates, Inc., Columbia, Md. AVAIL.NTIS  
SAP: HC A16/MF A01  
MAJS: /\*COAL LIQUEFACTION/\*MANUALS/\*PROCESS CONTROL  
(INDUSTRY)/\*SOLVENTS  
MINS: / COST EFFECTIVENESS/ INDUSTRIAL WASTES/ POLLUTION  
CONTROL/ PRODUCTION ENGINEERING/ TECHNOLOGY ASSESSMENT  
ABA: GRA  
ABS: The manual gives an integrated multimedia assessment  
of control/disposal options, emissions, and  
environmental requirements associated with a  
hypothetical 50,000 bbl/day Solvent Refined Coal (SRC)  
facility producing gaseous and liquid fuels. It gives  
an overall outline of the basic system, including  
module descriptions and summaries on pollution

concurrently available and developing control/disposal  
practices that may be applicable to waste streams from  
coal liquefaction technologies. In the detailed  
definition of the basic system, it describes modules  
in detail, and quantities input and output streams.

78N26962# ISSUE 17 PAGE 2330 CATEGORY 77 RPT#:  
FE-2035-10 CNT#: EX-76-C-01-2035 78/01/15 20  
PAGES UNCLASSIFIED DOCUMENT  
UTTL: Enthalpy measurement of coal-derived liquids TLSP:  
Quarterly Technical Progress Report, Oct. - Dec. 1977  
AUTH: A/KIDNAY, A. J.; B/YESAVAGE, V. F.  
CORP: Colorado School of Mines, Golden. CSS: (Dept. of  
Chemical and Petroleum Refining, Engineering.)  
AVAIL.NTIS SAP: HC A02/MF A01  
MAJS: /\*COAL LIQUEFACTION/\*DISTILLATION/\*ENTHALPY/\*  
NAPHTHALENE  
MINS: / CHEMICAL ENGINEERING/ ENERGY SOURCES/ HEAT  
MEASUREMENT  
ABA: ERA  
ABS: Experimental enthalpy measurements were made on a  
naphtha sample produced by the SRC-I process. A total  
of 116 enthalpy determinations were made covering the  
ranges 160 to 670 F and 30 to 900 psia. A comparison  
of three correlations for enthalpy with the  
experimental data for a Synthoil distillate was also  
made. The predicted enthalpies were considerably in  
error.

78N29273# ISSUE 20 PAGE 2649 CATEGORY 28 RPT#:  
PB-279322/2 IMMR33-PD20-78 CNT#: NSF  
AER-73-03259-A03 78/01/00 85 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Synthetic oil from coal: The economic impact of five alternatives for making hydrogen from coal TLSP: Final Report  
AUTH: A/MOORE, H. F.; B/KIM, E. T.; C/KERMODE, R. I.  
CORP: Kentucky Univ., Lexington. CSS: (Dept. of Chemical Engineering.) AVAIL.NTIS SAP: HC A05/MF A01  
Sponsored in part by Ashland Oil, Inc., Ky.  
MAJS: /\*COAL LIQUEFACTION/\*HYDROGEN  
MINS: / COST ANALYSIS/ ENVIRONMENTAL SURVEYS/ HIGH PRESSURE/ PYROLYSIS  
ABA: GRA  
ABS: This study evaluated the effect of several hydrogen production configurations on the cost of syncrude produced by a general catalytic liquefaction process. The five cases analyzed were: partial oxidation of coal at 44.7, 500, and 1000 psia; partial oxidation of char at 1000 psia; and, partial oxidation of process-derived vacuum bottoms at 1000 psia. Material balances for all cases were based on a total coal consumption of 25,000 tons per stream day (TPSD). This study showed that increasing the pressure of partial oxidation 44.7 to 1000 psia reduced the oil cost by 10 percent. This incremental savings in going from 500 to 1000 psia was only two percent, which may make this increase marginal.

79N26226# ISSUE 17 PAGE 2246 CATEGORY 28 RPT#:  
FE-1517-67 CNT#: EX-76-C-01-1517 78/09/00 75  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Coal liquefaction test center TLSP: Quarterly Technical Progress Report, Jan. - Mar. 1978  
CORP: Fluor Engineers and Constructors, Inc., Irvine, Calif. AVAIL.NTIS SAP: HC A04/MF A01  
MAJS: /\*COAL LIQUEFACTION/\*ENERGY POLICY/\*TEST FACILITIES  
MINS: / COAL/ COAL UTILIZATION/ ENERGY TECHNOLOGY/ POWER PLANTS  
ABA: DOE  
ABS: The attempt to bring the plant on stream in an integrated mode is described.

However, because of the nature of the graphite (low porosity and high chemical reactivity at the temperature of the runs) the behavior corresponds to the limiting case of surface reaction control for the model.

78A50150 ISSUE 22 PAGE 4035 CATEGORY 44  
78/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Conversion of western U.S. coals to liquid products  
AUTH: A/WOLK, R. H.; B/LEBOWITZ, H. E.; C/ROVESTI, W. C.; D/STEWART, N. C. PAA: D/(Electric Power Research Institute, Palo Alto, Calif.)  
In: Pacific Chemical Engineering Congress, 2nd, Denver, Colo., August 28-31, 1977. Proceedings, Volume 2. (A78-50126 22-45) New York, American Institute of Chemical Engineers, 1978, p. 900-907.  
MAJS: /\*COAL LIQUEFACTION/\*ENERGY CONVERSION/\*FOSSIL FUELS/\* HYDROCARBON FUEL PRODUCTION  
MINS: / COAL GASIFICATION/ ELECTRIC POWER/ ENERGY TECHNOLOGY / HYDROGENATION/ KINETICS/ MONTANA/ NORTH DAKOTA/ TABLES (DATA)/ WYOMING

ABA: B.J.  
ABS: Information is reviewed on yields and operating conditions based on Wyodak, Amax, Kaiparowitz, and Black Mesa subbituminous coals. These are compared with results from eastern coals. Recent information on early reaction chemistry for Wyodak coal is also presented and compared to similar results with bituminous coal. The formation of calcium-rich solids has been noted in several of the test programs. Several speculative flowsheets are presented which combine hydrogenation, residue gasification, and solids separations in new ways with the aim of lowering liquid product cost.

79N27339# ISSUE 18 PAGE 2391 CATEGORY 28 RPT#:  
DOE/TIC-10039 CNT#: EV-78-C-01-6388 78/11/10 53  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Coal liquefaction: Report on a focus group discussion  
AUTH: A/CRESPI, I.  
CORP: Mathematica, Inc., Princeton, N. J. AVAIL.NTIS  
SAP: HC A04/MF A01  
MAJS: /\*COAL LIQUEFACTION/\*ECONOMIC ANALYSIS/\*TECHNOLOGY ASSESSMENT  
MINS: / COAL UTILIZATION/ EVALUATION/ MARKETING  
ABA: DOE  
ABS: The consensus was that demonstration projects are needed for all coal liquefaction processes and that it is premature to narrow consideration to only one or two. Although the various processes are technically different, the end-use products are said to be essentially interchangeable. The general feeling is that, at this time, little is known about the comparative technical problems, costs, and market potential of SRC-2 as compared with other coal liquefaction processes. Government financing is felt to be essential. It was agreed that the potential market for coal liquefaction products is primarily for use in oil boilers and not in motor fuels.

76-31871 ISSUE 12 PAGE 2122 CATEGORY 23 CNT#:  
EX-76-S-01-2454 78/04/00 9 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: A dispersion model for the Solvent Refined Coal  
Process  
AUTH: A/LEE, M.-H.; B/GUIN, J. A.; C/TARRER, A. R. PAA:  
C/(Auburn University, Auburn, Ala.)  
I & EC - Industrial and Engineering Chemistry, Process  
Design and Development, vol. 17, Apr. 1978, p.  
127-135.

MAJS: /\*COAL LIQUEFACTION/\*DISPERSIONS/\*MATHEMATICAL MODELS  
/\*MULTIPHASE FLOW/\*REFINING

MINS: / DESULFURIZING/ ENERGY TECHNOLOGY/ HYDROGENATION/  
LIQUID-GAS MIXTURES/ MASS TRANSFER/ PECLET NUMBER/  
PILOT PLANTS/ REACTION KINETICS/ REACTOR DESIGN/ TWO  
PHASE FLOW

ABA: (Author)

ABS: The axial dispersion model is applied to the  
reactor-dissolver in the Solvent Refined Coal (SRC)  
liquefaction process. The effect of mixing in the  
two-phase vertical flow coal liquefaction system is  
examined. The parameters arising in the model, such as  
the axial dispersion coefficient for both liquid and  
gas phases, the mass transfer coefficient, and the gas  
phase holdup, are obtainable independently from  
literature correlations. Reaction rate expressions for  
the coal liquefaction, hydrogenation, and  
hydrodesulfurization reactions in the SRC reactor are  
obtained from laboratory studies. A numerical  
simulation for the Wilsonville SRC pilot plant is  
given. The effects of flow behavior and mass transfer  
on the extent of coal dissolution, hydrogen  
consumption, and hydrodesulfurization are illustrated.  
The results predicted from the proposed model are also  
compared to those experimentally measured in the  
Wilsonville pilot plant.

79A26464 ISSUE 9 PAGE 1548 CATEGORY 23  
78/10/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Moessbauer spectroscopy of iron in coal and coal  
hydrogenation products

AUTH: A/KEITSCH, B.; B/GIBBON, G. A.; C/AKHAR, S. PAA:  
A/(Carnegie-Mellon University, Pittsburgh, Pa.);  
C/(U.S. Department of Energy, Pittsburgh Energy  
Research Center, Pittsburgh, Pa.)  
Fuel Processing Technology, vol. 1, Oct. 1978, p.  
269-278.

MAJS: /\*COAL LIQUEFACTION/\*HYDROCARBON FUEL PRODUCTION/\*IRON  
/\*MOSSBAUER EFFECT/\*SPECTROSCOPY

MINS: / CHEMICAL COMPOSITION/ ENERGY TECHNOLOGY/ HYDROGEN  
SULFIDE/ HYDROGENATION/ OILS/ PYRITES/ SULFATES/  
SYNTHETIC FUELS

78N25545\*# ISSUE 16 PAGE 2136 CATEGORY 44  
RPT#: NASA-TM-78696 L-12275 78/05/00 27 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Progress on coal-derived fuels for aviation systems

AUTH: A/WITCOFSKI, R. D.

CORP: National Aeronautics and Space Administration, Langley  
Research Center, Hampton, Va. AVAIL NTIS SAP: HC  
A03/MF A01

Presented at CTOL Transport Technol. Conf., Hampton,  
Va., 28 Feb. - 3 Mar. 1978. Published in NASA-CR-2036

MAJS: /\*AIRCRAFT FUELS/\*COAL LIQUEFACTION/\*TECHNOLOGY  
ASSESSMENT

MINS: / CRYOGENIC FLUIDS/ FUEL SYSTEMS/ HYDROGEN/ METHANE/  
SYNTHETIC FUELS

ABA: Author

ABS: Synthetic aviation kerosene (Syn. Jet-A), liquid  
methane (LCH4), and liquid hydrogen (LH2) appear to be  
the most promising coal-derived fuels. Liquid hydrogen  
aircraft configurations, their fuel systems, and their  
ground requirements at the airport are identified.  
These aircraft appear viable, particularly for long  
haul use, where aircraft fueled with coal derived LH2  
would consume 9 percent less coal resources than would  
aircraft fueled with coal derived Syn. Jet-A.  
Distribution of hydrogen from the point of manufacture  
to airports may pose problems. Synthetic JET-A would  
appear to cause fewer concerns to the air  
transportation industry. Of the three candidate fuels,  
LCH4 is the most energy efficient to produce, and an  
aircraft fueled with coal derived LCH4 may provide  
both the most efficient utilization of coal resources  
and the least expensive ticket as well.

BT Greater Los Angeles Area Energy Symposium, Los  
163.2 Angeles, 1978.

.G74 Greater Los Angeles Area Energy Symposium  
1979 : Tuesday, May 23, 1978 ... Los Angeles,

\* Conversion of Coal to Liquid Fuels - P.147 by Los Angeles  
E. Nelson, Fluor Corporation

A commercial scale plant using sound basic technology has  
been designed to produce gasoline at a cost of \$24.35 per  
barrel based on a 14% return on investment. Feed to the  
plant is 30,000 tpd of coal to make 66,000 bpd of unleaded  
gasoline plus butane, propane, sulfur, ammonia and SNG. Cost  
of the complex including the underground mine is about \$2.6  
billion based on mid-1977 capital requirements.

78A40594 ISSUE 17 PAGE 3122 CATEGORY 44  
78/06/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Combined gas chromatographic-mass spectrometric analyses of nitrogen bases in light oil from a coal liquefaction product

AUTH: A/WHITE, C. M.; B/SCHWEIGHARDT, F. K.; C/SHULTZ, J. L. PAA: C/(U.S. Department of Energy, Pittsburgh Energy Research Center, Pittsburgh, Pa.) Fuel Processing Technology, vol. 1, June 1978, p. 209-215.

MAJS: /\*COAL LIQUEFACTION/\*DESULFURIZING/\*GAS CHROMATOGRAPHY /\*HYDROGENATION/\*MASS SPECTROSCOPY/\*NITROGEN COMPOUNDS

MINS: / ANILINE/ CHEMICAL COMPOSITION/ ENERGY TECHNOLOGY/ OILS/ PYRIDINES

ABA: (Author)

ABS: Nitrogen base components of light oil produced during the catalytic hydrodesulfurization of coal were isolated by precipitation with hydrogen chloride and analyzed by combined gas chromatography-mass spectrometry. Anilines and alkyl pyridines, 71 and 16 weight percent, respectively, were the major components. This is the first quantitative report of anilines and pyridines in materials produced by the hydrogenation of coal. Analytical techniques described provide a rapid and precise method for the analysis of pyridines and anilines.

78A53074\* ISSUE 24 PAGE 4330 CATEGORY 31 CNT#:  
NAS7-100 78/04/00 4 PAGES UNCLASSIFIED DOCUMENT

UTTL: New method of feeding coal - Continuous extrusion of fully plastic coal

AUTH: A/RYASON, P. R.; B/ENGLAND, C. PAA: B/(California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.)

CORP: Jet Propulsion Lab., California Inst. of Tech., Pasadena.

Fuel, vol. 57, Apr. 1978, p. 241-244.

MAJS: /\*COAL LIQUEFACTION/\*EXTRUDING/\*FEEDING (SUPPLYING)/\* MATERIALS HANDLING/\*RHEOLOGY

MINS: / COAL GASIFICATION/ DIES/ ENERGY TECHNOLOGY/ FLOW CHARACTERISTICS/ TEMPERATURE EFFECTS/ THERMOPLASTICITY

ABA: (Author)

ABS: Continuous feeding of coal in a compressing screw extruder is described as a method of introducing coal into pressurized systems. The method utilizes the property of many bituminous coals of softening at temperatures from 350 to 400 C. Coal is then fed much in the manner of common thermoplastics, using screw extruders. Preliminary results show that coals can be extruded at rates of about 3.3 kg/MJ, similar to those for plastics.

78N32287\* ISSUE 23 PAGE 3065 CATEGORY 28 RPT#:  
EPRI-AF-710 78/03/00 76 PAGES UNCLASSIFIED DOCUMENT

UTTL: Economic screening evaluation of upgrading coal liquids to turbine fuels TLSP: Final Report

AUTH: A/DABKOWSKI, M. J.; B/HECK, R. H.; C/PERRELLA, A. V. ; D/SCHREINER, M., JR.; E/STEIN, T. R.

CORP: Mobil Research and Development Corp., Paulsboro, N. J. CSS: (Process Research and Technical Service Div.)

AVAIL.NTIS SAP: HC A05/MF A01

Sponsored by Electric Power Research Inst.

MAJS: /\*COAL LIQUEFACTION/\*COST ESTIMATES/ HYDROCARBON FUELS / MATERIALS RECOVERY/ TURBINES

MINS: / DESULFURIZING/ EXOTHERMIC REACTIONS/ FLUIDIZED BED PROCESSORS/ SOLVENTS/ TABLES (DATA)/ WASTE WATER

ABA: ERA

ABS: Experimental fixed bed hydroprocessing data were used to estimate costs for a 20 MB/SD hydrotreater including waste water treater and sulfur plant using both utility and equity methods of financing. The costs of upgrading the five coal liquids from the H-Coal and Solvent Refined Coal (SRC) processes vary from \$0.34 to \$2.59/MMBTU of liquid fuel product with utility financing (1976 dollars, 0 percent/year inflation) and \$0.36 to \$2.87/MMBTU with equity financing (1980 dollars, 5 percent/year inflation). Cost is a function of the raw coal liquid quality and the hydroprocessing severity necessary to achieve a given product quality. Approximately one-half of the processing cost is for hydrogen input; the other half is about equally divided between capital recovery and operating costs. Capital investment ranged from \$39. MM to \$273 MM for utility financing (1976 dollars) and \$45 MM to \$308 MM for equity financing (1980 dollars).

79N27616\*# ISSUE 18 PAGE 2426 CATEGORY 28  
78/08/15 4 PAGES UNCLASSIFIED DOCUMENT

UTTL: Status report the SRC-1 and SRC-2 processes

AUTH: A/CHENOWETH, G. E.

CORP: Gulf Mineral Resources Co., Denver, Colo.

AVAIL.NTIS SAP: HC A21/MF A01

In JPL Proc. of the Conf. on Coal Use for California p 258-261 (SEE N79-27597 18-42)

MAJS: /\*COAL LIQUEFACTION/\*ENERGY CONVERSION/\*PILOT PLANTS/\* REFINING/\*SOLVENT EXTRACTION

MINS: / CALIFORNIA/ CLEAN ENERGY/ COAL UTILIZATION/ ENERGY POLICY/ ENERGY TECHNOLOGY

ABA: J.M.S.

ABS: Bench-scale and pilot plant development of solvent refined coal (SRC) processes is reviewed. Large SRC demonstration plants are described. Commercialization of the process is envisioned for the 1980's.

79A15323 ISSUE 4 PAGE 573 CATEGORY 31 78/00/00  
10 PAGES UNCLASSIFIED DOCUMENT

UTTL: A conceptual design of a helium liquefaction system for a 300-MVA superconducting generator  
AUTH: A/TOSCANO, W. M.; B/JOHNSON, R. W.; C/MORRIS, R. N. PAA: C/(Helix Technology Corp., Waltham, Mass.)  
In: Advances in cryogenic engineering, Volume 23 - Proceedings of the Conference, Boulder, Colo., August 2-5, 1977. (A79-15301 04-31) New York, Plenum Press, 1978, p. 467-476; Discussion, p. 476. Research supported by the Westinghouse Electric Corp.  
MAJS: /\*CRYOGENIC EQUIPMENT/\*ELECTRIC GENERATORS/\*LIQUEFACTION/\*LIQUID HELIUM/\*SUPERCONDUCTIVITY  
MINS: / COMPRESSORS/ COMPUTER TECHNIQUES/ LIQUID COOLING/ STRUCTURAL RELIABILITY/ SUPERCONDUCTING MAGNETS  
ABA: M.L.  
ABS: The design of a helium liquefaction system intended to provide continuous refrigeration for a 300-MVA superconducting generator is described. Flow system, compressor, liquefier, computer process control, and reliability are discussed. Equipment used includes oil-flooded screw compressors, oil-removal system, gas-bearing turbines, plate fin exchangers, helium dewar, and various valves. The development of superconductivity technology is considered, and refrigeration requirements for a 1200-MVA generator are reported.

79A:0062 ISSUE 1 PAGE 108 CATEGORY 44 78/00/00  
6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Coal liquefaction - Status and new directions  
AUTH: A/ALPFERT, S. B.; B/WOLK, R. H. PAA: B/(Electric Power Research Institute, Palo Alto, Calif.)  
In: Intersociety Energy Conversion Engineering Conference, 13th, San Diego, Calif., August 20-25, 1978, Proceedings, Volume 1. (A79-10001 01-44) Warrendale, Pa., Society of Automotive Engineers, Inc., 1978, p. 463-468.  
ABA: S.C.S.  
ABS: The development status of coal liquefaction processes is discussed noting the H-Coal, Exxon Donor Solvent, and Gulf SRC-II methods. Studies of coal and its liquid products, interactions among coal, solvent, hydrogen, and reaction products, and of the effect of mineral matter on reaction kinetics are described. Prospects for lowering the costs of liquid fuels are outlined along with the investment costs for coal liquefaction. The development of operating plant units is considered in terms of pumps, diagnostic equipment, and valves and valve materials.

79A10059 ISSUE 1 PAGE 108 CATEGORY 44 CNT#:  
EX-76-C-01-2247 78/00/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Gasification of coal liquefaction residues  
AUTH: A/ROBIN, A. M.; B/SCHLINGER, W. G. PAA: B/(Texaco, Inc., Montebello Research Laboratory, El Monte, Calif.)  
In: Intersociety Energy Conversion Engineering Conference, 13th, San Diego, Calif., August 20-25, 1978, Proceedings, Volume 1. (A79-10001 01-44) Warrendale, Pa., Society of Automotive Engineers, Inc., 1978, p. 431-437. Research supported by the Electric Power Research Institute;  
MAJS: /\*COAL LIQUEFACTION/\*ENERGY TECHNOLOGY/\*GASIFICATION/\*PILOT PLANTS/\*RESIDUES  
MINS: / ASHES/ DIAGRAMS/ FEASIBILITY/ HYDROGENATION/ RECYCLING  
ABA: S.C.S.  
ABS: Methods for the gasification of high-ash-coal liquefaction residues are considered and a pilot plant process flow diagram is presented. Particular attention is given to the feed preparation system, gasifier operation, the removal of molten slag, char recovery, and water recycling procedures. Six coal liquefaction processes are listed noting the capacity, plant type, and plant location of each. Primary physical and chemical properties of twelve residues are presented. Preliminary and extended evaluations are made for pilot plant test runs.

79A15889 ISSUE 4 PAGE 645 CATEGORY 44 78/00/00  
12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Status and outlook of the Exxon Donor Solvent coal liquefaction process development  
AUTH: A/EPPERLY, W. R.; B/TAUNTON, J. W. PAA: B/(Exxon Research and Engineering Co., Bayton, Tex.)  
In: Energy technology V: Challenges to technology; Proceedings of the Fifth Conference, Washington, D.C., February 27-March 1, 1978. (A79-15879 04-44) Washington, D.C., Government Institutes, Inc., 1978, p. 353-364.  
MAJS: /\*COAL LIQUEFACTION/\*COMMERCIAL ENERGY/\*HYDROCARBON FUEL PRODUCTION/\*PROCESS CONTROL (INDUSTRY)/\*PRODUCTION ENGINEERING  
MINS: / COST EFFECTIVENESS/ ENERGY CONVERSION EFFICIENCY/ ENERGY TECHNOLOGY/ PILOT PLANTS/ PROJECT PLANNING/ RESEARCH AND DEVELOPMENT

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OF POOR QUALITY

79A15887 ISSUE 4 PAGE 645 CATEGORY 44 78/00/00  
16 PAGES UNCLASSIFIED DOCUMENT

UTTL: SRC-II - Review of development and status --- Solvent Refined Coal process for fuel oil production

AUTH: A/JACKSON, D. M.; B/SCHMID, B. K. PAA: B/(Gulf Mineral Resources Co.)

In: Energy technology V: Challenges to technology: Proceedings of the Fifth Conference, Washington, D.C., February 27-March 1, 1978. (A79-15879 04-44) Washington, D.C., Government Institutes, Inc., 1978, p. 331-346.

MAJS: /\*COAL LIQUEFACTION/\*COAL UTILIZATION/\*FUEL OILS/\*  
HYDROCARBON FUEL PRODUCTION

MINS: / BITUMENS/ ENERGY POLICY/ ENERGY TECHNOLOGY/  
FEASIBILITY ANALYSIS/ FUEL TESTS/ INDUSTRIAL ENERGY/  
MARKET RESEARCH/ PILOT PLANTS/ PROCESS CONTROL  
(INDUSTRY)/ PRODUCTION ENGINEERING/ SYNTHANE

ABA: B.J.

ABS: Recent experience in large pilot plant operations with the Solvent Refined Coal (SRC) fuel oil process on a variety of high-sulfur bituminous coals has demonstrated the technical feasibility of the process for producing a clean coal-derived fuel oil and byproduct SNG. Product characterization and testing of the SRC fuel oil product indicate a potential for displacement of petroleum fuel oil in industrial and utility boilers. This paper describes the SRC-II process and gives attention to SRC fuel oil properties, preliminary combustion tests, the SRC module program schedule, and SRC fuels commercialization.

79A10056 ISSUE 1 PAGE 107 CATEGORY 44 78/00/00  
5 PAGES UNCLASSIFIED DOCUMENT

UTTL: H-coal products for direct application to power generation -- coal liquefaction derived fuels

AUTH: A/KYDD, P. H. PAA: A/(Hydrocarbon Research, Inc., Research and Development Center, Lawrenceville, N.J.)

In: Intersociety Energy Conversion Engineering Conference, 13th, San Diego, Calif., August 20-25, 1978, Proceedings, Volume 1. (A79-10001 01-44) Warrendale, Pa., Society of Automotive Engineers, Inc., 1978, p. 409-413. Research supported by the U.S. Department of Energy.

ABA: S.C.S.

ABS: The basic aspects of the H-coal process are outlined with reference to the types of fuel which may be made available. Attention is given to the coal liquefaction process, solid-liquid separation, and hydrogen supplies. H-coal product fractions and gas turbine fuel specifications are listed. Heteroatom removal procedures are noted and the NO(x) problem is discussed in terms of NO(x) emissions associated with the conversion of fuel-bound nitrogen to NO(x).

78A40595 ISSUE 17 PAGE 3122 CATEGORY 44  
78/06/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Viscosity of coal-derived liquids

AUTH: A/BOCKRATH, B. C.; B/MOCETI, R. P.; C/LACOUNT, R. B.

PAA: B/(U.S. Department of Energy, Pittsburgh Energy Research Center, Pittsburgh, Pa.); C/(Waynesburg College, Waynesburg, Pa.)  
Fuel Processing Technology, vol. 1, June 1978, p. 217-226.

MAJS: /\*CHEMICAL FRACTIONATION/\*COAL LIQUEFACTION/\*  
HYDROCARBON FUEL PRODUCTION/\*VISCOSITY

MINS: / ASPHALT/ COAL UTILIZATION/ ENERGY TECHNOLOGY/  
HYDROGENATION/ TOLUENE

ABA: G.R.

ABS: It is pointed out that viscosity is one of the important characteristics of interest in the case of liquid products derived from coal hydrogenation processes. An investigation is conducted concerning the quantitative relationships between viscosity and product composition. It is found that the natural logarithm of the viscosity ratio shows a linear dependence on the solution concentration within the examined range. This relationship provides a basis for the approximate estimation of the viscosities of liquids of varying asphaltene and toluene insolubles content. The toluene insolubles, on a weight basis, produce a viscosity about twice that found for the whole asphaltene fraction. The basic asphaltene subfraction has a greater effect on viscosity than either the acid-neutral subfraction or the whole asphaltene.

79A10521 ISSUE 1 PAGE 122 CATEGORY 44 78/00/00  
23 PAGES UNCLASSIFIED DOCUMENT

UTTL: Engineering analysis of in situ liquefaction of coal

AUTH: A/WISE, D. L.; B/AUGENSTEIN, D. C. PAA: B/(Dynatech R/D Co., Cambridge, Mass.)

In Situ, vol. 2, no. 3, 1978, p. 173-195.

ABA: M.L.

ABS: In situ liquefaction of underground coal by hot aqueous alkaline extraction is discussed and is evaluated as an economic and practical alternative to deep shaft mining as well as in situ gasification. In the described process, hot alkali, pumped at high

pressure down a borehole, passes through the coal bed (rendered permeable by fracturing) and reacts with coal to form a product mix which exits through a second borehole. Examination of material and energy balances and thermal effects suggests that this liquefaction concept has favorable features.

78A38405 ISSUE 16 PAGE 2878 CATEGORY 25  
78/01/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Residence time measurements in a coal hydrogenation process

AUTH: A/LYTTLE, J. M.; B/WOOD, R. E.; C/WISER, W. H.;  
D/MLADEJOVSKY, M. G. PAA: D/(Utah, University, Salt  
Lake City, Utah)  
Fuel Processing Technology, vol. 1, Jan. 1978, p.  
95-102.

MAJS: /\*COAL LIQUEFACTION/\*HYDROCARBON FUEL PRODUCTION/\*  
HYDROGENATION/\*REACTION TIME

MINS: / ENERGY TECHNOLOGY/ IRON/ MAGNETIC FIELDS/ PRODUCTION  
ENGINEERING/ PYROLYSIS/ RESONANT FREQUENCIES/ TRACE  
ELEMENTS

ABA: (Author)

ABS: Residence time of coal in the University of Utah  
'coiled tube' coal hydrogenation reactor has been  
measured. This has been done with an electronic device  
which detects a tracer (usually iron) as it passes  
specific places at the beginning and end of the  
reactor. The measured coal solids residence time in

the reactor has varied from a few seconds to a few  
minutes. Calculated vapor and gas residence times are  
one or two seconds. Short vapor residence time  
terminates further hydrogenation of vapors and thus  
reduces gas production and hydrogen consumption. The  
relatively longer coal solids residence time permits  
further hydrogenation which increases liquid yields.

78V11199 1977 ISS: 09 TP343.L678 0-12-237250-6 662.662

AUTH: A/Ellington, Rex T.

UTTL: Liquid fuels from coal / edited by Rex T. Ellington. -  
American Chemical Society.  
Academic Press, New York : xvii, 273 p. : ill. : 24  
cm.

Proceedings of a symposium held at the American  
Chemical Society meeting in San Francisco, Aug.  
29-Sep. 3, 1976. @Includes bibliographical references  
and index.

LC: Coal liquefaction--Congresses.

NASA: / COAGULATION/ COAL LIQUEFACTION/ CONFERENCES/  
FILTRATION/ HYDROGEN/ HYDROGENATION/ KINETICS/ LIQUID  
CHROMATOGRAPHY/ PARTICLES/ PETROGRAPHY/ PHENANTHRENE/  
SOLUBILITY/ SOLVENTS

JPL: / TP343.L767 1976 LE: / TP343.L678 HQ: /  
TP343.L678

MAIN-TITL TRACE-CORP\*AUTH\* CATLG BY-FACILITY  
77/12/05 AVAIL: / JPL/ LANGLEY/ LEWIS/ NASA HQ.

78A41221 ISSUE 17 PAGE 304 CATEGORY 25  
78/07/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Kinetics of thermal liquefaction of Belle Ayr  
subbituminous coal

AUTH: A/CRONAUER, D. C.; B/RUBERTO, R. G.; C/SHAH, Y. T.  
PAA: B/(Gulf Research and Development Co., Pittsburgh,  
Pa.); C/(Gulf Research and Development Co.,  
Pittsburgh, University, Pittsburgh, Pa.)  
I & EC - Industrial and Engineering Chemistry, Process  
Design and Development, vol. 17, July 1978, p.  
281-288. Research supported by the Electric Power  
Research Institute.

MAJS: /\*CATALYSIS/\*COAL LIQUEFACTION/\*REACTION KINETICS

MINS: / ANTHRACENE/ CLEAVAGE/ ENERGY TECHNOLOGY/ HYDROGEN  
COMPOUNDS/ HYDROGENATION/ SLURRIES

ABA: M.L.

ABS: A kinetic study of thermal liquefaction of Belle Ayr  
subbituminous coal is reported. Experiments were  
performed in a laboratory-scale continuous stirred  
tank reactor, and data on coal conversion and the  
production of pre-asphaltenes, asphaltenes, oils, and  
gases such as C1 through C6 hydrocarbons, NH3, H2S,  
CO, CO2, and water are presented. Experimental  
conditions involved a temperature range of 400 to 470  
C, space times of approximately 5 to 55 min, a total  
unit pressure of 2000 psig, and a coal-to-solvent  
ratio of 1:1.5. Two solvents, hydrogenated anthracene  
oil and hydrogenated phenanthrene, were studied. A  
kinetic model which assumes reaction rates to be  
pseudo-first order with respect to reacting species is  
found suitable at 400-450 C for all space times, and  
at 460 and 470 C for small space times.

78N78704# CATEGORY 44 RPT#: FE-2306-9 OPR-3  
CNT#: EX-76-C-01-2306 E(49-18)-2306 77/11/00 44  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Research and development of an advanced process for  
the conversion of coal to synthetic gasoline and other  
distillate fuels. TLSP: Quarterly Progress Report,  
Nov. 1976 - Jan. 1977

AUTH: A/SCHNEIDER, A.; B/HOLLSTEIN, E. J.; C/JANOSKI, E.  
J.; D/CHONG, V. M.

CORP: Suntech, Inc., Marcus Hook, Pa. CSS: (Research and  
Engineering Div.) AVAIL:NTIS

MAJS: /\*COAL LIQUEFACTION/\*ENERGY CONVERSION/\*ENERGY POLICY  
/\*RESEARCH AND DEVELOPMENT/\*SYNTHETIC FUELS

MINS: / BAUXITE/ CATALYSTS/ CHEMICAL ENGINEERING/ GASOLINE/  
NITROGEN

78N32290# ISSUE 23 PAGE 3066 CATEGORY 28 RPT#:  
FE-2003-27 CNT#: EY-77-C-01-2003 77/09/00 297  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Chemical characterization, handling, and refining of  
solvent refined coal to liquid fuels TLSP: Final  
Report

AUTH: A/GIVENS, E. N.; B/COLLURA, M. A.; C/ALEXANDER, W.;  
D/GRESKOVICH, E. J.; E/ENGELMAN, C. D.;  
F/WETHERINGTON, J. B.; G/CLUMP, C. W.; H/LEVY, E. K.  
PAA: G/(Lehigh Univ., Bethlehem, Pa.); H/(Lehigh  
Univ., Bethlehem, Pa.)

CORP: Air Products, Inc., Allentown, Pa. CSS: (Corporate  
Research Dept.) AVAIL.NTIS SAP: HC A13/MF A01

MAJS: /\*CHEMICAL ANALYSIS/\*COAL LIQUEFACTION/\*SOLVENT  
EXTRACTION

MINS: / CATALYSTS/ COAL UTILIZATION/ FILTRATION/  
HYDROMETALLURGY

ABA: ERA

ABS: Solvent refined coal (SRC) products from the  
Wilsonville, Alabama and Tacoma, Washington  
liquefaction facilities were characterized by a broad  
range of chemical methods. Analytical procedures were  
established to analyze feed and products from the  
hydroprocessing of these SRC materials in a unit  
designed and built specifically for processing  
residual materials. Authentic and synthetic filtrates  
were processed upflow in hydrogen over three different  
commercially available catalysts. Residual (greater  
than 850 F boiling point) SRC conversions up to 46 wt  
percent were observed under typical hydrotreating  
conditions on authentic filtrate over a cobalt  
molybdenum catalyst. A synthetic filtrate comprised of  
creosote oil containing 52 wt percent Tacoma SRC was  
used for evaluating nickel molybdenum and nickel  
tungsten catalysts. Nickel molybdenum on alumina  
catalyst converted more 850 F+ SRC, consumed less  
hydrogen and produced a better product distribution

than nickel tungsten on silica alumina.

77N84766# CATEGORY 25 RPT#: PERC/RI-77/3  
77/02/00 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: Chromatographic characterization of coal liquefaction  
products

CORP: Energy Research and Development Administration,  
Pittsburgh, Pa. CSS: (Energy Research Center.)  
AVAIL.NTIS

MAJS: /\*CHEMICAL ANALYSIS/\*CHROMATOGRAPHY/\*COAL LIQUEFACTION  
/\*THIN LAYER CHROMATOGRAPHY

MINS: / ADSORPTION/ ELECTROPHORESIS/ HYDROCARBON FUELS/  
SOLVENT EXTRACTION/ SYNTHETIC FUELS

78A43419 ISSUE 19 PAGE 3505 CATEGORY 44  
77/00/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: The Exxon donor solvent process

AUTH: A/FURLONG, L. E.; B/EFFRON, E.; C/VERNON, L. W.;  
D/WILSON, E. L. PAA: D/(Exxon Research and  
Engineering Co., Baytown, Tex.)  
In: Coal processing technology, Volume 3. (478-43403  
19-44) New York, American Institute of Chemical  
Engineers, 1977, p. 145-151.

MAJS: /\*CHEMICAL ENGINEERING/\*COAL LIQUEFACTION/\*HYDROCARBON  
FUEL PRODUCTION/\*HYDROGENATION/\*SOLVENTS

MINS: / ENERGY TECHNOLOGY/ NAPHTHALENE/ STOICHIOMETRY  
ABA: V.P.

ABS: In the present paper, Exxon's research work on coal  
liquefaction is reviewed, and the currently envisioned  
commercial EDS process is outlined. Particular  
attention is given to the donor solvent, the currently  
operating 1-ton/day pilot plant, and the nature of the  
liquid products. The principal steps of the EDS  
process directed toward production of naphtha blending  
components and low-sulfur fuel oil are discussed, and  
the basic requirements and specifications for a  
250-ton/day pilot unit are established.

78A38403 ISSUE 16 PAGE 2876 CATEGORY 23  
77/08/00 18 PAGES UNCLASSIFIED DOCUMENT

UTTL: Early coal hydrogenation catalysis

AUTH: A/DONATH, E. E.; B/HOERING, M.  
Fuel Processing Technology, vol. 1, Aug. 1977, p.  
3-20.

MAJS: /\*CATALYSIS/\*COAL LIQUEFACTION/\*ENERGY TECHNOLOGY/\*  
HYDROGENATION

MINS: / CRUDE OIL/ FUEL OILS/ PHASE TRANSFORMATIONS/  
RESEARCH AND DEVELOPMENT

ABA: S.D.

ABS: The early stages of research and development of coal  
hydrogenation catalysts and their use in hydrogenating  
coal to produce liquid fuels are reviewed. The  
preparation of sulfur-resistant hydrogenation  
catalysts allowed production of fuels that met  
petroleum-fuel specifications. The discussion is  
focused on catalyst development for the liquid and  
vapor phases. The catalysts used for the hydrogenation  
of brown coal tar residue in the liquid phase are  
described. The vapor phase is divided into the  
prehydrogenation (hydrotreating) and the  
splitting-hydrogenation (hydrocracking) steps. It is  
concluded that the continuing development of catalysts  
together with progress in the hydrogenation process  
and plant engineering are largely responsible for the  
rapid acceptance of the process.

77N28322\*# ISSUE 19 PAGE 2515 CATEGORY 28  
RPT#: NASA-TM-X-74030 77/05/00 44 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Alternate aircraft fuels: Prospects and operational implications  
AUTH: A/WITCOFSKI, R. D.  
CORP: National Aeronautics and Space Administration, Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A03/MF A01  
MAJS: /\*AIRCRAFT FUELS/\*COAL LIQUEFACTION/\*SYNTHETIC FUELS  
MINS: / AIRCRAFT PERFORMANCE/ EXHAUST GASES/ KEROSENE/ LIQUID HYDROGEN/ METHANE/ THERMODYNAMIC EFFICIENCY/ TRANSPORT AIRCRAFT  
ABA: Author  
ABS: The potential use of coal-derived aviation fuels was assessed. The studies addressed the prices and thermal efficiencies associated with the production of coal-derived aviation kerosene, liquid methane and liquid hydrogen and the air terminal requirements and subsonic transport performance when utilizing liquid hydrogen. The fuel production studies indicated that liquid methane can be produced at a lower price and with a higher thermal efficiency than aviation kerosene or liquid hydrogen. Ground facilities of liquefaction, storage, distribution and refueling of liquid hydrogen fueled aircraft at airports appear technically feasible. The aircraft studies indicate modest onboard energy savings for hydrogen compared to conventional fuels. Liquid hydrogen was found to be superior to both aviation kerosene and liquid methane from the standpoint of aircraft engine emissions.

78A26585 ISSUE 9 PAGE 1604 CATEGORY 44 CNT#: NSF 38701 77/00/00 19 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Kinetics and solubility of hydrogen in coal liquefaction reactions  
AUTH: A/GUIN, J. A.; B/TARRER, A. R.; C/PITTS, W. S.; D/PRATHER, J. W. PAA: D/(Auburn University, Auburn, Ala.)  
In: Liquid fuels from coal; Proceedings of the Symposium, San Francisco, Calif., August 29-September 3, 1976. (A78-26576 09-44) New York, Academic Press, Inc., 1977, p. 133-151.  
MAJS: /\*COAL LIQUEFACTION/\*HYDROGENATION/\*REACTION KINETICS /\*SOLUBILITY  
MINS: / ENERGY TECHNOLOGY/ HYDROCARBONS/ OILS

77A51588 ISSUE 24 PAGE 4128 CATEGORY 25  
77/10/00 5 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Ignition of droplets of liquid fuels solvent extracted from coal  
AUTH: A/JORDAN, J. B.; B/WILLIAMS, A.; C/KIMBER, G. M. PAA: B/(Leeds University, Leeds, England); C/(Coal Research Establishment, Cheltenham, Glos., England) Fuel, vol. 56, Oct. 1977, p. 417-421.  
MAJS: /\*COAL LIQUEFACTION/\*DROPS (LIQUIDS)/\*FUEL COMBUSTION /\*IGNITION/\*SYNTHETIC FUELS  
MINS: / AIR POLLUTION/ CHEMICAL COMPOSITION/ CLEAN ENERGY/ ENERGY TECHNOLOGY/ FUEL OILS/ PARTICLE SIZE DISTRIBUTION  
ABA: (Author)  
ABS: A single suspended-droplet technique has been used to study droplet combustion of a range of solvent-refined coal extracts in a furnace at 850 C. The small particles of extract are solid at room temperature but they rapidly liquefy on exposure to the hot furnace environment, permitting the size and mass-time combustion history to be measured. Their combustion behaviour is discussed in terms of their high aromaticity and comparison with the single droplet combustion of fuel oils of different asphaltene content was used to highlight potential solids emissions problems which may arise when firing in large systems.

77N27498\*# ISSUE 18 PAGE 2402 CATEGORY 44  
RPT#: NASA-TM-75151 CNT#: NAS7-100 77/07/00 44 PAGES UNCLASSIFIED DOCUMENT  
Original language document was announced as A76-46522  
UTTL: Solubilization of coal in organic media  
AUTH: A/LAHAYE, P.; B/DECROOCCQ, D.  
CORP: Scientific Translation Service, Santa Barbara, Calif. AVAIL.NTIS SAP: HC A03/MF A01  
Washington NASA Transl. into ENGLISH from Rev. Inst. Fr. Petrole Ann. Combust. Liquides (Paris), v. 31, no. 1, Jan. - Feb. 1976 p 99-130  
MAJS: /\*COAL LIQUEFACTION/\*SOLVENT EXTRACTION  
MINS: / AMINES/ EXPERIMENTAL DESIGN/ SOLVENTS/ TECHNOLOGY ASSESSMENT/ TEMPERATURE/ YIELD  
ABA: D.M.L.  
ABS: The use of solvent extraction to solubilize coal is discussed. Simple extractions are described which are conducted at moderate temperatures to exclude extraneous chemical reactions which would lead to uncontrolled changes in the components of the treated coal. Sample preparation, extraction apparatus, and the determination of extract yield for different experiments are also described.

78A43415\* ISSUE 19 PAGE 3453 CATEGORY 28 CNT#:  
NAS3-19747 77/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Jet fuels from synthetic crudes  
AUTH: A/ANTOINE, A. C.; B/GALLAGHER, J. P. PAA: A/(NASA,  
Lewis Research Center, Cleveland, Ohio); B/(Atlantic  
Richfield Co., Harvey, Ill.)  
CORP: National Aeronautics and Space Administration, Lewis  
Research Center, Cleveland, Ohio.; Atlantic Richfield  
Co., Harvey, Ill.  
In: Coal processing technology, Volume 3. (A78-43403  
19-44) New York, American Institute of Chemical  
Engineers, 1977, p. 107-114.  
MAJS: /\*COAL LIQUEFACTION/\*JET ENGINE FUELS/\*SHALE OIL/\*  
SYNTHETIC FUELS  
MINS: / CLEAN FUELS/ ENERGY TECHNOLOGY/ GAS TURBINE ENGINES/  
TABLES (DATA)  
ABA: G.R.

ABS: An investigation was conducted to determine the  
technical problems in the conversion of a significant  
portion of a barrel of either a shale oil or a coal  
synthetic crude oil into a suitable aviation turbine  
fuel. Three syncrudes were used, one from shale and  
two from coal, chosen as representative of typical  
crudes from future commercial production. The material  
was used to produce jet fuels of varying  
specifications by distillation, hydrotreating, and  
hydrocracking. Attention is given to process  
requirements, hydrotreating process conditions, the  
methods used to analyze the final products, the  
conditions for shale oil processing, and the coal  
liquid processing conditions. The results of the  
investigation show that jet fuels of defined

specifications can be made from oil shale and coal  
syncrudes using readily available commercial  
processes.

77N83869# CATEGORY 44 RPT#: COO-0020-6 CNT#:  
EX-76-S-02-0020 77/01/05 10 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Mass spectrometric analytical services and research  
activities to support coal-liquid characterization  
research TLSP: Quarterly Report, 9 Sep. - 8 Dec.  
1976  
AUTH: A/SCHEPPELE, S. E.  
CORP: Oklahoma State Univ., Stillwater. CSS: (Dept. of  
Chemistry.) AVAIL.NTIS  
MAJS: /\*COAL LIQUEFACTION/\*MASS SPECTROSCOPY/\*RESEARCH AND  
DEVELOPMENT  
MINS: / ALKYL COMPOUNDS/ GALLIUM/ ION SOURCES/  
OXIDATION-REDUCTION REACTIONS

79N14242# ISSUE 5 PAGE 581 CATEGORY 28 RPT#:  
ANL/CEN-FE-77-5 CNT#: W-31-109-ENG-38 77/00/00 21  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Coal liquefaction support studies. Task 1: Heat of  
reaction of hydrogen with coal slurries. Task 2:  
Heat transfer coefficient TLSP: Quarterly Report,  
Apr. - Jun. 1977  
AUTH: A/FISCHER, J.; B/YOUNG, J.; C/LO, R.; D/MULCAHEY,  
T.; E/FREDRICKSON, D.; F/BANE, R.; G/CANNON, T.;  
H/BROCK, R.; I/WILSON, W. D.; J/JONKE, A.  
CORP: Argonne National Lab., Ill. CSS: (Chemical  
Engineering Div.) AVAIL.NTIS SAP: HC A02/MF A01  
MAJS: /\*COAL LIQUEFACTION/\*HEAT TRANSFER COEFFICIENTS/\*  
HYDROGEN/\*OILS  
MINS: / CALORIMETERS/ COAL/ HEAT EXCHANGERS/ HYDROGENATION/  
SLURRIES  
ABA: DOE

ABS: A development program is being carried out to obtain  
information applicable to the Synthoil process for  
converting coal to liquid fuel of low sulfur content.  
This report presents information on: (1) a calorimeter  
to measure heat of reaction of hydrogen with coal  
slurries; and (2) the construction status and a test  
program for the apparatus for measuring heat transfer  
coefficients of Synthoil feed and effluents.

77A18582 ISSUE 6 PAGE 797 CATEGORY 23 77/01/00  
6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fractionation and structural characterization of coal  
liquids  
AUTH: A/FARCASIU, M. PAA: A/(Mobil Research and  
Development Corp., Princeton, N.J.)  
Fuel, vol. 56, Jan. 1977, p. 9-14. Research supported  
by the Mobil Research and Development Corp. and  
Electric Power Research Institute.  
MAJS: /\*COAL LIQUEFACTION/\*FRACTIONATION/\*MOLECULAR  
STRUCTURE/\*SILICA GEL  
MINS: / AROMATIC COMPOUNDS/ ELUTION/ ENERGY TECHNOLOGY/  
HYDROCARBONS/ SOLUBILITY/ THIN LAYER CHROMATOGRAPHY  
ABA: (Author)  
ABS: A method of characterizing coal liquids in terms of  
fractions of different chemical functionality is  
described. This method is based on chromatographic  
fractionation of both benzene-soluble and  
pyridine-soluble components by sequential elution with  
specific solvents on silica gel columns. The paper  
presents the theoretical criteria for choosing the  
conditions and the sequence of elution solvents, the  
methods used to establish the chemical structure, and  
model compound comparisons.

78A26576 ISSUE 9 PAGE 1603 CATEGORY 44  
77/00/00 289 PAGES UNCLASSIFIED DOCUMENT

UTTL: Liquid fuels from coal; Proceedings of the Symposium,  
San Francisco, Calif., August 29-September 3, 1976  
AUTH: A/ELLINGTON, R. T. PAA: A/(Fluor Engineers and  
Constructors, Inc., Houston, Tex.) PAT: A/(ED.)  
SAP: \$14.50

Symposium sponsored by the American Chemical Society  
New York, Academic Press, Inc., 1977. 289 p (For  
individual items see A78-26577 to A78-26592)

MAJS: /\*COAL LIQUEFACTION/\*CONFERENCES/\*ENERGY TECHNOLOGY/\*  
HYDROCARBON FUEL PRODUCTION

MINS: / CHEMICAL REACTORS/ COAL UTILIZATION/ DESULFURIZING/  
FRACTIONATION/ HYDROCARBONS/ HYDROGENATION/ LIQUID  
CHROMATOGRAPHY/ REACTION KINETICS

ABA: G.R.

ABS: The role of the solvent in the solvent refined coal  
process is considered along with the products from  
two-step coal liquefaction using three different  
first-step reactor packings, the effect of coal  
minerals on reaction rates during coal liquefaction,  
the hydrogenation of phenanthrene over a commercial  
cobalt molybdenum sulfide catalyst under severe  
reaction conditions, new materials for coal  
liquefaction, and the deactivation and attrition of  
Co-Mo catalyst during H-coal operations. Attention is  
also given to the catalytic liquefaction of coal, the  
kinetics of coal hydrodesulfurization in a batch  
reactor, kinetics and solubility of hydrogen in coal  
liquefaction reactions, techniques and product  
distributions related to short contact time coal  
liquefaction, the reformation of inorganic  
particulates suspended in coal derived liquids and  
improved separation, the coagulation and filtration of  
solids from liquefied coal of the Synthoil process,  
the filterability of coal-derived liquid, the analysis  
of liquid products derived from coal conversion  
processes, and the separation of coal liquids from  
major liquefaction processes into meaningful  
fractions.

78N77372# CATEGORY 28 RPT#: TID-28167 CNT#:  
EX-76-C-01-2047 77/00/00 88 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Clean solid and liquid fuels from coal TLSP:  
Quarterly Progress Report, Jul. - Sep. 1977

AUTH: A/GARY, J. H.; B/GOLDEN, J. O.; C/BALDWIN, R.;  
D/BAIN, R. L.; E/DICKERHOOF, D. W.

CORP: Colorado School of Mines, Golden. AVAIL.NTIS

MAJS: /\*CHEMICAL REACTORS/\*CLEAN ENERGY/\*COAL LIQUEFACTION/\*  
HYDROCARBON FUELS

MINS: / ENERGY POLICY/ ENERGY TECHNOLOGY/ LIQUID  
CHROMATOGRAPHY

78A16637 ISSUE 4 PAGE 563 CATEGORY 25 77/00/00  
12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Synthetic fuels and combustion  
AUTH: A/LONGWELL, J. P. PAA: A/(Exxon Research and  
Engineering Co., Linden, N.J.)  
Progress in Energy and Combustion Science, vol. 3, no.  
2, 1977, p. 127-138.

MAJS: /\*COAL LIQUEFACTION/\*FUEL COMBUSTION/\*POLLUTION  
CONTROL/\*SYNTHETIC FUELS

MINS: / CLEAN ENERGY/ ENERGY REQUIREMENTS/ ENERGY TECHNOLOGY  
/ RESEARCH AND DEVELOPMENT/ SOOT/ THERMODYNAMIC  
EFFICIENCY/ TRANSPORTATION ENERGY

ABA: S.D.

ABS: The term synthetic fuels is used in the energy  
industry to mean fossil fuels produced from sources  
other than petroleum. The large coal resources and  
their extensive occurrence throughout the world  
suggest that coal liquefaction will in time be the  
major source of liquid fuels. Emphasis is placed on  
conversion of coal to liquid fuels for transportation  
use. Transportation fuel requirements and solution to  
combustion problems in automotive systems are  
discussed. Future work should focus on improvement in  
the ability of aircraft engines to burn highly  
aromatic fuels with a wide boiling range and on  
research into the chemistry of soot formation and  
burnout along with the mechanics of reactive flows  
involving high-molecular-weight liquids and vapors and  
soot.

78N25606# ISSUE 16 PAGE 2144 CATEGORY 44 RPT#:  
ANL-77-61 CNT#: W-31-109-ENG-38 77/09/00 47 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Nondestructive evaluation needs for coal liquefaction

AUTH: A/KUPPERMAN, D. S.

CORP: Argonne National Lab., Ill. AVAIL.NTIS SAP: MC  
A03/MF A01

MAJS: /\*COAL LIQUEFACTION/\*CORROSION PREVENTION/\*  
NONDESTRUCTIVE TESTS/\*PRODUCTION ENGINEERING

MINS: / CORROSION TESTS/ ENERGY POLICY/ ENERGY TECHNOLOGY/  
QUALITY CONTROL/ SLURRIES

ABA: ERA

ABS: Nondestructive evaluation was highly rated in  
importance as a way to help alleviate problems in  
coal-conversion systems. The primary problems were  
associated with highly erosive and corrosive slurries  
being transferred throughout the coal-conversion  
process. Applicable NDE techniques for both preservice  
and in-service inspection include high-temperature  
ultrasonics, acoustic emission, radiography, acoustic  
holography, and ultrasonic spectroscopy.

78A43417 ISSUE 19 PAGE 3453 CATEGORY 28  
77/00/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Evaluation of coal-derived JP-5 fuels  
AUTH: A/NOWACK, C. J.; B/SOLASH, J.; C/DELFOSE, R. J.  
PAA: C/(U.S. Naval Air Propulsion Test Center,  
Trenton, N.J.)  
In: Coal processing technology. Volume 3. (A78-43403  
19-44) New York, American Institute of Chemical  
Engineers, 1977, p. 122-126.

ABA: G.R.

ABS: On the basis of an evaluation of the data obtained in  
the pilot plant experiment of an American company, it  
is concluded that it will be difficult to convert coal  
syncrudes from the Char Oil Energy Development process  
into a jet fuel having all the properties of the  
present MIL-T-5624K specification for grade JP-5 fuel.  
Those properties which will not be acceptable for a  
wide boiling range fuel, having an end point of 575 F,  
are specific gravity, viscosity, and smoke point on a  
25% aromatic level. Development work on refining coal  
syncrudes should be conducted to improve process  
variables. This work should also include the  
development of catalysts that are resistant to those  
compounds in coal syncrudes which are responsible for  
deactivation. Both high and low aromatic fuels derived  
from Utah and Western Kentucky coals had acceptable  
storage and thermal oxidation stability.

78A26589 ISSUE 9 PAGE 1605 CATEGORY 44  
77/00/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Analyzing liquid products derived from coal conversion  
processes

AUTH: A/DOOLEY, J. E.; B/THOMPSON, C. J. PAA: B/(U.S.  
Department of Energy, Bartlesville Energy Research  
Center, Bartlesville, Okla.)  
In: Liquid fuels from coal; Proceedings of the  
Symposium, San Francisco, Calif., August 29-September  
3, 1976. (A78-26576 09-44) New York, Academic Press,  
Inc., 1977, p. 221-231.

ABA: (Author)

ABS: Coal derived liquids were characterized by means of  
separation techniques such as distillation, gradient  
elution chromatography, acid and base extractions, and  
gel permeation chromatography (GPC) followed by  
instrumental analyses such as mass spectrometry and  
nuclear magnetic resonance spectrometry. Samples from  
the COED and SYNTHOIL liquefaction processes were  
studied. Results show liquids are amenable to the  
characterization procedure and provide basic data that  
should be useful in formulating refining processes for  
these materials. The procedure provides considerable  
detail in the analysis and relates chain carbons,  
naphthenic ring carbons, and aromatic ring carbons to  
established GPC-mass spectral correlations.

78A43416 ISSUE 19 PAGE 3453 CATEGORY 28  
77/00/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Gas turbine engine fuel from synthetic crude  
AUTH: A/EISEN, F. S.; B/TICE, J. D. PAA: B/(Suntech,  
Inc., Marcus Hook, Pa.)  
In: Coal processing technology. Volume 3. (A78-43403  
19-44) New York, American Institute of Chemical  
Engineers, 1977, p. 115-121.

ABA: G.R.

ABS: In an effort to expand the domestic supply base for  
liquid fuel, a program was initiated to evaluate the  
suitability of synthetic fuels (from coal, oil shale,  
and tar sands) for DOD needs. In this connection a  
contract was awarded to an American company to produce  
jet fuel from coal-derived synthetic crude oil. The  
objective was to provide JP-5 type jet fuel samples  
for testing. In the first phase of the project four  
10-gal lots of jet fuel were prepared from coal  
syncrude. During the second phase 250 gal were  
produced of one of the fuels. The investigation shows  
that gas turbine engine fuels having 2-25 vol %  
aromatics, which meet most current JP-5  
specifications, can be produced from the coal  
syncrudes tested. Severe hydrogenation conditions are  
required to reduce the aromatic content of the coal  
syncrude kerosine fraction to 20-25 vol % in one  
stage. Meeting the current JP-5 smoke point  
specification will be difficult for coal-derived fuels  
with aromatics greater than 20 vol % or so.

78V21810 1977 ISS: 00 TP360.073 1977 338.4766266 LC-  
78-301762

UTTL: Potential environmental impacts from the production of  
synthetic fuels from coal / Environment Directorate,  
Organization for Economic Cooperation and Development,  
Environment Directorate.

Organisation for Economic Co-operation and  
Development, Paris : 54 p. : diagrs. : 30 cm.  
Cover title. Bibliography: p. 54.

LC: Synthetic fuel. Coal liquefaction. Coal  
gasification.

MAIN-CORP TRACE-TITL\* CATLG BY-LC

/ / Pubi In FRANCE

78A26583 ISSUE 9 PAGE 1604 CATEGORY 44  
77/00/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Catalytic liquefaction of coal  
AUTH: A/FU, Y. C.; B/BATCHELDER, R. F. PAA: B/(U.S. Department of Energy, Pittsburgh Energy Research Center, Pittsburgh, Pa.)  
In: Liquid fuels from coal; Proceedings of the Symposium, San Francisco, Calif., August 29-September 3, 1976. (A78-26576 09-44) New York, Academic Press, Inc., 1977, p. 103-116.

MAJS: /\*CATALYTIC ACTIVITY/\*COAL LIQUEFACTION/\*DESULFURIZING  
/\*HYDROGENATION

MINS: / BITUMENS/ CATALYSTS/ CHEMICAL REACTORS/ ENERGY TECHNOLOGY

ABA: (Author)

ABS: High sulfur bituminous coal is liquefied and desulfurized by hydrotreating with syngas at 3,000 psi in the presence of added water, vehicle, and catalyst. Cobalt molybdate catalyst impregnated with alkali metal compounds, such as potassium carbonate, sodium carbonate, and potassium acetate exhibited good activities for liquefaction and desulfurization. High coal conversions and oil yields can be obtained in the temperature range of 400 to 450 C, and the asphaltene and the sulfur contents of the oil products are comparable to that obtained in coal liquefaction using pure hydrogen and cobalt molybdate under similar conditions. Further improvements in the oil quality could be attained under more severe conditions at 450 C and increased reaction time, but both syngas usage and hydrogen usage would increase substantially. Catalytic coal liquefaction using syngas gives an improved thermal efficiency and reduces the capital and operating costs by eliminating shift converters and purifying systems need for the liquefaction process using hydrogen.

78V27926 1977 ISS: 00 TP343.L67E 0-122372-50-6  
662.6622 LC-77-5002

AUTH: A/Ellington, R. T.

UTTL: Liquid fuels from coal / edited by Rex T. Ellington. Academic Press, New York : xvii, 273 p. : ill. ; 24 cm.

Proceedings of a symposium held at the American Chemical Society meeting in San Francisco, Aug. 29-Sept. 3, 1976. Includes bibliographical references and index.

LC: Coal liquefaction -- Congresses.

ADDED: American Chemical Society.

MAIN-AUTH TRACE-CORP\*AUTH\* CATLG BY-LC

/ /

78A26591 ISSUE 9 PAGE 1605 CATEGORY 44 CNT#: NSF 38701 77/00/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: High pressure liquid chromatographic studies of coal liquefaction kinetics

AUTH: A/PRATHER, J. W.; B/TARRER, A. R.; C/GUIN, J. A.; D/JOHNSON, D. R.; E/NEELY, W. C. PAA: E/(Auburn University, Auburn, Ala.)

In: Liquid fuels from coal; Proceedings of the Symposium, San Francisco, Calif., August 29-September 3, 1976. (A78-26576 09-44) New York, Academic Press, Inc., 1977, p. 245-253. Research supported by Auburn University and Alabama Mining Institute

MAJS: /\*CHEMICAL ANALYSIS/\*COAL LIQUEFACTION/\*LIQUID CHROMATOGRAPHY/\*OILS

MINS: / ENERGY TECHNOLOGY/ HIGH PRESSURE/ SOLVENTS

ABA: (Author)

ABS: High pressure liquid chromatography (HPLC) provides a relatively simple analytical method for analysis of the complex organic mixtures found in coal liquefaction processes. This technique offers the advantage that preparatory scale work is accomplished with relative ease allowing for positive identification of the various components by other methods, e.g., infrared and ultraviolet spectroscopy. The feasibility of using HPLC to characterize solvents used in the Solvent Refined Coal (SRC) process is reported. The effects of catalytic agents namely, a commercial Co-Mo-Al catalyst; a coal mineral, iron pyrite; coal ash; and actual mineral residue from an SRC process on twelve constituents of a coal derived solvent, creosote oil - is monitored using HPLC.

78V14030 1977 ISS: 00 TP352.U54 1977 353.008232 LC-77-603520 SOD GA 1.13:EMD-77-59.

UTTL: First Federal attempt to demonstrate a synthetic fossil energy technology--a failure : TLSP: report of the Comptroller General of the United States. United States. General Accounting Office. U.S. General Accounting Office). (Washington : 22 p. 27 cm.

\$1.00 Cover title. "EMD-77-59."

LC: Coal liquefaction.

MAIN-CORP TRACE-TITL\* CATLG BY-LC

/ /

7 ORIGINAL PAGE  
OF POOR QUALITY

77A46449 ISSUE 22 PAGE 3811 CATEGORY 44  
77/09/00 9 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Liquid fuels and chemical feedstocks from coal by  
supercritical gas extraction  
AUTH: A/GANGOLI, N.; B/THODOS, G. PAA: B/(Northwestern  
University, Evanston, Ill.)  
I & EC - Industrial and Engineering Chemistry, Product  
Research and Development, vol. 16, Sept. 1977, p.  
208-216.  
MAJS: /\*COAL LIQUEFACTION/\*COAL UTILIZATION/\*ENERGY  
TECHNOLOGY/\*HYDROCARBON FUEL PRODUCTION/\*SYNTHETIC  
FUELS  
MINS: / CHEMICAL PROPERTIES/ COAL GASIFICATION/ CRITICAL  
PRESSURE/ CRITICAL TEMPERATURE/ TERNARY SYSTEMS  
ABA: S.C.S.  
ABS: As an alternative source of energy, theoretical

arguments and basic experimental evidence of a new  
separation technique for the extraction of liquid fuel  
constituents from coal are presented. The technique is  
based on the solvent capability of compressed gases  
under supercritical state conditions. Several research  
investigations regarding the chemical constitution of  
coal are described and a study of the critical state  
behavior of various simple and complex mixtures is  
presented in detail, including the possibility of a  
liquid phase occurrence. The five basic steps of the  
new process are outlined. Detailed lists of the  
advantages of this new technique, and particularly its  
advantages over the older method of liquid extraction  
are included. Other applications of the method are  
briefly surveyed.

78N71743# CATEGORY 77 RPT#: FE-2035-6 CNT#:  
EX-76-C-01-2035 77/01/15 15 PAGES UNCLASSIFIED  
DOCUMENT  
UTTL: Enthalpy measurement of coal-derived liquids TLSP:  
Quarterly Technical Progress Report, Oct. - Dec. 1976  
AUTH: A/KIDNAY, A. J.; B/YESAVAGE, V. F.  
CORP: Colorado School of Mines, Golden. CSS: (Dept. of  
Chemical and Petroleum Refining Engineering.)  
AVAIL: NTIS  
MAJS: /\*COAL LIQUEFACTION/\*ENTHALPY/\*THERMODYNAMIC  
PROPERTIES  
MINS: / COAL/ HYDROCARBON COMBUSTION/ HYDROCARBON FUELS

78N23590# ISSUE 14 PAGE 1870 CATEGORY 44 RPT#:  
NSF/AER-75-15213 CNT#: NSF AER-75-15213 DRDA PROJ.  
013722 77/09/00 458 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Studies on the separation of coal extract from solid  
residue in liquefied coal TLSP: Final Report  
AUTH: A/BRIGGS, D. E.; B/MCALPINE, D. B.; C/BEDFORD, C. D.  
; D/HO, B.; E/JOHNSON, P. J.; F/MCKEEN, J. A.;  
G/SENGUPTA, U.; H/STIRLING, J. A.; I/SMITH, P. A. S.  
; J/CAMERON, J. R.  
CORP: Michigan Univ., Ann Arbor. CSS: (Dept. of Chemical  
Engineering.) AVAIL: NTIS SAP: HC A20/MF A01  
MAJS: /\*COAL LIQUEFACTION/\*SOLID SUSPENSIONS/\*SOLVENT  
EXTRACTION  
MINS: / COMPRESSIBILITY/ INTERFACIAL TENSION/ PARTICLE SIZE  
DISTRIBUTION/ TEMPERATURE EFFECTS/ VISCOSITY  
ABA: ERA  
ABS: Coal liquefaction residues from the SYNTHOIL

(Pittsburgh Seam) and H-Coal (Illinois No. 6)  
processes were fractionated by solvent extraction into  
oils and resins, asphaltenes, preasphaltenes, and  
mineral solids for adsorption, filtration, surface  
tension, and viscosity measurements. Suspended solids  
in liquefied coal range in size from less than 0.05  
microns to greater than 1 microns. The specific  
resistance of filter cakes varies as an inverse  
function of the number average particle size. At  
temperatures below 200 C, the H-Coal filter cake  
compressibility was 0.36. The specific filtration  
resistance is temperature dependent above 200 C, being  
from 50 to 100 percent higher at 232 C than at 177 C.  
Surface tension and reduced viscosity data for oils,  
resins, and asphaltenes in tetralin indicate  
intermolecular association and colloid micellization.

78V35030 1976 ISS: 60 TP325.U6 1975 PT.4 770356: S  
77-013605C.1  
UTTL: Coal: liquefaction: TLSP: quarterly report,  
July-September 1976 (part 4)  
United States. Energy Research and Research  
Administration. Office of Fossil Energy.  
Energy Research and Development Administration.  
Washington, 59 p.  
ERDA 76-33-3  
LC: Coal, Coal liquefaction.  
ADDED: Series: United States. Energy Research and  
Development Administration. ERDA 76-33-3  
NASA: / COAL LIQUEFACTION/ COAL UTILIZATION  
MAIN-CORP TRACE-SERS' CATLG BY-GODDARD  
75/10/06 AVAIL: / GODDARD

78N15571# ISSUE 6 PAGE 776 CATEGORY 44 RPT#:  
FE-2047-2 CNT#: EX-76-C-01-2047 76/10/00 25 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Clean solid and liquid fuels from coal TLSP:  
Quarterly Progress Report, Jul. - Sep. 1976  
AUTH: A/GARY, J. H.; B/GOLDEN, J. O.; C/BALDWIN, R. M.;  
D/BAIN, R. L.; E/DICKERHOOF, D. W.  
CORP: Colorado School of Mines, Golden, CSS: (Dept. of  
Chemical and Petroleum Refining Engineering.)  
AVAIL.NTIS SAP: HC A02/MF A01  
MAJS: /\*CLEAN ENERGY/\*COAL LIQUEFACTION/\*COAL UTILIZATION  
MINS: / AIR QUALITY/ DESULFURIZING/ ELECTRIC POWER PLANTS/  
ENVIRONMENT EFFECTS/ ENVIRONMENT PROTECTION  
ABA: Author

ABS: Research being done with the goal of producing an  
environmentally acceptable fuel from coal is  
disclosed. This fuel may be either solid or liquid,  
depending upon processing conditions and operational  
mode chosen. An ash-containing low sulfur, low  
nitrogen fuel that may be burned in new and existing  
power generating facilities is the primary objective,  
while the production of a suitable refinery feedstock  
is secondary. The work scope covers sulfur removal  
using nascent hydrogen in a bench scale pilot plant,  
catalytic hydrodenitrogenation of coal-derived  
liquids, improved solid-liquid separation  
characteristics for coal liquids and improved analysis  
techniques for sulfur, nitrogen and characteristic  
compounds found in coal liquids. The process under  
development uses conventional chemical engineering  
equipment and does not entail the consumption of pure  
hydrogen in the initial liquefaction/desulfurization  
step. This process will ultimately allow greater  
utilization of our fossil fuels without deteriorating  
the environment by the emission of pollutants.

77N83873# CATEGORY 44 RPT#: ANL-76-117 CNT#:  
W-31-109-ENG-38 76/10/00 41 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Coal liquefaction support studies TLSP: Annual  
Report, Oct. 1975 - Sep. 1976  
AUTH: A/FISCHER, J.; B/LO, R.; C/WANDI, S.;  
D/FREDRICKSON, D.; E/CANNON, T.; F/BUMP, T.;  
G/MULCAHEY, T.; H/HUANG, H.; I/JONKE, A.  
CORP: Argonne National Lab., Ill. AVAIL.NTIS  
MAJS: /\*COAL LIQUEFACTION/\*ENERGY CONVERSION EFFICIENCY/\*  
SULFUR  
MINS: / CALORIMETERS/ HEAT MEASUREMENT/ HEAT TRANSFER/  
MATERIALS RECOVERY

77A26411# ISSUE 10 PAGE 1673 CATEGORY 44 RPT#:  
ASME PAPER 76-WA/APC-6 76/12/00 9 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Evaluation of the practical aspects of the use of coal  
derived synthetic fuels  
AUTH: A/ZABOLOTNY, E. R.; B/MCCARTHY, D. J. PAA: B/(Stone  
and Webster Engineering Corp., Boston, Mass.) SAP:  
MEMBERS, \$1.50; NONMEMBERS, \$3.00  
American Society of Mechanical Engineers, Winter  
Annual Meeting, New York, N.Y., Dec. 5-10, 1976. 9 p.  
MAJS: /\*COAL LIQUEFACTION/\*COAL UTILIZATION/\*HYDROCARBON  
FUEL PRODUCTION/\*HYDROGEN-BASED ENERGY/\*MARKET  
RESEARCH/\*SYNTHETIC FUELS  
MINS: / BOILERS/ COMBUSTION EFFICIENCY/ CRUDE OIL/ ENERGY  
STORAGE/ MATERIALS HANDLING/ POLLUTION CONTROL/  
STORAGE TANKS  
ABA: G.R.

ABS: The coal liquefaction processes are examined, taking  
into account the H coal process, solvent refined coal,  
the EXXON donor solvent process, and the Coalcon  
process. Potential problem areas in synthetic fuel  
utilization are considered along with power station  
retrofitting requirements. A description of fuel  
handling and storage equipment is presented and an  
investigation is conducted concerning the potential  
market for synthetic boiler fuels.

77A12934 ISSUE 2 PAGE 250 CATEGORY 44 76/11/00  
3 PAGES UNCLASSIFIED DOCUMENT

UTTL: COSTEAM: Low-rank coal liquefaction - An updated  
analysis  
AUTH: A/APPELL, H. R. PAA: A/(ERDA, Pittsburgh Energy  
Research Center, Pittsburgh, Pa.)  
Energy, vol. 1, Summer-Fall 1976, p. 24-26.  
MAJS: /\*CARBON MONOXIDE/\*COAL LIQUEFACTION/\*COAL UTILIZATION  
/\*COST REDUCTION/\*FUEL OILS  
MINS: / DOMESTIC ENERGY/ ENERGY CONSERVATION/ ENERGY  
TECHNOLOGY/ HYDROGENATION/ PRESSURE EFFECTS/  
TEMPERATURE EFFECTS  
ABA: B.J.

ABS: COSTEAM is a process under development at the  
Pittsburgh Energy Research Center of ERDA for  
converting lignite to a low-sulfur, low-ash industrial  
fuel oil. The name comes from the use of carbon  
monoxide (CO) and steam, which react with the lignite  
and convert it to an oil. This paper reports on  
research carried out on the substitution of synthesis  
gas (a mixture of carbon monoxide and hydrogen) for  
carbon monoxide because of its lower cost, and the  
achievement of a product of improved fluidity that  
could also be used as a slurry vehicle for pumping the  
coal into the high pressure hydrogenation unit.

77A11244 ISSUE 1 PAGE 75 CATEGORY 44 CNT#: E(49-1B)-2031 76/00/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Evaluation of coal liquefaction efficiency based on various ranks

AUTH: A/HSIA, Y.-P.; B/YEN, T. F. PAA: B/(Southern California, University, Los Angeles, Calif.) Energy Sources, vol. 3, no. 1, 1976, p. 39-47.

MAJS: / CLEAN ENERGY/ COAL LIQUEFACTION/ ENERGY CONVERSION EFFICIENCY/ HYDROCARBON FUELS/ HYDROGENATION

MINS: / ATOMIZING/ COAL UTILIZATION/ ENERGY SOURCES/ ENTHALPY/ HEAT OF FORMATION/ REACTION KINETICS/ TRANSPORTATION

ABA: (Author)

ABS: A method has been developed to calculate the efficiency of coal liquefaction, based on various coal ranks. The assumption is made that the service requirement (both enthalpy and hydrogen) is provided from the same rank of coal when it is being converted to transportation fuel or specialty oils. Results for most coals indicate that in order to upgrade coal to fuels of H/C = 2, the actual fraction of coal used for liquefaction is about 35-45%.

77A27301# ISSUE 11 PAGE 1860 CATEGORY 44 76/08/00 26 PAGES UNCLASSIFIED DOCUMENT

UTTL: Implications of utilizing synthetic fuels in combined cycles

AUTH: A/AHNER, D. J. PAA: A/(General Electric Co., Schenectady, N.Y.) University of Pittsburgh, Annual International Conference on Coal Gasification and Liquefaction, 3rd, Pittsburgh, Pa., Aug. 3-5, 1976, Paper, 26 p.

MAJS: / COAL LIQUEFACTION/ GAS TURBINES/ SYNTHETIC FUELS/ THERMODYNAMIC CYCLES

MINS: / ENERGY CONVERSION EFFICIENCY/ ENGINE DESIGN/ STEAM TURBINES

ABA: G.R.

ABS: It is pointed out that gas turbines operating on oil or natural gas fuels and integrated with heat recovery steam cycles have the highest conversion efficiencies

in the industry. The type of fuels to be utilized in combined cycles can have an important effect on the basic equipment configuration employed. Liquid fuels from coal are considered and the significance of fuel properties on gas turbine performance is examined. Ash-forming trace contaminants, chemical properties, and physical properties of gas turbine liquid fuels are discussed. Attention is also given to gas fuels from coal and coal based solid fuels integrated with combined cycles.

77A21623 ISSUE 8 PAGE 1187 CATEGORY 28 76/12/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Upgrading coal liquids to gas turbine fuels. 1 - Analytical characterization of coal liquids

AUTH: A/CALLEN, R. B.; B/BENDORAITIS, J. G.; C/SIMPSON, C. A.; D/VOLTZ, S. E. PAA: D/(Mobil Research and Development Corp., Paulsboro, N.J.) I & EC - Industrial and Engineering Chemistry, Product Research and Development, vol. 15, Dec. 1976, p. 222-233. Research supported by the Electric Power Research Institute and Mobil Research and Development Corp.

MAJS: / AIRCRAFT FUELS/ COAL LIQUEFACTION/ GAS TURBINE ENGINES/ HYDROCARBON FUELS/ SYNTHETIC FUELS

MINS: / CHROMATOGRAPHY/ COMBUSTION PRODUCTS

ABA: (Author)

ABS: The physical properties and chemical compositions of three coal liquids (SRC, H-Coal, and Synthoil) were determined. Coal liquids contain less hydrogen (6-8 wt % vs. about 11 wt %) than petroleum fuels or residua, whereas their concentrations of nitrogen and oxygen are considerably higher. The aromaticities of coal liquids are much greater (60-75 vs. 20-35 atom % aromatic carbon) than petroleum residua; they also have very high concentrations of asphaltenes. The detailed molecular compositions were analyzed by

gradient elution chromatography. Improvement in certain physical and chemical properties will be required to upgrade coal liquids for use as gas turbine fuels.

77V37704 1976 ISS: 00 TA168.K35 NO. 71, VOL. 1 620.708 S: 662.662 LC-77-367527

AUTH: A/Fan, Liang-tseng.; B/Miyanami, K.; C/Fan, Liang-shih. B/1936- PAT: B/joint author.

UTTL: Modeling and simulation of the NenKen coal liquefaction process / by L. T. Fan, K. Miyanami, L. S. Fan.

Dept. of Chemical Engineering, Kansas State University, Manhattan : III, 22 p., (5) leaves of plates : III. ; 28 cm.

Their A model for the extractive coal liquefaction ; 1 Report - Institute for Systems Design and Optimization, Kansas State University : no. 71 Bibliography: p. 20.

LC: Coal liquefaction -- Mathematical models.

ADDED: Kansas State University of Agriculture and Applied Science, Manhattan, Institute for Systems Design and Optimization, Report ; no. 71.

MAIN-AUTH TRACE-SERS-CORP-TITL-AUTH- CATLG BY-LC / /

77A16475 ISSUE 5 PAGE 647 CATEGORY 23 CNT#:  
NSF GI-38701 76/10/00 5 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Mechanisms of coal particle dissolution

AUTH: A/GUIN, J.; B/TARRER, A.; C/TAYLOR, L., JR.;  
D/PRATHER, J.; E/GREEN, S., JR. PAA: E/(Auburn

University, Auburn, Ala.)

I & EC - Industrial and Engineering Chemistry, Process  
Design and Development, vol. 15, Oct. 1976, p.  
490-494. Research supported by the Alabama Mining  
Institute and Auburn University

MAJS: /\*COAL LIQUEFACTION/\*DISSOLVING/\*PHOTOMICROGRAPHY/\*  
SOLVENT EXTRACTION

MINS: / AUTOCLAVING/ GAS COMPOSITION/ HYDROGEN/ PHASE  
TRANSFORMATIONS/ SURFACE REACTIONS/ TEMPERATURE  
EFFECTS

ABA: (Author)

ABS: The rate of dissolution of coal in vehicle solvent is  
of primary importance in coal conversion processes. In  
this study, dissolution of individual coal particles  
is followed using photomicroscopy in a sequence of  
batch experiments. At 350 C, coal particles are  
observed to disintegrate into smaller units. Effects  
of temperature, gas phase composition, and solvent  
hydrogen donor activity on the extent of particle  
breakup are studied. Providing sufficient hydrogen is  
available, the process of disintegration is observed  
to occur very rapidly, with the qualitative appearance  
of a fluid-solid surface reaction having a high  
activation energy. Implications of this evidence are  
discussed and interpreted in light of previous  
investigations of coal dissolution.

77V37527 1976 ISS: 00 TA168.K35 NO. 71, ETC. 620.708 S  
: 662.662 LC-76-624000 TP352

AUTH: A/Fan, Liang-tseng.; B/Miyanami, K.; C/Fan,  
Liang-shih, B/1936- PAT: B/joint author.

UTTL: A model for the extractive coal liquefaction / by L.  
T. Fan, K. Miyanami, L. S. Fan.

Dept. of Chemical Engineering, Kansas State  
University, Manhattan : v. : ill. : 28 cm.  
Report - Institute for Systems Design and  
Optimization, Kansas State University : no. 71-  
Bibliography: v. 1, p. 20, 1. Modeling and simulation  
of the NenKen coal liquefaction process.  
LC: Coal liquefaction -- Mathematical models --  
Collected works.

ADDED: Kansas, State University of Agriculture and  
Applied Science, Manhattan, Institute for Systems  
Design and Optimization, Report : no. 71  
MAIN-AUTH TRACE-SERS\*CORP\*TITL\*AUTH\* CATLG BY-LC  
/ /

77N12230\*# ISSUE 3 PAGE 316 CATEGORY 28 RPT#:  
NASA-CR-135112 M1.76-1 CNT# : NAS3-19747 76/11/17  
64 PAGES UNCLASSIFIED DOCUMENT

UTTL: Synthesis and analysis of jet fuel from shale oil and  
coal syncrudes

AUTH: A/GALLAGHER, J. P.; B/COLLINS, T. A.; C/NELSON, T.  
J.; D/PEDERSEN, M. J.; E/ROBISON, M. G.;  
F/WISINSKI, L. J.

CORP: Atlantic Richfield Co., Harvey, Ill. CSS: (Technical  
Center.) AVAIL:NTIS SAP: HC A04/MF A01

MAJS: /\*COAL LIQUEFACTION/\*HYDROGENATION/\*JET ENGINE FUELS/\*  
SHALE OIL

MINS: / COKE/ ENERGY POLICY/ FUEL TESTS/ HYDROCARBONS/  
REFINING

ABA: Author

ABS: Thirty-two jet fuel samples of varying properties were  
produced from shale oil and coal syncrudes, and  
analyzed to assess their suitability for use. IOSCO II  
shale oil and H-COAL and COED syncrudes were used as  
starting materials. The processes used were among  
those commonly in use in petroleum  
processing-distillation, hydrogenation and catalytic  
hydrocracking. The processing conditions required to  
meet two levels of specifications regarding aromatic,  
hydrogen, sulfur and nitrogen contents at two yield  
levels were determined and found to be more demanding  
than normally required in petroleum processing.  
Analysis of the samples produced indicated that if the  
more stringent specifications of 13.5% hydrogen (min.)  
and 0.02% nitrogen (max.) were met, products similar  
in properties to conventional jet fuels were obtained.  
In general, shale oil was easier to process (catalyst  
deactivation was seen when processing coal syncrudes),  
consumed less hydrogen and yielded superior products.  
Based on these considerations, shale oil appears to be

preferred to coal as a petroleum substitute for jet  
fuel production.

78V20732 1976 ISS: 00 TP352.M3 662.6622 LC-77-623397

AUTH: A/McBride, John Raymond, A/1946-

UTTL: Coal liquefaction : TLSP: technology, impacts, and  
technical suitability for Montana : a report to the  
Montana Energy Advisory Council, Helena, Montana / by  
John R. McBride.  
The Council, Helena, Mont. : iv, 87 p. : ill. : 28 cm.  
Bibliography: p. 83-87.

LC: Coal liquefaction, Coal -- Montana.  
ADDED: N\*US\*MT Montana, Energy Advisory Council.  
MAIN-AUTH TRACE-CORP\*TITL\* CATLG BY-LC  
/ /

77A12690 ISSUE 2 PAGE 186 CATEGORY 26 CNT#:  
F33615-74 C-2036 76/00/00 5 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: A preliminary engineering assessment of jet fuel  
production from domestic coal and shale derived oils  
AUTH: A/KALFADELIS, C. D.; B/SHAW, H.; C/TAYLOR, W. F.  
PAA: C/(Exxon Research and Engineering Co., Linden,  
N.J.)

In: Intersociety Energy Conversion Engineering  
Conference, 11th, State Line, Nev., September 12-17,  
1976. Proceedings, Volume 1. (477-12662 02-44) New  
York, American Institute of Chemical Engineers, 1976,  
p. 315-319.

MAJS: /\*COAL LIQUEFACTION/\*JET ENGINE FUELS/\*SHALE OIL/\*  
SYNTHETIC FUELS

MINS: / ENERGY TECHNOLOGY/ HYDROGENATION/ JP-4 JET FUEL/  
KEROSENE/ PILOT PLANTS

ABA: (Author)

ABS: A pilot plant program was recently completed that  
demonstrated that specification JP-4 and Jet A can be  
produced from domestic shale oils and coal liquids.  
Three shale oils and two coal liquids were evaluated  
in this study. All crude oil samples received were  
analyzed in our laboratories. The kerosene range  
(1BP-570 F/300 C) fraction was utilized as feed to our  
coal and shale hydrogenation (CASH) unit. Experimental  
runs with synthetic crudes have been made at liquid  
hourly space velocities (LHSV) of 0.5 to 1.0 at 700 F  
(370 C), using Ni/Mo or Co/Mo catalysts with target  
inlet hydrogen rate equivalent to 4000 SCF per barrel  
of liquid feed. Operations have been conducted at  
total pressures of 1500 psig (normal severity), 800  
psig (low severity), and 2200 psig (high severity).

79V44501 1975 ISS: 00 TN805.13562 553.2409773 LC-  
75-623963

AUTH: A/Smith, William Henking.; B/Stall, John Byron.  
A/1919- PAT: B/joint author.

UTTL: Coal and water resources for coal conversion in  
Illinois / William H. Smith and John B. Stall.  
State Water Survey, Urbana, Ill. : 79 p. : ill., maps  
(3 fold, col. in pocket) ; 28 cm.  
Cooperative resources report ; 4 Includes  
bibliographies.

LC: Coal -- Illinois. Water-supply -- Illinois. Coal  
gasification -- Illinois. Coal liquefaction --  
Illinois.

ADDED: N\*US\*IL

MAIN-AUTH TRACE-SERS-TITL-AUTH\* CATLG BY-LC  
/ /

77V26044 1976 ISS: 15 TP698.S19  
UTTL: Sampling strategy and characterization of potential  
emissions from synfuel production; TLSP;  
symposium/workshop proceedings. Sponsored by Energy  
Research and Development Administration; hosted by  
Radian Corp., Austin, Tex., June 8 - 10, 1976.  
U.S. Energy Research and Development Administration.  
NTIS, Springfield, Va., 146 p. illus.  
\*\*CONF-760602\*\*

LC: Petroleum, Synthetic--Environmental aspects--Cong.  
Coal liquefaction--Environmental aspects--Cong. Coal  
gasification--Environmental aspects--Cong.  
Shale-oils--Refining--Environmental aspects--Cong.  
NASA: / COAL GASIFICATION/ COAL LIQUEFACTION/  
CONFERENCES/ CRUDE OIL/ ENERGY POLICY/ ENVIRONMENT  
EFFECTS/ SHALE OIL  
MAIN-TITL TRACE-CORP\* CATLG BY-JOHNSON

77/04/13 AVAIL: / JOHNSON

77N70579\* CATEGORY 9B RPT#: DERC-0020-2 CNT#:  
E(34-1)-0020 75/12/29 29 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Mass spectrometric analytical services and research  
activities to support coal-liquid characterization  
research TLSP: Quarterly Report, 9 Sep. - 8 Dec.  
1975

AUTH: A/SCHeppeLE, S. E.  
CORP: Oklahoma State Univ., Stillwater. CSS: (Dept. of  
Chemistry.) AVAIL:NTIS

MAJS: /\*COAL LIQUEFACTION/\*GAS CHROMATOGRAPHY/\*MASS  
SPECTROSCOPY

MINS: / ANTHRACENE/ MASS SPECTROMETERS/ OILS

78V52885 1974 ISS: 00 TP360.T48 662.66 LC-74-623555

AUTH: A/Thode, Edward F.

UTTL: Synthetic liquid fuels from coal and wood / prepared  
for the Governor's Energy Task Force, State of New  
Mexico by Edward F. Thode.  
New Mexico State University, (Las Cruces) : 35 leaves  
: ill. ; 28 cm.

Engineering Experiment Station technical report ; no.  
86 Position paper - New Mexico State University, no.  
15 "NMSU-EES-86-74." Bibliography: leaf 14.

LC: Synthetic fuels. Coal liquefaction. Wood waste.  
ADDED: New Mexico. Governor's Energy Task Force. New  
Mexico State University. Engineering Experiment  
Station. Technical report ; no. 85. New Mexico State  
University. Position paper ; no. 15.

MAIN-AUTH TRACE-SERS-CORP-TITL\* CATLG BY-LC  
/ /

79V14554 1974 ISS: 00 TP343.W67 1974 662.625 LC-  
78-620972

AUTH: A/Staehle, R. W., A/1934-

UTTL: Conclusions and recommendations from Workshop on  
Materials Problems and Research Opportunities in Coal  
Conversion, 16-18 April 1974, Columbus, Ohio /  
sponsored by The National Science Foundation and The  
Office of Coal Research ; organized by The Department  
of Metallurgical Engineering, The Ohio State  
University, Columbus, Ohio ; workshop director, R. W.  
Staehle.

Workshop on Materials Problems and Research  
Opportunities in Coal Conversion, Columbus, Ohio,  
1974.

Available from Corrosion Center, Ohio State  
University, Columbus : vi, 67 p. ; 28 cm.  
"Volume 1."

LC: Coal liquefaction -- Congresses. Coal gasification  
-- Congresses.

ADDED: United States. National Science Foundation.  
United States. Office of Coal Research.

MAIN-MEET TRACE-CORP\*AUTH\* CATLG BY-LC  
/ /

78N76929# CATEGORY 28 RPT#: CONF-741146-1  
74/00/00 19 PAGES UNCLASSIFIED DOCUMENT

UTTL: Coal liquefaction

AUTH: A/FRIEDMAN, S.; B/YAVORSKY, P. M.; C/AKHTAR, S.;  
D/WENDER, I.

CORP: Bureau of Mines, Pittsburgh, Pa. AVAIL.NTIS  
Sponsored by DOE Presented at Natl. Petroleum  
Refiners Assoc. Natl. Fuels and Lubricants Meeting,  
Houston, 6-8 Nov. 1974

MAJS: /\*COAL LIQUEFACTION/\*TECHNOLOGY ASSESSMENT

MINS: / ENERGY POLICY/ ENERGY TECHNOLOGY

NATURAL GAS - LIQUIDIFIED NATURAL GAS

79N30839# ISSUE 21 PAGE 2854 CATEGORY 44 RPT#:  
PB-294610/1 FTC/BE-79/04 79/02/00 179 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Economic structure and behavior in the natural gas production industry

AUTH: A/MULHOLLAND, J. P.

CORP: Federal Trade Commission, Washington, D.C. CSS: (Bureau of Economics.) AVAIL: NTIS GAP: HC A09/MF A01

MAJS: /\*ECONOMIC FACTORS/\*INDUSTRIES/\*NATURAL GAS/\* PRODUCTION ENGINEERING

MINS: / COMMERCE/ COST ESTIMATES/ MANAGEMENT PLANNING/ MARKET RESEARCH

ABA: GRA

ABS: The competitive potential of the natural gas production industry is evaluated. Attention focuses primarily on seller structure within the gas sector, on both a nationwide and regional basis. In a behavioral context, changes of monopolistic supply restraint by the major producers are evaluated by examining the ownership pattern or nonproducing leases in the Federal offshore area. Since Federal price regulation has had a pervasive effect on the gas sector's performance up to the present time, the report's objective is not to evaluate the industry's past performance but, rather, to gauge its potential for workable competition in the absence of price regulation in the future.

LIQUEFIED NATURAL GAS: AN ENERGY ALTERNATIVE.

Gail Porter and Kent Higgins.

Dimensions, vol 63, no 9, September 1979  
p. 14-18.

PRINT 09/2/1-294 TERMINAL=33  
79N33605# ISSUE 24 PAGE 3231 CATEGORY 44 RPT#:  
NTIS/PS-79/0665 NTIS/PS-78/0599 79/07/00 151 PAGES  
UNCLASSIFIED DOCUMENT

Supersedes NTIS/PS-78/0599

UTTL: Energy supply and demand modeling. A bibliography with abstracts TLSP: Report, 1964 - May 1979

AUTH: A/HUDEMANN, A. S.

CORP: National Technical Information Service, Springfield, Va. AVAIL: NTIS GAP: HC \$28.00/MF \$28.00

MAJS: /\*BIBLIOGRAPHIES/\*ECONOMIC ANALYSIS/\*ENERGY CONSUMPTION/\*MODELS

MINS: / ABSTRACTS/ COAL/ CRUDE OIL/ DEMAND (ECONOMICS)/ ELECTRICITY/ ENERGY TECHNOLOGY/ FORECASTING/ NATURAL GAS/ PETROLEUM PRODUCTS/ SUPPLYING

ABA: GRA

ABS: The use of energy models to estimate the supply and demand of electricity, oil, natural gas, coal, and petroleum products on national, regional, and state levels is discussed. The models cover residential, commercial, and industrial supply and demand; the impact of economic conditions on demand; energy use alternatives; and optimal allocation of regionally produced energy resources. Abstracts pertaining to design and development of energy models are included.

79N79713# CATEGORY 43 RPT#: DOE/ERC-0029  
79/03/00 223 PAGES UNCLASSIFIED DOCUMENT

UTTL: Nonconventional natural gas resources. Sub-task force 1: Gas dissolved in water

CORP: Stanford Univ., Calif. CSS: (Dept. of Applied Earth Sciences.) AVAIL: NTIS

MAJS: /\*AQUIFERS/\*ENERGY TECHNOLOGY/\*GEOLOGICAL SURVEYS/\* GEOTHERMAL RESOURCES/\*HYDROGEOLOGY/\*METHANE/\*NATURAL GAS

MINS: / BEDS (GEOLOGY)/ GULF OF MEXICO/ PREDICTION ANALYSIS TECHNIQUES/ PRESSURE DISTRIBUTION/ SALINITY/ SHALES/ WATER PRESSURE

ORIGINAL PAGE IS  
OF POOR QUALITY

79N27615\*# ISSUE 18 PAGE 2426 CATEGORY 28  
78/08/15 4 PAGES UNCLASSIFIED DOCUMENT

UTTL: Synthetic natural gas in California: When and why ---  
from coal

AUTH: A/WOOD, W. B.

CORP: Southern California Gas Co., Los Angeles.  
AVAIL.NTIS SAP: HC A23/MF A01  
In JPL Proc. of the Conf. on Coal Use for California  
p 249-252 (SEE N79-27597 18-42)

MAJS: /\*COAL GASIFICATION/\*ENERGY CONVERSION/\*NATURAL GAS/\*  
SYNTHANE

MINS: / CALIFORNIA/ COAL UTILIZATION/ ECONOMIC FACTORS/

ENERGY POLICY/ ENERGY TECHNOLOGY

ABA: J.M.S.

ABS: A coal gasification plant planned for northwestern New  
Mexico to produce 250 MCFD of pipeline quality gas  
(SNG) using the German Lurgi process is discussed. The  
SNG will be commingled with natural gas in existing  
pipelines for delivery to southern California and the  
Midwest. Cost of the plant is figured at more than  
\$1.4 billion in January 1978 dollars with a current  
inflation rate of \$255,000 for each day of delay.  
Plant start-up is now scheduled for 1984.

#### DETONABILITY STUDIES FOR LIQUEFIED NATURAL GAS.

Energy and Technology Review, May 1979, p. 18-23.

*The transportation, storage, and use of natural gas in liquefied form involves a number of potential hazards, many of which are not yet well understood. We are currently working to identify these potential safety problems, to quantify their effects both by field experiments and by computer modeling, and eventually to help formulate guidelines to make the use of liquefied natural gas safe. Our recently developed calculational models have provided new insights into the basic mechanism of detonation.*

79A51951\* ISSUE 23 PAGE 4378 CATEGORY 44  
79/00/00 4 PAGES UNCLASSIFIED DOCUMENT

UTTL: Toward the renewables - A natural gas/solar energy  
transition strategy

AUTH: A/HANSON, J. A.; B/ESCHER, W. J. D. PAA:  
A/(California Institute of Technology, Jet Propulsion  
Laboratory, Pasadena, Calif.); B/(Escher: Foster  
Technology Associates, Inc., St. Johns, Mich.)

CORP: Jet Propulsion Lab., California Inst. of Tech.,  
Pasadena.; Escher Technology Associates, St. Johns,  
Mich.

In: Intersociety Energy Conversion Engineering  
Conference, 14th, Boston, Mass., August 5-10, 1979.  
Proceedings, Volume 1. (A79-51726 23-44) Washington,  
D.C., American Chemical Society, 1979, p. 796-799.

MAJS: /\*ELECTROCHEMISTRY/\*FORECASTING/\*INDUSTRIAL MANAGEMENT  
/\*NATURAL GAS/\*SOLAR ENERGY CONVERSION/\*SYSTEMS

ENGINEERING

MINS: / BLOCK DIAGRAMS/ CHEMICAL REACTIONS/ ENERGY  
TECHNOLOGY/ HYDROGEN/ METHANE/ RESEARCH MANAGEMENT/  
WATER

ABA: (Author)

ABS: The inevitability of an energy transition from today's  
non-renewable fossil base toward a renewable energy  
base is considered from the viewpoint of the need for  
a national transition strategy. Then, one such  
strategy is offered. Its technological building blocks  
are described in terms of both energy use and energy  
supply. The strategy itself is then sketched at four  
points in its implementation: (1) initiation, (2)  
early transition, (3) late transition, and (4)  
completion. The transition is assumed to evolve from a  
heavily natural gas-dependent energy economy. It then  
proceeds through its transition toward a balanced,  
hybrid energy system consisting of both centralized  
and dispersed energy supply technologies supplying  
hydrogen and electricity from solar energy. Related  
institutional, environmental and economic factors are  
examined briefly.

#### SYNTHETIC NATURAL GAS FROM PEAT. A. Rader.

Industrial Engineering Chemistry, vol 18, no 5,  
December 1979, p. 291-296.

79N30837# ISSUE 21 PAGE 2854 CATEGORY 44 RPT#:  
PB-294013/B APL/JHU-GEMS-005 APL/JHU-QM-79-016  
MCGER-79/0001 CNT#: EX-76-A-36-100B 79/03/00 47  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Geothermal energy market study on the Atlantic coastal plain. A review of recent energy price projections for traditional space heating fuel. 1985-2000

AUTH: A/WEISSBROD, R. S. P.; B/BARRON, W.  
CORP: Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.  
AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /\*ATLANTIC OCEAN/\*COAL/\*COASTAL PLAINS/\*COST ESTIMATES  
/\*ELECTRICITY/\*NATURAL GAS

MINS: / COMMERCE/ FORECASTING/ GEOTHERMAL RESOURCES/  
MANAGEMENT PLANNING/ RESIDENTIAL AREAS

ABA: GRA

ABS: In order to develop an initial estimate of the potential competitiveness of low-temperature (45 to 100 C) geothermal resources on the Atlantic Coastal Plain, available energy price projections are reviewed and compared. Since low-temperature geothermal energy competes primarily for the space and process heating markets currently held by petroleum, natural gas, and electricity, projected trends in the real prices for these fuels were examined.

79N30701# ISSUE 21 PAGE 2837 CATEGORY 43 RPT#:  
PB-293751/4 EMD-78-98 79/03/07 116 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Unique helium resources are wasting: A new conservation policy is needed

CORP: General Accounting Office, Washington, D. C. CSS: (Energy and Minerals Div.) AVAIL.NTIS SAP: HC A06/MF A01

MAJS: /\*CONGRESSIONAL REPORTS/\*ENERGY CONSERVATION/\*ENERGY POLICY/\*HELIUM/\*NATURAL GAS/\*RESOURCES MANAGEMENT

MINS: / DEMAND (ECONOMICS)/ ECONOMIC ANALYSIS/ ENERGY TECHNOLOGY/ FUEL CONSUMPTION/ GAS RECOVERY/ MATERIALS RECOVERY/ NATURAL GAS/ TECHNOLOGICAL FORECASTING/ WASTE UTILIZATION

ABA: GRA

ABS: The loss of helium through the use of natural gas, its most economical source, is considered. Available alternatives to conserve helium are discussed. Continuing investment in helium dependent, energy related technologies is predicted to sharply increase demand after the year 2000. The present helium program is shown to be inadequate and in need of congressional legislation to establish Federal responsibility for conserving helium for national needs.

79A49517 ISSUE 22 PAGE 41&2 CATEGORY 44  
79/09/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: The advance of natural gas --- historical demand increases

AUTH: A/TOMANOFF, M. PAA: A/(Gaz de France, Paris, France)  
Revue de l'Energie, vol. 30, Aug.-Sept. 1979, p. 685-695. In English and French.

MAJS: /\*INDUSTRIAL ENERGY/\*LIQUEFIED NATURAL GAS/\*NATURAL GAS

MINS: / ENERGY CONSUMPTION/ ENERGY TECHNOLOGY/ FORECASTING/  
FRANCE/ TABLES (DATA)

ABA: B.J.

ABS: Developments in the European natural gas industry over the past 30 years are reviewed with particular reference to the French situation. Various aspects of natural gas production are reviewed, with emphasis on gas reserves and transportation of liquefied gas. The enormous future potential of natural gas is emphasized.

79A19649# ISSUE 6 PAGE 970 CATEGORY 25 RPT#:  
AIAA PAPER 79-0289 79/01/00 6 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Mathematical models of direct initiation of unconfined gas phase detonations --- hazards of LNG/air clouds from spills

AUTH: A/BONI, A. A.; B/WILSON, C. W. PAA: B/(Science Applications, Inc., La Jolla, Calif.)  
American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 17th, New Orleans, La., Jan. 15-17, 1979, 6 p.

MAJS: /\*DETONATION WAVES/\*LIQUEFIED NATURAL GAS/\*LIQUID-GAS MIXTURES/\*RANKINE-HUGONOT RELATION/\*STOICHIOMETRY

MINS: / AMBIENT TEMPERATURE/ BINARY MIXTURES/ CHEMICAL EQUILIBRIUM/ FUEL-AIR RATIO/ HYDROCARBON COMBUSTION/ SAFETY/ SHOCK WAVE PROPAGATION

ABA: (Author)

ABS: Previous worst-case analyses have shown that the threshold for unconfined detonation of LNG/air clouds was attainable under certain idealized circumstances. Here the analyses are extended to more realistic situations to assess the implications of these worst-case results with respect to the detonation potential of natural gas/air clouds resulting from accidental spills of liquefied natural gas (LNG). We examine the effects of three distinct deviations from the worst case on the threshold for unconfined detonation. All three of these - cloud inhomogeneities, cloud temperature variations, and nonideal sources are shown to significantly increase this threshold.

79N18373\*# ISSUE 9 PAGE 1148 CATEGORY 43 RPT#:  
E79-10099 NASA-CR-158055 REPT-79-243 79/00/00 49  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Late diagenetic indicators of buried oil and gas. 2:  
Direct detection experiment at Cement and Garza  
fields, Oklahoma and Texas, using enhanced LANDSAT 1  
and 2 images

AUTH: A/DONOVAN, T. J.; B/TERMAIN, P. A.; C/HENRY, M. E.  
PAT: C/Principal Investigators

CORP: Geological Survey, Denver, Colo. AVAIL.NTIS SAP:  
HC A03/MF A01  
Sponsored by NASA Original contains color imagery.  
Original photography may be purchased from the EROS  
Data Center, Sioux Falls, S. D. 57198 ERIS

MAJS: /\*CRUDE OIL/\*GROUND TRUTH/\*HYDROCARBONS/\*NATURAL GAS/\*  
OIL FIELDS/\*OKLAHOMA/\*ROCKS/\*SEEPAGE/\*TEXAS

MINS: / EARTH RESOURCES PROGRAM/ IRON/ MAPPING/ SANDSTONES

ABS: The author has identified the following significant  
results. The Cement oil field, Oklahoma, was a test  
site for an experiment designed to evaluate LANDSAT's  
capability to detect an alteration zone in surface  
rocks caused by hydrocarbon microseepage. Loss of iron  
and impregnation of sandstone by carbonate cements and  
replacement of gypsum by calcite were the major  
alteration phenomena at Cement. The bedrock  
alterations were partially masked by unaltered  
overlying beds, thick soils, and dense natural and  
cultivated vegetation. Interpreters, biased by  
detailed ground truth, were able to map the alteration  
zone subjectively using a magnified, filtered, and  
sinusoidally stretched LANDSAT composite image; other  
interpreters, unbiased by ground truth data, could not  
duplicate that interpretation.

79N28654# ISSUE 19 PAGE 2565 CATEGORY 43 RPT#:  
HCP/T2705-03 CNT#: EF-77-C-01-2705 79/02/00 3  
VOLS 407 PAGES UNCLASSIFIED DOCUMENT

UTTL: Enhanced recovery of unconventional gas: The  
Methodology, volume 3

AUTH: A/KUUSKRAA, V. A.; B/BRASHEAR, J. P.; C/DOSCHER, T.  
M.; D/ELKINS, L. E. PAA: C/(University of Southern  
California)

CORP: Lewin and Associates, Inc., Washington, D. C.  
AVAIL.NTIS SAP: HC A18/MF A01

MAJS: /\*ENERGY TECHNOLOGY/\*GAS RECOVERY/\*NATURAL GAS/\*  
TECHNOLOGY ASSESSMENT

MINS: / AQUIFERS/ COAL/ ECONOMIC ANALYSIS/ MATHEMATICAL  
MODELS/ METHODOLOGY/ PRODUCTION ENGINEERING/  
RECLAMATION/ SANDS/ SHALES

ABA: Author (DOE)

ABS: The methodology is described on the analytic approach,  
estimated natural gas production, recovery from tight  
gas sands, recovery from Devonian shales, recovery  
from coal seams, and recovery from geopressed  
aquifers.

79N29630# ISSUE 20 PAGE 2694 CATEGORY 44 RPT#:  
ORNL/TM-5937 CNT#: W-7405-ENG-26 79/02/00 126  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Electricity in lieu of natural gas and oil for  
industrial thermal energy: A preliminary survey

AUTH: A/TALLACKSON, J. R.

CORP: Oak Ridge National Lab., Tenn. AVAIL.NTIS SAP: HC  
A07/MF A01

MAJS: /\*CRUDE OIL/\*ELECTRICITY/\*ENERGY POLICY/\*INDUSTRIAL  
ENERGY/\*NATURAL GAS/\*THERMAL ENERGY

MINS: / BOILERS/ COAL UTILIZATION/ COST ANALYSIS/ ECONOMIC  
IMPACT/ ENERGY CONSERVATION/ HEAT PUMPS/ NUCLEAR  
FISSION/ RESOURCE ALLOCATION/ SOCIAL FACTORS/  
UTILITIES

ABA: DOE

ABS: The capability of the process industries to substitute  
utility-generated electricity for natural gas and oil  
is assessed. It is concluded that the existing  
technology will permit substitution of electricity for  
approximately 75% of the natural gas and petroleum now  
being consumed by industrial processors. Process steam  
generation, representing 40% of its energy usage,  
offers the best near-term potential for conversion to  
electricity. Electric boilers and energy costs for  
steam are briefly discussed. Electrically driven heat  
pumps are considered as a possible method to save  
additional low-grade energy. Electrical reheating at  
high temperatures in the primary metals sector will be  
in effective way to conserve gas and oil. A wholesale  
shift by industry to electricity to replace gas and  
oil will produce impacts on the public utilities. The  
principal bar to large-scale electrical substitution  
is economics, not technology.

79N28346# ISSUE 19 PAGE 2528 CATEGORY 28 RPT#:  
GPO-26-349 78/00/00 156 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Liquefied natural gas. Safety, siting, and policy  
concerns --- congressional reports

CORP: Committee on Commerce, Science, and Transportation (U.  
S. Senate). SAP: Avail: SOD HC  
Washington GPO Rept. for Comm. on Commerce, Sci.,  
and Transportation, 95th Congr., 2d Sess., Jun. 1978

MAJS: /\*CONGRESSIONAL REPORTS/\*ENERGY POLICY/\*FUELS/\*LIQUIDS  
/\*NATURAL GAS/\*POSITION (LOCATION)/\*SAFETY FACTORS

MINS: / ENERGY STORAGE/ ENVIRONMENT EFFECTS/ MANUFACTURING/  
MATERIALS HANDLING/ SAFETY MANAGEMENT

ABA: M.M.M.

ABS: The policy concerns associated with liquid natural gas  
(LNG) import industry are discussed as well as the  
issues associated with LNG safety, siting, and  
regulatory factors.

79A51963 ISSUE 23 PAGE 4348 CATEGORY 37  
79/00/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Modeling the performance of gas-fired heat pump systems

AUTH: A/PATANI, A.; B/BONNE, U. PAA: B/(Honeywell, Inc., Corporate Technology Center, Bloomington, Minn.)  
In: Intersociety Energy Conversion Engineering Conference, 14th, Boston, Mass., August 5-10, 1979. Proceedings, Volume 2. (A79-51726 23-44) Washington, D.C., American Chemical Society, 1979, p. 1699-1705. Research supported by the Gas Research Institute.

MAJS: /\*COMPUTERIZED SIMULATION/\*COOLING SYSTEMS/\*DOMESTIC ENERGY/\*GASEOUS FUELS/\*HEAT PUMPS

MINS: / COMPRESSORS/ COST EFFECTIVENESS/ DESIGN ANALYSIS/ ENERGY CONSUMPTION/ ENERGY TECHNOLOGY/ FURNACES/ HEAT EXCHANGERS/ NATURAL GAS/ POWER EFFICIENCY/ SPACE HEATING (BUILDINGS)

ABA: V.T.

ABS: The energy performance of gas-fired heat pumps for residences has been computer-simulated and the influence of the major factors affecting it has been studied by analyzing operation of various system configurations. The physical elements and assumptions used in the simulation model, including engine and compressor performance vs. speed and/or throttle conditions, and waste-heat recovery are described in detail. Consideration is given to such factors as engine size, engine efficiency, compressor efficiency, electric consumption, mode of operation, climate, refrigerant circuit features, cycling and crankcase losses, etc. which can affect efficiency and operating costs of a system consisting of an internal combustion engine coupled to a Rankin cycle refrigerant circuit, a heat-recovery unit, and a gas-fired auxiliary furnace.

NATURAL GAS AND NATIONAL POLICY, by Harvey A. Proctor

Public Utilities Fortnightly, vol. 102, no. 8,  
October 1978, p. 15-16

79N30406# ISSUE 21 PAGE 2797 CATEGORY 28 RPT#:  
DOE/EIA-0103/4 TM/ES/78-17 78/09/14 114 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Oil and gas supply curves for the administrator's annual report

CORP: Department of Energy, Washington, D. C. CSS: (Energy Information Administration.) AVAIL:NTIS SAP: HC A06/MF A01

MAJS: /\*ALLOCATIONS/\*ENERGY CONSUMPTION/\*POWER SUPPLIES/\*PROFILE METHOD (FORECASTING)

MINS: / DATA BASES/ MATHEMATICAL MODELS/ NATURAL GAS/ PETROLEUM PRODUCTS

ABA: DOE

ABS: Regional supply curves are presented for crude oil, natural gas, and natural gas liquids for the years of 1985 and 1990. These curves are generated by DOE's Oil and Gas Model and are part of the database for PIES, a static equilibrium model. The PIES system integrates supply and demand and other factors in energy markets for each region and for several categories of product. The supply projections are based on economic and engineering factors which effect oil and gas supply decisions. The DOE model produces a supply forecast for crude oil, associated-dissolved natural gas, and associated natural gas liquids production which consists of a fifteen year production series based on an assumed new oil price trajectory. The DOE gas model likewise produces a fifteen year production forecast of non-associated natural gas and natural gas liquids based on an assumed trajectory for new natural gas prices. The oil and gas modeling system then combines several oil and gas cases to produce a supply curve

for a given year.

THE PERFORMANCE OF ELECTRIC AND NATURAL GAS UTILITY EQUITIES, by Albert J. Fredman and Rodha M. Sharma

Public Utilities Fortnightly, vol. 102, no. 8,  
October 1978, p. 22-27

78A50253 ISSUE 23 PAGE 4223 CATEGORY 44

78/07/00 4 PAGES In GERMAN UNCLASSIFIED DOCUMENT

UTTL: Cold energy --- liquefied natural gas evaporation energy utilization

AUTH: A/WEBER, D. PAA: A/(Gutehoffnungsnueette Sterkrade AG, Oberhausen, West Germany)  
Energie, vol. 30, July 1978, p. 238-241. In German.

MAJS: /\*CLOSED CYCLES/\*ENERGY CONVERSION EFFICIENCY/\*GAS TURBINES/\*LIQUEFIED NATURAL GAS/\*WASTE ENERGY UTILIZATION

MINS: / DIESEL ENGINES/ ENERGY REQUIREMENTS/ EVAPORATION/ MATERIALS HANDLING/ OPERATIONAL PROBLEMS/ SHIPS

ABA: M.L.

ABS: A procedure for obtaining low-cost electricity by using evaporated LNG to drive gas turbines in a closed process is proposed. The gas turbine in conjunction with a diesel motor would be located at an LNG terminal and is thought to be capable of providing 211 MW at an efficiency of 60%. The components and the circulation scheme of the proposed gas turbine are considered, and characteristics of existing gas turbines, LNG terminals, LNG evaporation, and cost estimates are explained.

78A35897 ISSUE 14 PAGE 2489 CATEGORY 25

78/00/00 21 PAGES In FRENCH UNCLASSIFIED DOCUMENT

UTTL: Research in a pre-vaporization combustion chamber on natural gas in liquid and gaseous states

AUTH: A/MATTON, G.; B/MULLER, J.-P. PAA: A/(Valenciennes, Centre Universitaire, Valenciennes, Nord, France); B/(Ecole Nationale Polytechnique, Algiers, Algeria) L'Aeronautique et l'Astronautique, no. 69, 1978, p. 57-77. In French.

MAJS: /\*AIRCRAFT FUELS/\*COMBUSTION CHAMBERS/\*COMBUSTION EFFICIENCY/\*LIQUEFIED NATURAL GAS/\*METHANE

MINS: / AIR TO AIR REFUELING/ COMBUSTION PRODUCTS/ CRYOGENIC FLUID STORAGE/ ENTHALPY/ FUEL CONSUMPTION/ HEAT BALANCE/ HEAT EXCHANGERS/ PHASE DIAGRAMS/ TEST STANDS

ABA: D.M.W.

ABS: Phase diagrams derived from pre-vaporization combustion chamber observations are presented to support the contention that LNG or liquid methane could be employed as reliably as LH2 in aircraft fuel. It is noted that LNG can be burned as effectively as natural gas in gaseous form, and can also be used to start gas jet turbines and increase overall power by bypassing the heat exchanger. The cryogenic circuitry involved in aircraft applications is reviewed. It is also pointed out that LNG can be used more safely than LH2.

79N28059# ISSUE 18 PAGE 2488 CATEGORY 84 RPT#: DOE/EIA-0103/17 TM/ES/79-05 78/11/00 51 PAGES UNCLASSIFIED DOCUMENT

UTTL: Midterm oil and gas supply modeling system methodology description

AUTH: A/EVERETT, C.; B/MAHN, N.; C/JONES, K.

CORP: Department of Energy, Washington, D. C. CSS: (Energy Information Administration.) AVAIL:NTIS SAP: MC A04/MF A01

MAJS: /\*CRUDE OIL/\*ECONOMIC ANALYSIS/\*NATURAL GAS/\* PRODUCTION ENGINEERING

MINS: / COMPUTERS/ COST ANALYSIS/ METHODOLOGY/ MODELS/ SUPPLYING/ SYSTEMS ANALYSIS

ABA: DOE

ABS: The Midterm Oil and Gas Supply Modeling System is a computer based model which projects domestic oil and natural gas production for 15 years based on economic and engineering factors which effect oil and gas supply. The regional oil and gas supply curves developed are input to the Project Independence Evaluation System. The Oil Supply Model consist primarily of three interconnected submodels: a drilling submodel; a resource submodel; and an economic submodel. Also included in the Modeling System is a financial model which tabulates detailed costs and revenue information calculated from the minimum acceptable price model into regional income statements and selected balance sheet items for the oil and gas producing industry.

78A33126# ISSUE 13 PAGE 2399 CATEGORY 45 RPT#: ASME PAPER 77-WA/APC-1 CNT#: EPA-68-02-2144 77/11/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Evaluation of two industrial boilers with combustion modifications for reduced pollutant emissions

AUTH: A/HUNTER, S. C.; B/SOTTER, J. C.; C/HALL, R. E.; D/NAZIMOWITZ, W. PAA: B/(KVB, Inc., Tustin, Calif.); C/(U.S. Environmental Protection Agency, Industrial Environmental Research Laboratory, Research Triangle Park, N.C.); D/(KVB, Inc., Scarsdale, N.Y.) SAP: MEMBERS, \$1.50; NONMEMBERS, \$3.00

American Society of Mechanical Engineers, Winter Annual Meeting, Atlanta, Ga., Nov. 27-Dec. 2, 1977, 13 p. U.S. Environmental Protection Agency

MAJS: /\*AIR POLLUTION/\*BOILERS/\*COMBUSTION PRODUCTS/\*NATURAL GAS/\*POLLUTION CONTROL

MINS: / AIR FLOW/ FUEL OILS/ INDUSTRIAL PLANTS/ NITROGEN OXIDES/ PERFORMANCE TESTS

ORIGINAL PAGE IS  
OF POOR QUALITY

79N26229# ISSUE 17 PAGE 2246 CATEGORY 28 RPT#:  
CONS/2925-3 CNT#: EY-76-C-02-2925 78/05/00 66  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Blending of hydrogen in natural gas distribution systems. Volume 3: Gas blends leakage tests of selected distribution system components TLSP: Final Report, 1 Jun. 1976 - 30 Apr. 1978

CORP: Public Service Electric and Gas Co., Newark, N. J.  
AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /\*JOINTS (JUNCTIONS)/ \*LEAKAGE/ \*NATURAL GAS

MINS: / CONCENTRATION (COMPOSITION)/ HYDROGEN

ABA: DOE

ABS: Twenty sample test joints, consisting of eleven cast-iron, cement, and jute joints, five steel joints, and four plastic joints, were tested using straight natural gas, varying blends of hydrogen with natural gas, and varying humidity levels of the gas mixture. Test results show: (1) cast-iron joints and steel joints that did not leak with natural gas did not leak with blends of up to 40% hydrogen in natural gas; (2) cast-iron joints and steel joints that had small leaks with natural gas did not leak at a higher rate with blends of up to 40% hydrogen in natural gas; (3) cast-iron joints that had large leaks with natural gas showed a detectable increase in leakage as the hydrogen level in the gas blend increased; (4) efforts to determine if the permeability of polyethylene tubing increases with increasing concentrations of hydrogen in natural gas, and with aging of the plastic, were inconclusive; and (5) there was no preferential leakage of hydrogen in any of the joints tested using blends with up to 40% hydrogen in natural gas.

7 78A36372 ISSUE 15 PAGE 2760 CATEGORY 44  
78/00/00 6 PAGES In GERMAN UNCLASSIFIED DOCUMENT

UTTL: Use of gas turbines in natural gas transport systems /pipelines/

AUTH: A/GUENTHER, J.; B/MOLDENHAUER, W. PAA: B/(AEG-KANIS Turbinenfabrik GmbH, Berlin, West Germany)

AEG-Telefunken, Technische Mitteilungen, vol. 68, no. 1-2, 1978, p. 48-53. In German.

MAJS: /\*GAS TRANSPORT/ \*GAS TURBINES/ \*MATERIALS HANDLING/ \*NATURAL GAS/ \*PIPELINES

MINS: / ENERGY TECHNOLOGY/ PUMPS/ U.S.S.R.

ABA: P.T.H.

ABS: The paper describes some of the materials and equipment requirements for a natural gas pipeline station. The effect of environmental demands on design is discussed in the light of the Orenburg-Chust pipeline in the USSR. Requirements on an attendance-free station are examined.

79N21233# ISSUE 12 PAGE 1E47 CATEGORY 31 RPT#:  
AD-A063714 78/12/00 72 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Liquefied natural gas safety research overview TLSP: Final Report

AUTH: A/SCHNEIDER, A. L.

CORP: Coast Guard, Washington, D.C. CSS: (Merchant Marine Safety.) AVAIL.NTIS SAP: HC A04/MF A01

Presented at the LNG Terminal and Safety Symp., San Diego, Calif., 12-13 Oct. 1978; sponsored by the Am. Gas Assoc. and the Cryogenic Soc. of Am.

MAJS: /\*CRYOGENIC FLUID STORAGE/ \*LIQUEFIED NATURAL GAS/ \*SAFETY MANAGEMENT/ \*TRANSPORTATION ENERGY

MINS: / FIRE PREVENTION/ GOVERNMENT PROCUREMENT/ INDUSTRIAL MANAGEMENT/ SPILLING/ STORAGE TANKS

ABA: Author (GRA)

ABS: Liquefied Natural Gas (LNG) is a growing factor in the United States energy supply situation, both for periods of high demand, peak shaving, and for daily supply (base load). Safety has been a major issue in its acceptance by the public, the government, and industry. Perhaps because of this, industry and government have undertaken programs of research, development, testing, and evaluation that are more extensive than those for most other new hazardous materials. This paper records the experimental and theoretical work performed with the goal of increasing LNG safety, and has been organized in fourteen divisions: land storage tank studies, rollover, dispersion from spills on land, land spill fire studies, land spill fire protection, ship studies, flameless explosion, dispersion from spills on water, underwater releases, water spill fire studies, vapor cloud deflagration, vapor cloud detonation, physical properties, and gelation. Examining the record of the LNG research effort leads inevitably to the conclusion that there is a basic understanding of the material, sufficient to design, operate, and regulate LNG transportation and storage.

## THE REGULATORY TREATMENT OF NATURAL GAS EXPLORATION BY DISTRIBUTORS

Arnold Fieldman

Fortnightly, vol.101, no. 7, March 30, 1978, p. 11-15

Explores the cost-recovery problems of gas utilities which engage in natural gas exploration and development and various treatments of those problems by regulatory authorities who have considered them.

79N28252 ISSUE 19 PAGE 2515 CATEGORY 25  
78/00/00 122 PAGES UNCLASSIFIED DOCUMENT

UTTL: Solvent selectivity for purification of natural gases  
TLSP: Ph.D. Thesis  
AUTH: A/RIVAS, O. R.  
CORP: California Univ., Berkeley. SAP: Avail: Univ.  
Microfilms Order No. 7914742  
MAJS: /\*GAS ANALYSIS/\*HENRY LAW/\*INDICATING INSTRUMENTS/\*  
LIQUID-GAS MIXTURES/\*NATURAL GAS

MINS: / CARBON DIOXIDE/ ETHANE/ HYDROGEN SULFIDE/ SCRUBBERS  
ABA: Dissert. Abstr.  
ABS: A gas solubility apparatus was developed for measuring the solubility of gases in pure or mixed solvents at pressures below one atmosphere and at temperatures ranging from -20 to 200 C. Equilibrium solubilities accurate to about one percent are determined from total gas pressure and from material balances. This apparatus was used for research on purification of sour natural gases by absorption. The absorbing liquid was a mixture, containing one chemical solvent and one physical solvent. Preliminary design calculations for sweetening natural gases by absorption suggest that under some circumstances, mixed solvent absorption may be economically superior to absorption using conventional aqueous alkanolamine solutions.

79N15423# ISSUE 6 PAGE 745 CATEGORY 44 RPT#:  
PB-286246/4 IMMR38-PD21-78 ISBN-0-89779-006-5  
78/08/00 119 PAGES UNCLASSIFIED DOCUMENT

UTTL: Proceedings of Energy Resource 5th Conference  
CORP: Kentucky Univ., Lexington. CSS: (Inst. for Mining and Minerals Research.) AVAIL.NTIS SAP: HC A06/MF A01  
Conf. held at Lexington, Ky., 10-11 Jan. 1978  
MAJS: /\*COAL/\*CONFERENCES/\*CRUDE OIL/\*ENERGY TECHNOLOGY/\*  
NATURAL GAS  
MINS: / COAL GASIFICATION/ COAL LIQUEFACTION/ ECONOMIC  
ANALYSIS/ ENERGY POLICY/ FLUIDIZED BED PROCESSORS/  
MINING/ PLANNING/ REGULATIONS  
ABA: GRA

ABS: The most recent information available on the rapidly changing energy resource picture fuel policies, economics, and technical advances is presented. The theme of the conference was Gas from Coal for Industry: Direct Utilization of Coal Problems and Solutions. Topics covered include facilities siting, an update of energy resources, state and federal regulations, economics, coal utilization, and environmental and social considerations.

79N17230# ISSUE 8 PAGE 989 CATEGORY 37 RPT#:  
AD-A058486 ARL/MECH-ENG-TM-391 78/05/00 14 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Tests of Wisconsin S12D engine running on natural gas with addition of carbon dioxide  
AUTH: A/CATCHPOLE, B. G.; B/KEEBLE, T. S.  
CORP: Aeronautical Research Labs., Melbourne (Australia). AVAIL.NTIS SAP: HC A02/MF A01  
MAJS: /\*ENGINE TESTS/\*NATURAL GAS/\*PISTON ENGINES/\*SPARK IGNITION  
MINS: / CARBON DIOXIDE/ ENGINES/ FUEL CONSUMPTION/ GASOLINE/  
METHANE/ OTTO CYCLE

ABA: Author (GRA)  
ABS: Natural gas or bio-gas are possible alternative fuels to petrol in Otto-cycle engines. A commercial, single-cylinder, spark-ignition engine has been run on various mixtures of natural gas with carbon dioxide to gain experience of its operation and compare its behaviour with operation using petrol. While there was a considerable drop in power with straight natural gas, the specific fuel consumption was not greatly affected. No attempt was made to advance the spark timing or to increase the compression ratio although both of these changes would be expected to improve the performance considerably. When operating on gas, it was found possible to vary the power of the engine over a wide range by varying the mixture strength, as in a diesel. Performance was little affected by increase of carbon dioxide content up to 47%.

78N32293# ISSUE 23 PAGE 3066 CATEGORY 28 RPT#:  
NTIS/PS-78/0621/9 NTIS/PS-77/0574 NTIS/PS-76/0498  
78/06/00 259 PAGES UNCLASSIFIED DOCUMENT  
Supersedes NTIS/PS-77/0574; NTIS/PS-76/0498

UTTL: Natural gas: Supply, demand and utilization, volume 2. A bibliography with abstracts TLSP: Progress Report, 1976 - Jun. 1978  
AUTH: A/HUNDEMANN, A. S.  
CORP: National Technical Information Service, Springfield, Va. AVAIL.NTIS SAP: HC \$28.00/MF \$28.00  
MAJS: /\*BIBLIOGRAPHIES/\*ENERGY POLICY/\*NATURAL GAS  
MINS: / CANADA/ ECONOMIC ANALYSIS/ ENERGY CONSUMPTION/  
EUROPE/ GOVERNMENTS/ LAW (JURISPRUDENCE)/ TECHNOLOGY  
ASSESSMENT  
ABA: GRA  
ABS: Abstracts pertaining to natural gas supply and demand, industrial and residential consumption, fuel substitution, availability, costs. Government policies, and regulations are presented. Studies dealing with projections of natural gas use and the economics of supply and demand are included. (This updated bibliography contains 254 abstracts, 90 of which are new entries to the previous edition.)

79N30412# ISSUE 21 PAGE 279B CATEGORY 28 RPT#:  
BMFT-FB-77-84 CNT#: BMFT-ETS-3057-A 78/12/00 357  
PAGES In GERMAN; ENGLISH summary UNCLASSIFIED  
DOCUMENT DLAf E002631

UTTL: Methane and methanol as alternative energy sources: A  
comparative profitability study TLSP: Final Report

AUTH: A/DEIPENAU, H.

CORP: Salzgitter A.G. (West Germany). AVAIL.NTIS SAP:  
HC A16/MF A01; ZLD1, Munich DM 74.35  
Bonn Bundesmin. fuer Forsch. u. Technol.

MAJS: /\*ENERGY POLICY/\*GERMANY/\*LIQUEFIED NATURAL GAS/\*  
METHYL ALCOHOLS/\*SYNTHETIC FUELS

MINS: / ENERGY TECHNOLOGY/ FEASIBILITY ANALYSIS/ METHANE/  
PERSIAN GULF/ TRANSPORTATION

ABA: Author (ESA)

ABS: Elaborations of the economic and technical ways and  
means for the supply of LNG and methanol to industrial  
centers, using natural gas from the Iranian area as  
raw material, were compared. The classification of  
given possibilities for the preparation,  
transportation, and storage of potential sources of  
energy is discussed. Cost estimates of transportation,  
a comparative examination of economic and technical  
aspects, and a description of the use of LNG and  
methanol in Germany (motor cars, power plants, gas  
supply) are presented. It is concluded that energy  
costs for LNG in Wilhelmshaven are lower than those  
for methanol, and that large quantities of LNG and  
methanol from the Persian Gulf can be sold in the  
various sectors of the German energy market on the  
condition that crude gas prices on the Persian Gulf do  
not exceed 3-DM/Gcal.

79N12256# ISSUE 3 PAGE 308 CATEGORY 31 RPT#:  
SAN-W1364-01 CNT#: EE-77-C-03-1364 78/04/00 366  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Liquefied natural gas wind tunnel simulation and  
instrumentation assessments

CORP: R and D Associates, Marina Del Rey, Calif.; Colorado  
State Univ., Fort Collins. AVAIL.NTIS SAP: HC  
A16/MF A01

Prepared in cooperation with Colorado State Univ.,  
Fort Collins

MAJS: /\*LIQUEFIED NATURAL GAS/\*WIND TUNNEL TESTS

MINS: / DATA ACQUISITION/ FLAME PROPAGATION/ INSTRUMENTS/  
METEOROLOGICAL CHARTS/ RADIATION MEASUREMENT/ SAFETY  
DEVICES/ SIMULATION/ TEST FACILITIES/ WIND TUNNEL  
MODELS

ABA: DOE

ABS: An evaluation of selected aspects of Liquefied Natural  
Gas (LNG) safety research is presented. Findings are  
reported on LNG flame radiation data, criteria for  
test site selection, wind tunnel modeling, wind tunnel  
tests, instrumentation, and Salton Sea meteorological  
data. Recommendations are made for methods of studying  
LNG vapor dispersion.

78A53425\* ISSUE 24 PAGE 4330 CATEGORY 31 CNT#:  
NGR-05-007-221 78/08/00 2 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Variable-temperature cryogenic trap for the separation  
of gas mixtures

AUTH: A/DES MARAIS, D. J. PAA: A/(NASA, Ames Research  
Center, Extraterrestrial Biology Div., Moffett Field,  
Calif.)

CORP: National Aeronautics and Space Administration, Ames  
Research Center, Moffett Field, Calif.  
Analytical Chemistry, vol. 50, no. 9, Aug. 1978, p.  
1405, 1406

MAJS: /\*COLD TRAPS/\*COMBUSTION PRODUCTS/\*CRYOGENIC EQUIPMENT  
/\*GAS MIXTURES/\*NATURAL GAS

MINS: / ETHANE/ GAS CHROMATOGRAPHY/ GAS TEMPERATURE/  
ISOTROPY/ LIQUID NITROGEN/ METHANE

ABA: M.L.

ABS: The paper describes a continuous variable-temperature  
U-shaped cold trap which can both purify vacuum-line  
combustion products for subsequent stable isotopic  
analysis and isolate the methane and ethane  
constituents of natural gases. The canister containing  
the trap is submerged in liquid nitrogen, and, as the  
gas cools, the gas mixture components condense  
sequentially according to their relative vapor  
pressures. After the about 12 min required for the  
bottom of the trap to reach the liquid-nitrogen  
temperature, passage of electric current through the  
resistance wire wrapped around the tubing covering the  
U-trap permits distillation of successive gas  
components at optimal temperatures. Data on the  
separation achieved for two mixtures, the first being  
typical vacuum-line combustion products of geochemical  
samples such as rocks and the second being natural  
gas, are presented, and the thermal behavior and power  
consumption are reported.

79N16342# ISSUE 7 PAGE 868 CATEGORY 43 RPT#:  
PB-287394/1 FSLUPCA-34 78/05/00 79 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Northern Alaska hydrocarbon resources

AUTH: A/KREITNER, J. D.

CORP: Federal-State Land Use Planning Commission for Alaska,  
Anchorage. AVAIL.NTIS SAP: HC A05/MF A01

MAJS: /\*ALASKA/\*CRUDE OIL/\*ENERGY POLICY/\*NATURAL GAS  
MINS: / COST ANALYSIS/ ENERGY TECHNOLOGY/ EXPLORATION/  
HYDROCARBONS/ REGULATIONS

ABA: GRA

ABS: The private, federal, and state oil and gas  
initiatives in Northern Alaska over the past 35 years  
are brought together. It treats Northern Alaska oil  
and gas provinces as a planning unit, rather than  
using the classic (private, state, etc.) divisions.

79A34129 ISSUE 13 PAGE 2425 CATEGORY 44  
78/00/00 21 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen as a mid-term gaseous fuel supplement by blending with natural gas  
AUTH: A/STEINMETZ, G. F. PAA: A/(Baltimore Gas and Electric Co., Baltimore, Md.)  
In: Alternative energy sources; Proceedings of the Miami International Conference, Miami Beach, Fla., December 5-7, 1977. Volume 8. (A79-34106 13-44) Washington, D.C., Hemisphere Publishing Corp., 1978, p. 3889-3909.  
MAJS: /\*COST EFFECTIVENESS/\*ELECTROLYSIS/\*HYDROGEN FUELS/\*NATURAL GA  
MINS: / ENERGY STORAGE/ ENERGY TECHNOLOGY/ FEASIBILITY ANALYSIS/ HYDROGEN-BASED ENERGY/ LOW COST/ TECHNOLOGICAL FORECASTING  
ABA: B.J.  
ABS: The feasibility of blending hydrogen into the present

natural gas delivery system as an energy supplement was investigated for the mid-term (1985-2000). Successful development of advanced electrolyzer technology and the availability of low-cost off-peak electric generating capacity are basic to this concept. It was determined that a major federally funded research, development, and demonstration program aimed at proving the technical feasibility of this concept is not justified within the next five years.

78N26227# ISSUE 17 PAGE 2231 CATEGORY 28 RPT#:  
DOE/EV-0002 CNT#: EY-76-C-06-1830 EE-77-C-02-4234  
EE-77-C-02-4204 W-7405-ENG-48 EY-76-C-08-0020  
78/02/00 464 PAGES UNCLASSIFIED DOCUMENT

UTTL: Approach to liquefied natural gas (LNG) safety and environmental control research  
CORP: Department of Energy, Washington, D. C. CSS: (Div. of Environmental Control Technology.) AVAIL.NTIS  
SAP: HC A20/MF A01  
MAJS: /\*ENERGY POLICY/\*ENVIRONMENT EFFECTS/\*LIQUEFIED NATURAL GAS  
MINS: / ENERGY REQUIREMENTS/ RESEARCH AND DEVELOPMENT/ SAFETY  
ABA: ERA  
ABS: LNG safety and control information is presented for use by industry, regulatory bodies, and the general public. To achieve verified predictive capabilities and verified control methods, activities in six technical elements were identified: vapor generation and dispersion; fire and radiation hazards; flame propagation; release prevention and control; instrumentation and technique development; and scale effects experiments.

79A27897# ISSUE 10 PAGE 1837 CATEGORY 44  
78/12/25 3 PAGES UNCLASSIFIED DOCUMENT

UTTL: Transport fuels from natural gas  
AUTH: A/WALKER, B. V.  
New Zealand Energy Journal, vol. 51, Dec. 25, 1978, p. 194-196.  
MAJS: /\*GAS TRANSPORT/\*NATURAL GAS/\*OPERATIONAL PROBLEMS/\*RESEARCH AND DEVELOPMENT  
MINS: / CRUDE OIL/ ECONOMIC ANALYSIS/ FUEL CORROSION/ GASOLINE/ LOW COST/ METHYL ALCOHOLS/ NEW ZEALAND/ SYNTHETIC FUELS  
ABA: A.A.  
ABS: A solution to the energy problem with transport fuels in New Zealand is proposed through options based on natural gas. The advantages of natural gas are cited, noting that the technology for converting it for transport use is comparatively low in capital cost, high on reliability, and environmentally clean. A 15% methanol/gasoline blend is suggested for short-term options, and an examination of possible technical problems associated with the blend is presented, concluding that methanol/gasoline blends are good automotive fuels, and present no significant corrosion problems. Long-term options are analyzed, with methanol and synthetic gasoline as choices, showing that they are competitive and contrasting alternatives, methanol being economically more attractive, while synthetic gasoline displays no downstream problems.

RESIDENTIAL NATURAL GAS CONSUMPTION: EVIDENCE THAT CONSERVATION EFFORTS TO DATE HAVE FAILED  
Richard L. Lehman and Henry E. Warren  
Science  
Vol. 199 no. 4331 February 24, 1978  
p. 879-882

Abstract. A new short-term natural gas consumption model is developed, tested against American Gas Association sales data, and applied to the question of the effectiveness of conservation efforts. The results indicate that unit residential gas-heating sales per heating degree-day have remained constant in four major gas-consuming regions during the period 1974 to 1976 and that heating sales have not been affected by the recent sharp changes in price.

79A14704# ISSUE 3 PAGE 421 CATEGORY 44  
78/00/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: A systems study of our energy problems  
AUTH: A/LEE, S. C. PAA: A/(Missouri-Rolla, University,  
Rolla, Mo.)  
In: Annual Conference on Energy, 4th, Rolla, Mo.,  
October 11-13, 1977, Proceedings. (A79-14676 03-44)  
Rolla, Mo., University of Missouri-Rolla, 1978, p.  
623-635.  
MAJS: /\*ENERGY CONSERVATION/\*ENERGY SOURCES/\*FOSSIL FUELS/\*  
NUCLEAR ENERGY/\*SOLAR ENERGY  
MINS: / BIOMASS ENERGY PRODUCTION/ COAL UTILIZATION/ CRUDE  
OIL/ ENERGY TECHNOLOGY/ HYDROELECTRIC POWER STATIONS/  
NATURAL GAS/ RAPID TRANSIT SYSTEMS/ SHALE OIL/  
TRANSPORTATION ENERGY  
ABA: S.C.S.  
ABS: A variety of alternatives associated with the  
diminishing supply of petroleum and natural gas is  
presented including: (1) nuclear energy generated by  
fission or fusion, (2) fossil fuel such as petroleum  
and natural gas, coal, subbituminous coal, lignite,  
shale, oil, and tar, and (3) renewable resources  
including hydroelectric power, biomass fuels, solar  
energy, wind power, geothermal energy, and ocean  
energy. Approaches to energy conservation are noted  
with reference to increased use of mass transit  
facilities, building insulation, and the further  
development of renewable energy sources.

79N78098# CATEGORY 43 RPT#: PB-290504/0 CNT#:  
DI-14-01-0001-77-C-28 78/02/00 6 VOLS 120 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Opportunities for increasing natural gas production in  
the near term. Volume 6: The East Cameron Block 271  
Field TLSP: Final Report  
CORP: National Academy of Sciences - National Research  
Council, Washington, D. C. CSS: (Committee on Gas  
Production Opportunities.) AVAIL:NTIS  
MAJS: /\*EXPLORATION/\*GULF OF MEXICO/\*MINERAL DEPOSITS/\*  
NATURAL GAS/\*PRODUCTION ENGINEERING  
MINS: / CONTINENTAL SHELVES/ GRAPHS (CHARTS)/ MAPS/  
STATISTICAL ANALYSIS

79A15912 ISSUE 4 PAGE 647 CATEGORY 44 78/00/00  
18 PAGES UNCLASSIFIED DOCUMENT

UTTL: Production and use of low and medium Btu gas  
AUTH: A/PATTERSON, R. D.; B/BOLEZ, C. A. PAA: B/(Gilbert  
Associates, Reading, Pa.)  
In: Energy technology V: Challenges to technology:  
Proceedings of the Fifth Conference, Washington, D.C.,  
February 27-March 1, 1978. (A79-15879 04-44)  
Washington, D.C., Government Institutes, Inc., 1978,  
p. 738-755.  
MAJS: /\*COAL GASIFICATION/\*GASEOUS FUELS/\*HYDROCARBON FUEL  
PRODUCTION/\*INDUSTRIAL ENERGY/\*NATURAL GAS/\*PRODUCTION  
ENGINEERING  
MINS: / BLOCK DIAGRAMS/ COST ANALYSIS/ ENERGY TECHNOLOGY/  
FLUIDIZED BED PROCESSORS  
ABA: V.P.  
ABS: The market for low Btu gas has become a reality for  
the industrial sector during 1977. It is projected  
that by early 1979, some ten to fifteen privately  
funded industrial coal gasification plants, consuming  
3000 tons of coal per day, will be under design. The  
present paper deals with some aspects of the  
production and application of low and medium Btu gas  
as an industrial fuel. Specifically, the question of  
choosing between low and medium Btu gas is examined  
from a size and economic point of view.

79A12507\*# ISSUE 2 PAGE 248 CATEGORY 38  
78/08/00 20 PAGES UNCLASSIFIED DOCUMENT

UTTL: Detection of internal defects in a liquid natural gas  
tank by use of infrared thermography  
AUTH: A/KANTSIOS, A. G. PAA: A/(NASA, Langley Research  
Center, Hampton, Va.)  
CORP: National Aeronautics and Space Administration, Langley  
Research Center, Hampton, Va.  
Biennial Infrared Information Exchange, 4th, St.  
Louis, Mo., Aug. 22-24, 1978, Paper, 20 p.  
MAJS: /\*FUEL TANKS/\*INFRARED SCANNERS/\*LIQUEFIED NATURAL GAS  
/\*NONDESTRUCTIVE TESTS/\*TEMPERATURE MEASUREMENT  
MINS: / CAMERAS/ LEAKAGE/ STAINLESS STEELS/ TANKER SHIPS  
ABA: M.L.  
ABS: The use of an infrared scanning technique to detect  
defects in the secondary barrier of a liquid natural  
gas tank is described. The method works by detecting  
leak-caused temperature differences as low as 0.2 K,  
but can provide only an approximate idea of the extent  
of the defect. The nondestructive method was tested in  
a study of a LNG tank already at its location in a  
ship; the secondary barrier was located inside the  
tank wall. Defective areas indicated by the infrared  
radiometric measurements were confirmed by other probe  
techniques and by physical examination.

79A50881 ISSUE 22 PAGE 4188 CATEGORY 44

78/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Mixed fuel gas - A technically, economically and environmentally superior way to supplement natural gas supplies

AUTH: A/SINOR, J. E. PAA: A/(Cameron Engineers, Inc., Denver, Colo.)

In: Conference on Environmental Aspects of Non-Conventional Energy Resources - II, Denver, Colo., September 26-29, 1978. Proceedings. (A79-50876 22-45)

La Grange Park, Ill., American Nuclear Society, 1978. p. 15-3 to 15-10.

MAJS: /\*BINARY MIXTURES/\*COAL GASIFICATION/\*NATURAL GAS/\*SYNTHETIC FUELS

MINS: / CHEMICAL COMPOSITION/ CLEAN ENERGY/ ENERGY TECHNOLOGY/ ENVIRONMENT EFFECTS

ABA: V.T.

ABS: An approach to coal conversion is discussed in which approximately 85 volume % low-Btu gas is mixed with 15 volume % natural gas to produce a 300 Btu/SCF mixture called mixed fuel gas (MFG). The Btu percentage from each source will be approximately 50/50. A value of 300 Btu/SCF was chosen because combustion efficiency is maximum at this point. MFG could be burned in existing gas-fired boilers without incurring the large loss in both efficiency and capacity that may result from burning low-Btu gas alone. It can be produced at less cost and with less total environmental impact than either medium-Btu or high-Btu coal gas.

78A28475 ISSUE 10 PAGE 1798 CATEGORY 44

78/02/00 6 PAGES In GERMAN UNCLASSIFIED DOCUMENT

UTTL: Procedures for the production of hydrogen from natural gas and oil fractions

AUTH: A/JUENTGEN, H.; B/REICHENBERGER, J. PAA: B/(Bergbau-Forschung GmbH, Essen, West Germany) Brennstoff-Waerme-Kraft, vol. 30, Feb. 1978, p. 53-58. In German.

MAJS: /\*CHEMICAL FRACTIONATION/\*CRUDE OIL/\*ECONOMIC ANALYSIS /\*HYDROGEN PRODUCTION/\*NATURAL GAS/\*WASTE ENERGY UTILIZATION

MINS: / CATALYSIS/ DESULFURIZING/ ENERGY TECHNOLOGY/ METHANE / OXIDATION/ REACTION KINETICS

ABA: M.L.

ABS: Two procedures for producing hydrogen, the catalytic decomposition of methane and low-boiling hydrocarbons in the presence of steam and the partial oxidation of heavy petroleum residues, are described and compared. Reactions and industry-scale processes are examined with attention to the desulfurization of the starting material. Although from a technical point of view the two procedures are of equal usefulness, installation costs are much higher for the partial oxidation procedure. The use of heat from nuclear reactors for hydrogen production is considered.

78N20512\*# ISSUE 11 PAGE 1448 CATEGORY 37

RPT#: NASA-TP-1150 E-9195 78/02/00 18 PAGES UNCLASSIFIED DOCUMENT

UTTL: Friction and wear of selected metals and alloys in sliding contact with AISI 440 C stainless steel in liquid methane and in liquid natural gas

AUTH: A/WISANDER, D. W.

CORP: National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A02/MF A01

MAJS: /\*ALUMINUM/\*BERYLLIUM/\*COPPER/\*COPPER ALLOYS/\*IRON/\*NICKEL/\*SLIDING FRICTION/\*TITANIUM/\*WEAR

MINS: / COEFFICIENT OF FRICTION/ LIQUEFIED NATURAL GAS/ METHANE/ STAINLESS STEELS

ABA: Author

ABS: Aluminum, titanium, beryllium, nickel, iron, copper, and several copper alloys were run in sliding contact with AISI 440C in liquid methane and natural gas. All of the metals run except copper and the copper alloys of tin and tin-lead showed severely galled wear scars. Friction coefficients varied from 0.2 to 1.0, the lowest being for copper, copper-17 wt. % tin, and copper-8 wt. % tin-22 wt. % lead. The wear rate for copper was two orders of magnitude lower than that of the other metals run. An additional order of magnitude of wear reduction was achieved by the addition of tin and/or lead to copper.

78N28620\*# ISSUE 19 PAGE 2557 CATEGORY 44

78/00/00 28 PAGES UNCLASSIFIED DOCUMENT

UTTL: Agricultural and industrial process heat

AUTH: A/DOLLARD, J.

CORP: Department of Energy, Washington, D. C. CSS: (Office of Solar Applications.) AVAIL.NTIS SAP: HC A07/MF A01

In NASA, Langley Res. Center Emerging Energy Alternatives for the Southeastern States p 59-86 (SEE N78-28615 19-44)

MAJS: /\*AGRICULTURE/\*ENERGY POLICY/\*INDUSTRIAL ENERGY

MINS: / ALTERNATIVES/ ENERGY REQUIREMENTS/ HEAT GENERATION/ NATURAL GAS/ OILS/ SOLAR ENERGY

ABA: L.S.

ABS: The application of solar energy to agricultural and industrial process heat requirements is discussed. This energy end use sector has been the largest and it appears that solar energy can, when fully developed and commercialized, displace from three to eight or more quads of oil and natural gas in U.S. industry. This potential for fossil fuel displacement in the agricultural and industrial process heat area sector represents a possible savings of 1.4 to 3.8 million barrels of oil daily.

78N30263# ISSUE 21 PAGE 2780 CATEGORY 28 RPT#:  
DOE-TR-17 78/00/00 16 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Tests at the FOS terminal on the lng behavior in large  
tanks  
AUTH: A/BELLUS, F.; B/REVEILLARD, Y.; C/BONNAURE, C.;  
D/CHEVALIER, L.  
CORP: Department of Energy, Oak Ridge, Tenn. AVAIL:NTIS  
SAP: HC A02/MF A01  
Sponsored by DOE Transl. into ENGLISH from  
unidentified French report  
MAJS: /\*EVAPORATION RATE/\*LIQUEFIED NATURAL GAS/\*PRESSURE  
DISTRIBUTION/\*TANKS (CONTAINERS)/\*THERMODYNAMIC  
EQUILIBRIUM  
MINS: / ATMOSPHERIC PRESSURE/ FLOW VELOCITY/ INSTALLING/

METHANE/ STORAGE TANKS

ABA: ERA

ABS: The determination of the recovery process of the  
evaporation gases of the LNG tanks and the setting of  
rational operating methods imply the exact knowledge  
of the LNG behavior during its storage. The  
theoretical studies carried out in this direction did  
not allow removing all the uncertainties so that tests  
were undertaken on both 35,000 cu m tanks at Fos in  
order to determine the evaporation rate at constant  
pressure of a tank for various liquid levels, the  
development of pressure in an entirely insulated tank,  
and the time taken for the return to the thermodynamic  
equilibrium of LNG when the operating pressure of the  
tank is suddenly changed. Results of simulated  
operation without recovery of the boiloff gases  
carried out on several tankers' journeys are  
presented.

TD      **The Gas industry and the environment :**  
195      **proceedings of a symposium of the**  
.G3      **Economic Commission for Europe**  
G37      **Committee on gas, Minsk, Byelorussian**  
1978      **SSR, 20-27 June, 1977. Oxford ; New**  
         **York : Published for the United**  
         **Nations by Pergamon Press, 1978.**  
         **xvi, 263 p. : ill. ; 26 cm. £20.00**  
         **(\$36.00)**

**Includes bibliographical references.**

**1. Gas industry -- Environmental**

78N27516 ISSUE 18 PAGE 2407 CATEGORY 44  
78/00/00 165 PAGES UNCLASSIFIED DOCUMENT  
UTTL: A dynamic energy optimization model under uncertainty  
--- natural gas models and decision making TLSP:  
Ph.D. Thesis  
AUTH: A/LENARY, R. R.  
CORP: Case Western Reserve Univ., Cleveland, Ohio. SAP:  
Avail: Univ. Microfilms Order No. 78-09292  
MAJS: /\*DECISION MAKING/\*DYNAMIC MODELS/\*NATURAL GAS/\*  
OPTIMIZATION  
MINS: / ENERGY CONSERVATION/ LINEAR PROGRAMMING/ RESOURCE  
ALLOCATION  
ABA: Dissert. Abstr.  
ABS: The problem is formulated and solved using a  
multi-period linear programming model. The model takes  
into consideration the variability of weather  
conditions and its effect on the demand for natural  
gas. Forecasts of future weather conditions are  
updated several times during the model planning  
period; also, the optimal flows of natural gas are  
determined at the time that the forecasts are updated.  
The model considers alternatives such as: conservation  
of natural gas, emergency purchase of gas and  
gasifying coal to minimize shortages of natural gas.  
The optimal storage quantities at the beginning of  
each time period and the consequences of contracting  
additional storage facilities on the total natural gas

shortage are derived by using the model.

THE USE OF LIQUID NATURAL GAS AS HEAT SINK FOR POWER  
CYCLES.

G. Angelino.

J. Engineering for Power, v.100, no.1, Jan.1978,  
p.169-177.

*The thermodynamics of power cycles employing liquid natural gas (LNG) as heat sink is discussed. Condensation cycles in simple or in elaborate versions, employing nontoxic, nonflammable, inert organic fluids (CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, CHF<sub>3</sub>, C<sub>3</sub>F<sub>8</sub>), yield the best overall performance for LNG vaporization at subcritical pressure. For supercritical vaporization, heat rejection from Brayton cycles naturally fits heat sink thermal characteristics, which results in a particularly high efficiency for closed gas cycles. If only a fraction of the cooling capability of LNG is devoted to power uses, condensation cycles are superior to gas cycles even at supercritical LNG pressures. Under the most favorable circumstances gas cycles achieve efficiencies of around 60 percent, while some elaborate condensation cycles attain the 70 percent level.*

SUPPLEMENTAL GAS SUPPLIES AND THE NATION'S ENERGY FUTURE.

William T. McCormick, Jr. & Herbert B. Kalisch  
Public Utilities Fortnightly, Vol. 102, No. 2,  
July 20, 1978, p. 22-23.

Efforts to develop supplemental supplies of gas — natural and synthetic — from sources other than the existing conventional ones constitute a most important energy supply initiative. Just how important is indicated by some statistical data set forth in this article by two staff members of the American Gas Association.

NATURAL GAS: THE SEARCH GOES ON, by Brian Hodgson  
National Geographic, vol. 154, no. 5, November 1978, p. 632-651.

**"NATURAL GAS?** We could have it running out of our ears," says Dr. Paul Jones. "But first we've got to accept some new ideas about petroleum geology."

Public Utilities Fortnightly, v.102, Oct. 12, 1978, no.8.

AMERICAN GAS ASSOCIATION. (Special Issue).  
(Gas Utility Executives' Forum, p. 90-91).

Natural Gas and National Policy .....	Harvey A. Proctor	15
The Problems of Marginal Cost Pricing and Its Progeny .....	Randall K. Anderson	17
The Performance of Electric and Natural Gas Utility Equities .....	Albert J. Fredman and Radha M. Sharma	22

Gases, Natural - Liquefied

1978

TP Advances in cryogenic engineering, v.23 /  
190 edited by K. D. Timmerhaus. — New York :  
.A3 Plenum Press, 1978.  
v.23 xviii, 717 p. : ill.

LNG Properties

Thermodynamic Properties of Natural Gas, Petroleum Gas, and Related Mixtures: Enthalpy Predictions, J. MOLLERUP, Institutet for Kemiteknik, Danmarks Tekniske Højskole .....	550	v
Prediction of the Transport Properties of Natural Gas and Similar Mixtures, J. C. RAINWATER and H. J. M. HANLEY, National Bureau of Standards .....	561	
A Calculational Method for Obtaining the Density of a Liquefied Natural Gas, J. E. ORRIT and J. M. LAUPRETRE, Société Nationale Elf Aquitaine .....	566	
Density of Liquefied Natural Gas Components, J. E. ORRIT and J. M. LAUPRETRE, Société Nationale Elf Aquitaine .....	573	
VLE Calculations Using Temperature-Dependent $k_{12}$ Values for Methane-Containing Binary Systems, B. C.-Y. LU, W. K. CHUNG, M. KATO, and Y.-J. HSIAO, University of Ottawa .....	580	
Liquid Mixture Excess Volumes and Total Vapor Pressures Using a Magnetic Suspension Densimeter with Compositions Determined by Chromatographic Analysis: Methane Plus Ethane, M. J. HIZA and W. M. HAYNES, National Bureau of Standards ...	594	
Vapor Pressures and Heats of Vaporization for Propane and Propene from 50 K to the Normal Boiling Point, D. W. YARBROUGH and C.-H. TSAI, Tennessee Technological University ..	602	
On the Nonanalytic Equation of State for Propane, R. D. GOODWIN, National Bureau of Standards .....	611	

LIQUEFIED NATURAL GAS, by Sidney M. Wolf.  
The Bulletin of the Atomic Scientists, vol. 34, no. 10,  
December 1978, p.20-25.

**'My proposition is that pricing will determine whether this country gets into LNG imports in a big way.'**

ORIGINAL PAGE IS  
OF POOR QUALITY

**THERMAL HAZARD FROM LNG FIREBALLS**

H. C. Hardee, D. O. Lee, & W. B. Benedick  
 Combustion Science And Technology, vol. 17, no. 5 & 6,  
 February 1978, p. 189-197

**Abstract**—Accidents with many hydrocarbon materials such as propene, butane and gasoline frequently result in the formation of fireballs. The shipment of liquified natural gas (LNG) involves large quantities of fuel which, in the event of an accident, could ignite to form a fireball. Depending on atmospheric conditions, the thermal effects from such a fireball could produce third degree skin burns and start fires out to distances of several kilometers. A simple fireball model is presented here which describes the potential thermal hazard. Some experimental results for small quantities of fuel which form optically thin fireballs are also presented. The question of scaling is considered and it is concluded that for the investigation of optically thick fireballs involving extremely large quantities of LNG, meaningful tests can be run with 100 to 10,000 kg of fuel.

**NTIS-26227#** Department of Energy, Washington, D. C. Div. of Environmental Control Technology.

**APPROACH TO LIQUEFIED NATURAL GAS (LNG) SAFETY AND ENVIRONMENTAL CONTROL RESEARCH**

Feb. 1978 464 p refs  
 (Contracts EY-76-C-06-1830; EE-77-C-02-4234;  
 EE-77-C-02-4204; W-76-eng-48; EY-76-C-08-0020)  
 (DOE/EV-0002) Avail. NTIS HC A20/MF A01

LNG safety and control information is presented for use by industry, regulatory bodies, and the general public. To achieve verified predictive capabilities and verified control methods, activities in six technical elements were identified: vapor generation and dispersion; fire and radiation hazards; flame propagation; release prevention and control; instrumentation and technique development; and scale effects experiments. ERA

TP Advances in cryogenic engineering, v.23 /  
 1978 edited by K. D. Timmerhaus. -- New York :  
 Plenum Press, 1978.  
 .A3 xviii, 747 p. : ill.  
 v.23

**LNG Design**

Reversible LNG, T. H. MALYN and M. R. CREED, <i>British Gas Corporation</i> .....	515
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Internally Insulated Cryogenic Pipelines, G. WALKER, <i>The University of Calgary</i> , and J. STUCHLY, <i>Canuck Engineering Ltd.</i> ..	531
Solubility Enhancement of Solid Hydrocarbons in Liquid Methane Due to the Presence of Ethane, D. L. TIFFIN, K. D. LUKS, and J. P. KOHN, <i>University of Notre Dame</i> .....	538
Predicted Solubilities of Methanol in Compressed Natural Gas at Low Temperatures and High Pressures, K. W. WON, <i>Fluor Engineers and Constructors, Inc.</i> .....	544

TH Dillon, Joseph B.  
 1715 Thermal insulation : recent developments  
 .D55 / Joseph B. Dillon. -- Park Ridge, N.J. :  
 Noyes Data Corp., 1978.

<b>LIQUEFIED GAS STORAGE</b> .....	136
Prestressed Concrete Storage Tank .....	136
Insulation Member .....	140
Capillary Insulation .....	142
Wall Construction .....	146
Intermediate Envelope .....	146
Tube Holder Design .....	147
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Continuous Process for Three-Dimensional Fiber Insulation .....	151
Glass Fiber Nets on Tank Surface .....	152
Hydrocarbon-Based Foam .....	155
Foamed Sulfur .....	156

NASA TP-1150 *Gases, Natural* 1978

**FRICTION AND WEAR OF SELECTED METALS AND ALLOYS IN SLIDING CONTACT WITH AISI 440C STAINLESS STEEL IN LIQUID METHANE AND IN LIQUID NATURAL GAS.** Donald W. Hinzendor, LeRC. Feb. 1978. 16p.

79N16262# ISSUE 7 PAGE 858 CATEGORY 37  
77/00/00 40 PAGES UNCLASSIFIED DOCUMENT DCAF  
E002628

UTTL: The use of liquid natural gas as heat sink for power cycles

AUTH: A/ANGELINO, G.

CORP: Politecnico di Milano (Italy). CSS: (Ist. di Macchine.) AVAIL.NTIS SAP: HC A16/MF A01: Von Karman Inst. for Fluid Dyn. BF 4.500  
In Von Karman Inst. for Fluid Dyn. Closed Cycle Gas Turbines, Vol. 1 40 p (SEE N79-16260 07-37)

MAJS: /\*HEAT SINKS/\*LIQUEFIED NATURAL GAS/\*THERMODYNAMIC CYCLES

MINS: / CONDENSING/ COOLING/ FLUID DYNAMICS/ HIGH TEMPERATURE/ PRESSURE/ SUBCRITICAL FLOW/ SYSTEM EFFECTIVENESS/ WORKING FLUIDS

ABA: Author

ABS: The thermodynamics of power cycles employing LNG as heat sink is discussed. Condensation cycles in simple or in elaborate versions, employing non-toxic, non-flammable, inert organic working fluids (CF4, C2F6, CHF3, C3F8), yield the best overall performance for LNG vaporization at subcritical pressure. For supercritical vaporization, heat rejection from Brayton cycles naturally fits heat sink thermal characteristics, which results in a particularly high efficiency for closed gas cycles. If only a fraction of the cooling capability of LNG is devoted to power uses, condensation cycles are superior to gas cycles even at supercritical LNG pressures. Under the most favourable circumstances gas cycles achieve efficiencies of around 60 percent, while some elaborate condensation cycles attain the 70 percent level.

78N16419# ISSUE 7 PAGE 894 CATEGORY 43 RPT#:  
PB-272735/2 BM-IC-8749 77/00/00 99 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Analyses of natural gases, 1976 TLSP: Annual Report, Information Circular 1977

AUTH: A/MOORE, B. J.

CORP: Bureau of Mines, Amarillo, Tex. CSS: (Helium Operations.) AVAIL.NTIS SAP: HC A05/MF A01  
Sponsored by Dept. of Interior

MAJS: /\*GAS ANALYSIS/\*GEOCHEMISTRY/\*GEOLOGICAL SURVEYS/\* NATURAL GAS

MINS: / HELIUM/ METHANE/ PIPELINES/ WELLS

ABA: GRA

ABS: Analyses and related source data are presented for 252 natural gas samples from wells and pipelines in 17 states. All samples were obtained and analyzed during calendar year 1976 as a part of Bureau of Mines investigations of the occurrences of helium in natural gases of countries with free market economies.

79N11607# ISSUE 2 PAGE 216 CATEGORY 46 RPT#:  
FE-2025-3 CNT#: EX-76-C-01-2025 77/10/30 39 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Potential producibility and recovery of natural gas from geopressed aquifers of the Cenozoic sediments of the Gulf Coast Basin TLSP: Final Report

AUTH: A/CRONQUIST, C.; B/MALOTT, J. P.; C/OLSEN, N. H.; D/PURSER, P. E.; E/ZIMMERMAN, F. W.

CORP: Gulf Universities Research Consortium, Bellaire, Tex. AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /\*ENERGY POLICY/\*GAS RECOVERY/\*GEOTHERMAL RESOURCES/\* GULF OF MEXICO/\*HYDROSTATIC PRESSURE/\*NATURAL GAS

MINS: / BRINES/ ECONOMIC ANALYSIS/ LOUISIANA/ OCEAN BOTTOM/ TEXAS

ABA: DOE

ABS: The geothermal geopressed gas resource of the Texas-Louisiana Gulf Coast area was studied. It appears to offer a reasonable chance of developing into an energy resource of considerable magnitude. It has the additional advantage that the gas and electricity can be fed into existing transportation systems at minimal investments, and it would supplement declining production from other sources as it was brought on stream. No fundamental technical problems are foreseen, and there appears to be no radically new technology development required. Four areas discussed are: the economics of individual reservoir size, extended well productivity, brine saturation of the natural gas, and an economical and environmentally satisfactory means of brine disposal.

79N11446# ISSUE 2 PAGE 195 CATEGORY 39 RPT#:  
PB-202924/0 DOT-MTB-OPSO-78-02 CNT#: DOT-OS-60519  
77/12/00 150 PAGES UNCLASSIFIED DOCUMENT

UTTL: Environmentally induced cracking of natural gas and liquid pipelines. Volume 2: Appendices A and B  
TLSP: Final Report

AUTH: A/BARJOL, J. A.; B/WELLS, C. H.; C/WEI, R. P.

CORP: ASL Engineering, Goleta, Calif. AVAIL.NTIS SAP: HC A07/MF A01

MAJS: /\*CRACKING (FRACTURING)/\*CRUDE OIL/\*ENVIRONMENT EFFECTS/\*NATURAL GAS/\*PIPELINES

MINS: / FAILURE ANALYSIS/ HYDROGEN/ SAFETY MANAGEMENT/ STRESS CORROSION CRACKING

ABA: GRA

ABS: The Office of Pipeline Safety Operations was provided with an appraisal of the seriousness of certain types of environmentally induced cracking problems in natural gas and liquid petroleum pipelines. Measures for locating and identifying such cracks or for identifying conditions leading to their occurrence are identified. Predictions of future incidence probability are formulated and recommendations made for needed research and action.

78N13312# ISSUE 4 PAGE 465 CATEGORY 32 RPT#:  
CWJ1/C-640003-VOL-5-SUMM ESA-CR(P)-972-VOL-5-SUMM  
CNT#: ESA-2701/76-F-WMT(SC) 77/06/00 5 VOLS 61  
PAGES UNCLASSIFIED DOCUMENT DCAF E003091

UTTL: Study of satellite communications system serving  
off-shore oil and gas exploitation activities in  
European sea areas. Volume 5: Summary TLSP: Final  
Report

CORP: Marconi Communication Systems Ltd., Chelmsford  
(England). AVAIL.NTIS SAP: HC A04/MF A01  
Paris ESA

MAJS: /\*ARCTIC OCEAN/\*EUROPEAN COMMUNICATIONS SATELLITE/\*  
NORTH SEA/\*OFFSHORE ENERGY SOURCES/\*OFFSHORE PLATFORMS

MINS: / ANTENNA DESIGN/ ATMOSPHERIC ATTENUATION/ DATA  
TRANSMISSION/ NATURAL GAS/ OIL EXPLORATION/  
OPTIMIZATION/ USER REQUIREMENTS/ VOICE COMMUNICATION

ABA: ESA

ABS: A summary of a study concerning the provision of  
satellite services based on the European Communication  
Satellite to meet communications needs of the European  
offshore energy industry through the 1980's is  
presented. The potential requirement for satellite  
channels is established. An atmospheric propagation  
model is discussed in terms of topographical and  
climatic factors governing the attenuation of  
satellite-earth paths in the 11 to 14.5 GHz band.  
Environmental factors are related to antenna design.  
Results of the transmission system analysis are  
summarized, and the outcome of certain of the system  
optimization investigations is reported. The preferred  
offshore terminal configuration is described.

77N29640# ISSUE 20 PAGE 2695 CATEGORY 44 RPT#:  
PB-266419/1 MTR-7455 CNT#: DOT-FH-11-9209 77/02/00  
80 PAGES UNCLASSIFIED DOCUMENT

UTTL: Analysis of energy projections for infrastructure  
development requirements TLSP: Final Report

AUTH: A/LEIGH, J. G.

CORP: Mitre Corp., McLean, Va. CSS: (Metrek Div.)  
AVAIL.NTIS SAP: HC A05/MF A01

MAJS: /\*COAL/\*CRUDE OIL/\*ENERGY POLICY/\*FOSSIL FUELS/\*MODELS  
/\*NATURAL GAS

MINS: / ECONOMICS/ ELECTRIC POWER PLANTS/ FORECASTING

ABA: GRA

ABS: Current energy models and projections are surveyed.  
Four are analyzed in detail to provide a basis for  
projecting infrastructure and highway development  
needs associated with energy production.

79A14138# ISSUE 3 PAGE 356 CATEGORY 28  
77/00/00 45 PAGES UNCLASSIFIED DOCUMENT

UTTL: Alternate aircraft fuels prospects and operational  
implications

AUTH: A/WITCOFSKI, R. D. PAA: A/(NASA, Langley Research  
Center, Hampton, Va.)

CORP: National Aeronautics and Space Administration, Langley  
Research Center, Hampton, Va.

In: International Air Transportation Conference,  
Washington, D.C., April 4-6, 1977, Proceedings.

(A79-14126 03-03) New York, American Society of Civil  
Engineers, 1977, p. 197-241.

MAJS: /\*AIR TRANSPORTATION/\*AIRCRAFT FUELS/\*CIVIL AVIATION/\*  
COMMERCIAL AIRCRAFT/\*LIQUID HYDROGEN/\*SYNTHETIC FUELS

MINS: / COAL GASIFICATION/ ENERGY CONSUMPTION/ ENERGY  
REQUIREMENTS/ FUEL CONSUMPTION/ HYDROCARBON FUEL  
PRODUCTION/ HYDROGEN FUELS/ HYDROGEN PRODUCTION/  
KEROSENE/ LIQUEFIED NATURAL GAS/ METHANE

ABA: M.L.

ABS: The paper discusses NASA studies of the potentials of  
coal-derived aviation fuels, specifically synthetic  
aviation kerosene, liquid methane, and liquid  
hydrogen. Topics include areas of fuel production, air  
terminal requirements for aircraft fueling (for liquid  
hydrogen only), and the performance characteristics of  
aircraft designed to utilize alternate fuels. Energy  
requirements associated with the production of each of  
the three selected fuels are determined, and fuel  
prices are estimated. Subsonic commercial air  
transports using liquid hydrogen fuel have been  
analyzed, and their performance and the performance of  
aircraft which use commercial aviation kerosene are  
compared. Environmental and safety issues are  
considered.

77N29598# ISSUE 20 PAGE 2690 CATEGORY 43 RPT#:  
PB-265488/7 FEA/S-77/123 CNT#: FEA-CR-04-60918-00  
77/02/15 83 PAGES UNCLASSIFIED DOCUMENT

UTTL: The strategic petroleum reserve and liquefied natural  
gas supplies TLSP: Final Report

AUTH: A/FINK, R. J.; B/BANCROFT, B. A.; C/PALMIERI, T. M.  
CORP: TRW, Inc., McLean, Va. CSS: (Energy Systems Planning  
Div.) AVAIL.NTIS SAP: HC A05/MF A01

MAJS: /\*ENERGY POLICY/\*FOREIGN TRADE/\*LIQUEFIED NATURAL GAS  
MINS: / CRUDE OIL/ STRATEGY/ SUPPLYING

ABA: GRA

ABS: The impact which would be caused by an LNG embargo  
alone and a simultaneous LNG and oil embargo is  
analyzed.

78A24752 ISSUE 8 PAGE 1418 CATEGORY 44  
77/00/00 20 PAGES UNCLASSIFIED DOCUMENT

UTTL: Natural gas technology --- emphasizing production from  
unconventional sources in U.S.A.

AUTH: A/SUTHERLAND, L. H.  
In: Energy technology IV: Proceedings of the Fourth  
Conference, Washington, D.C., March 14-16, 1977.  
(A78-24751 08-44) Washington, D.C., Government  
Institutes, Inc., 1977, p. 58-77.

MAJS: /\*DOMESTIC ENERGY/\*ENERGY CONSERVATION/\*ENERGY SOURCES  
/\*NATURAL GAS/\*PRODUCTION ENGINEERING

MINS: / COAL UTILIZATION/ COMBUSTION EFFICIENCY/ EARTH  
RESOURCES/ ENERGY TECHNOLOGY/ HEAT PUMPS/ SYSTEMS  
ENGINEERING/ TEXAS

ABA: S.D.

ABS: The paper discusses the huge quantities of natural gas  
which can be produced from unconventional sources in  
the U.S.A. in order to bring great benefits to the gas  
consumers and the electric utility companies.

Attention is directed at the geopressurized waters in  
the Gulf Coast in Texas, the Devonian shale, the tight  
sands, the unmined bituminous coal, and conventional  
unmined coal. Methods of raising and bringing the  
efficiency of gas-burning appliances to a maximum are  
discussed, with special emphasis on the pulse  
combustion furnace operating as a stationary ram jet  
combustor with a spark plug instead of a pilot to  
provide the original ignition. Different design  
systems of heat pumps intended for transferring heat  
from a cool to a warm environment with high efficiency  
and source energy savings are briefly outlined.

77N31656# ISSUE 22 PAGE 2966 CATEGORY 44 RPT#:  
EPRI-EA-201 77/02/00 643 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Comparative state-of-the-art assessment of gas supply  
modeling TLSP: Final Report

AUTH: A/CILIANO, R.; B/LIMAYE, D. R.; C/HU, S. D.  
CORP: Mathematica, Inc., Princeton, N. J. AVAIL.NTIS  
SAP: HC A99/MF A01

Sponsored by ERDA and EPRI

MAJS: /\*DISTRIBUTING/\*MODELS/\*NATURAL GAS

MINS: / ECONOMICS/ ENERGY CONSUMPTION/ ENERGY POLICY/  
GEOLOGY

ABA: ERA

ABS: A state-of-the-art comparison of twelve major  
gas-supply-modeling efforts is described. As  
categorized into three general classifications,  
namely: (1) structural models of resource economics,  
(2) pure econometric models; and (3) resource  
base-geologic models. In addition model-by-model  
assessments are presented.

78N23988# ISSUE 14 PAGE 1924 CATEGORY 82 RPT#:  
MLM-2469(OP) CONF-771038-5 CNT#: EY-76-C-04-0053  
77/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Interactive data management and analysis system for  
the Eastern Gas Shale Program

AUTH: A/SEABAUGH, P. W.; B/ZIELINSKI, R. E.

CORP: Mound Lab., Miamisburg, Ohio. AVAIL.NTIS SAP: HC  
A02/MF A01

Presented at the Eastern Gas Shale Program Conf.,  
Morgantown, W.Va., 17 Oct. 1977

MAJS: /\*DATA MANAGEMENT/\*DATA PROCESSING/\*ENERGY POLICY/\*  
NATURAL GAS/\*SHALES

MINS: / COMPUTER GRAPHICS/ DATA BASES/ MANAGEMENT  
INFORMATION SYSTEMS/ RESOURCES MANAGEMENT

ABA: ERA

ABS: A versatile, easy to use data base system is  
described. The system provides flexibility in display  
formats as well as input and output options such as

format compatibility adaptive to field data.  
Versatility is attained through logical, Boolean, and  
arithmetic expressions. Consequently, computational  
capability is available so that data input can be  
minimized. Browsing and recursive searches are  
available through a search criteria command that  
allows the user to modify and narrow the request  
without restart. The system provides plotting options:  
data can be plotted in a well profile format. Through  
GEOLOG, a softwired synergistic log system, well log  
data can be integrated with geochemical and  
geophysical experimental data. This integration will  
provide a more accurate assessment of the resources  
potential of the well. Utilization of these features  
provides not only a fully interactive data management  
system but also an enhanced statistical capability for  
data analysis.

79A14736 ISSUE 3 PAGE 422 CATEGORY 44 77/00/00  
13 PAGES UNCLASSIFIED DOCUMENT DCAF A324000

UTTL: Study of the applicability of the geochemistry of  
gases in geothermal prospecting

AUTH: A/DAMORE, F. PAA: A/ICNR, Istituto Internazionale  
per le Ricerche Geotermiche, Pisa, Italy)

In: Seminar on Geothermal Energy, 1st, Brussels,  
Belgium, December 6-8, 1977, Proceedings, Volume 2,  
(A79-14726 03-44) Luxembourg, Commission of the  
European Communities, 1977, p. 441-453.

MAJS: /\*GAS COMPOSITION/\*GEOCHEMISTRY/\*GEOTHERMAL RESOURCES  
/\*ITALY/\*NATURAL GAS

MINS: / CHEMICAL REACTIONS/ ENERGY TECHNOLOGY/ HYDROGEN  
SULFIDE/ METHANE/ OXYGEN/ PARTIAL PRESSURE/ SULFUR/  
THERMODYNAMICS/ VAPOR PHASES

78N17490# ISSUE 8 PAGE 1038 CATEGORY 44 RPT#:  
PB-273098/4 FEA/H-77/369 FES-77-4 77/04/00 1013  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Allocation of petroleum feedstocks to synthetic natural gas plants TLSP: Final Programmatic Environmental Impact Statement  
CORP: Federal Energy Administration, Washington, D. C. CSS: (Office of Specialty Fuels.) AVAIL.NTIS SAP: HC A99/MF A01  
MAJS: /\*CRUDE OIL/\*LIQUEFIED NATURAL GAS/\*RESOURCE ALLOCATION/\*SYNTHETIC FUELS  
MINS: / ENERGY TECHNOLOGY/ ENVIRONMENTAL SURVEYS/ INDUSTRIAL PLANTS/ NAPHTHENES  
ABA: GRA  
ABS: The FEA proposes to reevaluate and possibly modify its current program of case-by-case review of applications for the allocation of naphtha and natural gas liquids (NGL) for use in the manufacture of synthetic natural gas (SNG). The FEA's programmatic environmental impact statement presents the impacts in 1980 and 1985 of (1) continuation of the current program, and (2) modification of that program through one of five options ranging from the adoption of a more restrictive policy toward the use of naphtha and NGL for SNG manufacture, to complete removal of controls on these products.

77N33596 ISSUE 24 PAGE 3235 CATEGORY 44  
77/00/00 207 PAGES UNCLASSIFIED DOCUMENT

UTTL: An economic model of new crude oil and natural gas supplies in the lower 48 states TLSP: Ph.D. Thesis  
AUTH: A/KIM, Y. Y.  
CORP: Houston Univ., Tex. SAP: Avail: Univ. Microfilms Order No. 77-19565  
MAJS: /\*CRUDE OIL/\*ECONOMICS/\*ENERGY CONSUMPTION/\*MARKETING /\*MODELS/\*NATURAL GAS/\*RESERVES  
MINS: / ENERGY POLICY/ GOVERNMENTS/ UNITED STATES OF AMERICA  
ABA: Dissert. Abstr.  
ABS: An economic model is developed to show how reserve additions and economics of oil and gas will be affected by wellhead prices, tax provisions, finding rates, and drilling capacity availabilities. The range of reserve additions estimated by the model, where government pricing and taxing policies are varied, is much greater than the range of reserve additions estimated by the U.S. Geological Survey, where government pricing and taxing policies are not varied. Results of the model show how supplies of crude oil and natural gas from new resources in the lower 48 states and Texas will be affected by different price relationships, tax provisions, finding rates, and time horizons. High priority in future research should be given to extending the economic analysis for the lower 48 states to include the Alaskan and Offshore areas.

78N25719# ISSUE 16 PAGE 2159 CATEGORY 46 RPT#:  
MLM-2467(OP) CONF-771038-4 CNT#: EY-76-C-04-0053  
77/00/00 24 PAGES UNCLASSIFIED DOCUMENT

UTTL: Geochemical characterization of Devonian gas shale  
AUTH: A/ZIELINSKI, R. E.  
CORP: Mound Lab., Miamisburg, Ohio. AVAIL.NTIS SAP: HC A02/MF A01  
Presented at the Eastern Gas Shale Program Conf., Morgantown, W. Va., 17 Oct. 1977  
MAJS: /\*GEOCHEMISTRY/\*NATURAL GAS/\*OIL RECOVERY/\*SHALES  
MINS: / ENERGY POLICY/ ENERGY SOURCES/ GAS CHROMATOGRAPHY/ ISOTOPIC LABELING  
ABA: ERA  
ABS: Detailed geochemical analyses are being used to provide an accurate assessment of the oil and gas resources present in the Devonian shales in the Appalachian and Illinois Basins. The suite of geochemical analyses is designed to evaluate the organic richness, the hydrocarbon potential, the type of organic matter and the thermal maturity of the organic matter. Laboratory techniques such as pyrolysis gas chromatography and mass balance thermal extraction were also employed to measure thermally derived oil and gas yields from the Devonian shales. Stable carbon isotope geochemistry has also been initiated. The first phase of this study involved the determination of stable carbon isotope values for shale core samples.

77N30680# ISSUE 21 PAGE 2833 CATEGORY 46  
RPT#: NASA-TM-75134 CNT#: NASW-2790 77/07/00 10  
PAGES UNCLASSIFIED DOCUMENT

UTTL: The relation between isotopic composition of argon and carbon in natural gases  
AUTH: A/GAVRILOV, Y. Y.; B/ZHUROV, Y. A.; C/TEPLINSKIY, G. I.  
CORP: Kanner (Leo) Associates, Redwood City, Calif. AVAIL.NTIS SAP: HC A02/MF A01  
Washington NASA Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Geokhimiya (USSR), v. 206, no. 2, 1972 p 448-451

MAJS: /\*ARGON ISOTOPES/\*CARBON/\*NATURAL GAS/\*SIBERIA  
MINS: / DEPOSITS/ MIGRATION/ SEDIMENTARY ROCKS  
ABA: Author  
ABS: The methods and results of determination of the argon and carbon isotope compositions of hydrocarbon gases of Mesozoic complexes of Western Siberia are presented. Based on the Ar-36, Ar-40, C-12, C-13 content of the various deposits and on the presumed mechanisms of entry of these isotopes into the deposits, it is concluded that formation of natural gas in some deposits included vertical migration from a lower complex.

78N10597# ISSUE 1 PAGE 87 CATEGORY 44 RPT#:  
PB-269366/1 EPA-450/3-77-017B-VOL-2 CNT#:  
BPA-68-02-1452 77/03/00 3 VOLS 95 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Impact of natural gas shortage on major industrial  
fuel-burning installations. Volume 2: Schedules  
(data and tables)

AUTH: A/BRICKHILL, J. A.

CORP: Foster Associates, Inc., Washington, D.C. CSS: (Energy Div.) AVAIL.NTIS SAP: HC A05/MF A01; also available in set of 3 reports, PC E07, PB-269364-SET

MAJS: /\*ECONOMIC IMPACT/\*ENERGY POLICY/\*FUEL CONSUMPTION/\*INDUSTRIAL ENERGY/\*NATURAL GAS/\*TABLES (DATA)

MINS: / AIR POLLUTION/ DATA REDUCTION/ DEMAND (ECONOMICS)/INDUSTRIAL PLANTS/ SUPPLYING

ABA: GRA

ABS: The impact of natural gas shortages on major fuel burning installations was analyzed. Gas curtailments plans, natural gas supplies, FEA survey data for MFBI and applicable state air pollution control regulations were reviewed. The availability of natural gas through 1980 for major fuel burning installations, the alternate fuel burning capability of these plants, the need for alternate fuels such as fuel oil and coal to offset the gas shortages and the estimated increase in sulfur dioxide and particulate emissions from the burning of these alternate fuels were estimated. Schedules of data summaries for the natural gas fired plants are presented.

78N25720# ISSUE 16 PAGE 2159 CATEGORY 46 RPT#:  
MLM-2466(OP) CONF-771038-3 CNT#: EY-76-C-04-0053  
77/00/00 24 PAGES UNCLASSIFIED DOCUMENT

UTTL: Physicochemical characterization of Devonian gas shale

AUTH: A/ZIELINSKI, R. E.; B/ATTALLA, A.; C/STACY, E.; D/CRAFT, B. D.; E/WISE, R. L.

CORP: Mound Lab., Miamisburg, Ohio. AVAIL.NTIS SAP: HC A02/MF A01

Presented at the Eastern Gas Shale Program Conf. Morgantown, W. Va., 17 Oct. 1977

MAJS: /\*GEOCHEMISTRY/\*NATURAL GAS/\*PHYSICAL CHEMISTRY/\*SHALES

MINS: / EARTH RESOURCES/ ENERGY POLICY/ ENERGY SOURCES/ SOIL MECHANICS

ABA: ERA

ABS: Several physicochemical analyses are being performed to better characterize the Devonian gas shales located in the Appalachian and Illinois Basins. The results of these analyses are being integrated with the geochemical analyses to present an accurate characterization of the Devonian shales and to accurately assess their resource potential. These studies are also providing data that are being used to evaluate the physical behavior of the shales.

78N21323# ISSUE 12 PAGE 1560 CATEGORY 28 RPT#:  
TID-27747 77/06/00 72 PAGES UNCLASSIFIED DOCUMENT

UTTL: Evaluation of the use of hydrogen as a supplement to natural gas

CORP: Ad Hoc Committee on the Use of Hydrogen as a Supplement to Natural Gas. AVAIL.NTIS SAP: HC A04/MF A01

Prepared for DOE

MAJS: /\*ENERGY POLICY/\*FEASIBILITY ANALYSIS/\*GAS MIXTURES/\*

HYDROGEN FUELS/\*NATURAL GAS

MINS: / COST EFFECTIVENESS/ ELECTROLYSIS/ ENERGY TECHNOLOGY

ABA: ERA

ABS: The potential for mid-term (1985-2000) commercial application of the use of hydrogen for blending into the present natural gas delivery system as an energy supplement was studied. Successful development of advanced electrolyzer technology and availability of low-cost off-peak and spinning reserve electric-generating capacity are basic to this concept. Because no source was found that would make such a concept economically viable in the near future, a major, federally funded R, D, and D program aimed at proving the technical feasibility is not justified within the next five years. No overriding environmental, safety, legal, code, or regulatory considerations were found that would preclude the hydrogen-natural gas supplementation concept. Fostering of long-term research activities for hydrogen production using gas electrolysis is recommended in connection with other prospective end uses.

78N28573\*# ISSUE 19 PAGE 2551 CATEGORY 43  
RPT#: E78-10168 NASA-CR-157286 77/00/00 19 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: LANDSAT satellite mapping in Egypt and its possible applications in petroleum and natural gas exploration

AUTH: A/ELSHAZLY, E. M.; B/ABDEL-HADY, M. A. PAT: B/Principal Investigators

CORP: Academy of Scientific Research and Technology, Cairo (Egypt). AVAIL.NTIS SAP: HC A02/MF A01  
Sponsored by NASA Presented at 10th Arab Petroleum

Congr., Tripoli, 19-25 Dec. 1977 ERTS

MAJS: /\*DELTAS/\*DEPRESSION/\*DESERTS/\*DRAINAGE/\*EGYPT/\*NATURAL GAS/\*OIL EXPLORATION/\*STRUCTURAL PROPERTIES (GEOLOGY)

MINS: / DATA COLLECTION PLATFORMS/ EARTH RESOURCES PROGRAM/ MAPPING/ MULTISPECTRAL BAND SCANNERS

ABS: There are no author-identified significant results in this report.

78A18828# ISSUE 6 PAGE 1006 CATEGORY 44  
77/00/00 21 PAGES In GERMAN UNCLASSIFIED DOCUMENT  
UTTL: Methods for the production of hydrogen from natural  
gas and petroleum fractions  
AUTH: A/JUNTGEN, H. PAA: A/(Bergbau-Forschung GmbH, Essen,  
West Germany)  
In: International Workshop on Hydrogen and its  
Perspectives, Liege, Belgium, November 15-18, 1976,  
Proceedings, Volume 1. (A78-18826 06-44) Liege,  
Association des Ingenieurs Electriciens sortis de  
l'Institut Electrotechnique Montefiore, 1977. 21 p.  
In German.  
MAJS: /\*CRUDE OIL/\*ENERGY TECHNOLOGY/\*HYDROGEN PRODUCTION/\*  
NATURAL GAS

MINS: / CATALYSIS/ DESULFURIZING/ DISTILLATION/  
HYDROGEN-BASED ENERGY/ METHANE/ NAPHTHALENE/ OXIDATION  
ABA: J.M.B.  
ABS: Partial oxidation of heavy petroleum distillates and  
catalytic cracking of methane and light hydrocarbons,  
two techniques of obtaining hydrogen for industrial  
processes, are contrasted in terms of economics and  
technological difficulties. Problems such as  
desulfurization, the high cost of the partial  
oxidation installations, as well as the formation of  
soot in both the catalytic cracking and the partial  
oxidation processes, are considered. The relative  
costs of methane and naphtha cracking with conventional  
techniques and with high-temperature nuclear reactor  
techniques are also assessed.

77N28610# ISSUE 19 PAGE 2554 CATEGORY 44 RPT#:  
PB-265267/5 LSU-T-76-006 NOAA-77021602 76/06/00 160  
PAGES UNCLASSIFIED DOCUMENT  
UTTL: Oil and gas use characterization, impacts, and  
guidelines  
AUTH: A/CONNER, W. H.; B/STONE, J. H.; C/BAHR, L. M.;  
D/BENNETT, V. R.; E/DAY, J. W., JR.; F/TURNER, R. E.  
CORP: Louisiana State Univ., Baton Rouge. CSS: (Center for  
Wetlands Resources.) AVAIL.NTIS SAP: HC AOB/MF  
A01  
Sponsored in part by Louisiana State Planning Office,  
Eaton Rouge, Coastal Resources Program; Louisiana  
Wildlife and Fisheries Commission, Baton Rouge; and  
Louisiana Coastal Commission, Baton Rouge  
MAJS: /\*CRUDE OIL/\*ENERGY POLICY/\*NATURAL GAS/\*SOCIAL  
FACTORS  
MINS: / COASTS/ CONTINENTAL SHELVES/ ENVIRONMENT PROTECTION/  
STANDARDS  
ABA: GRA  
ABS: A nontechnical survey of oil and gas activities and  
their impacts on wetland, and a discussion of  
preliminary guidelines for optimizing production and  
minimizing impact are presented.

78N29597# ISSUE 20 PAGE 2691 CATEGORY 44 RPT#:  
NVO/0655-100 77/09/01 100 PAGES UNCLASSIFIED  
DOCUMENT  
UTTL: Western gas sands project TLSP: Status Report  
CORP: CER Geonuclear Corp., Las Vegas, Nev. AVAIL.NTIS  
SAP: HC A05/MF A01  
MAJS: /\*ENERGY TECHNOLOGY/\*MINERAL DEPOSITS/\*NATURAL GAS/\*  
OIL EXPLORATION/\*RIVER BASINS/\*SANDS  
MINS: / COMPUTER TECHNIQUES/ DATA BASES/ FRACTURE MECHANICS/  
SPACEBORNE PHOTOGRAPHY  
ABA: ERA  
ABS: Resource assessment activities consist of those  
conducted by U.S.G.S. in Denver and the outcrop study  
of the eastern Uinta Basin. Some base maps are  
complete and field investigations in the principal  
areas of interest are being conducted. Laboratory R  
and D activities funded by ERDA have been directed  
toward new tools and instrumentation systems, rock  
mechanics experiments, mathematical modeling and data  
analysis. Many items are arbitrarily reported in this  
category and in the section devoted to the  
laboratories and Energy Research Centers even though  
they require considerable field experimentation. The  
positive results of system development and data  
analysis techniques in determining fracture  
orientation have been very encouraging. The Uinta BSIN  
in Utah and Piceance Basin in Colorado have had seven  
massive hydraulic fracture (MHF) experiments in the  
Upper Cretaceous tight gas formations.

77N27521# ISSUE 18 PAGE 2404 CATEGORY 44 RPT#:  
BNL-50556 CNT#: E(30-1)-16 76/04/00 103 PAGES  
UNCLASSIFIED DOCUMENT  
UTTL: Supply of liquefied natural gas to the Northeast  
AUTH: A/BRAY, G. R.; B/JULIN, S. K.; C/SIMMONS, J. A.  
CORP: Science Applications, Inc., McLean, Va. AVAIL.NTIS  
SAP: HC A06/MF A01  
MAJS: /\*ENVIRONMENTAL QUALITY/\*LIQUEFIED NATURAL GAS/\*UNITED  
STATES OF AMERICA  
MINS: / REGIONAL PLANNING/ RELIABILITY/ RESOURCES/ SITES  
ABA: ERA  
ABS: The following aspects of the supply of liquefied  
natural gas to the northeastern part of the U.S. are  
discussed: major facilities and equipment,  
institutional considerations and environmental  
impacts, site selection criteria, time required to  
implement an LNG (liquefied natural gas) project,  
projected availability and reliability of supply,  
projection of future imports to the northeast region,  
cost projections, and secondary benefits.

79A18840# ISSUE 6 PAGE 1007 CATEGORY 44  
77/00/00 19 PAGES In FRENCH UNCLASSIFIED DOCUMENT

UTTL: The manufacture of synthetic natural gas by  
hydrogenation of fossil fuel residuals

AUTH: A/RIBESSE, J.

In: International Workshop on Hydrogen and its  
Perspectives, Liege, Belgium, November 15-18, 1976.  
Proceedings, Volume 1. (A78-18826 06-44) Liege,  
Association des Ingenieurs Electriciens sortis de  
l'Institut Electrotechnique Montefiore, 1977. 19 p.  
In French.

MAJS: /\*COAL GASIFICATION/\*ENERGY TECHNOLOGY/\*HYDROGENATION  
/\*NATURAL GAS/\*SYNTHANE

MINS: / Fossil Fuels/ PRODUCTION ENGINEERING

ABA: J.M.B.

ABS: The hydrogenation of fossil fuel residuals is  
discussed, with emphasis on the high-pressure, in situ  
gasification of coal. High-pressure gasification has  
the advantages of accelerating reaction times and  
rendering even very deep deposits accessible to  
exploitation. Composition of the gaseous product and  
required energy consumption are compared for  
gasification processes which employ air and water,  
oxygen and water, or hydrogen as the gasifying agent.  
Attention is also given to surface installations for  
desulfurizing and further refining.

77N29320# ISSUE 20 PAGE 2654 CATEGORY 28 RPT#:  
TT-7605 76/07/00 37 PAGES UNCLASSIFIED DOCUMENT  
DCAF E004832

UTTL: Assessment of the role of the liquefied petroleum gas  
(LPG) engine in stage carriage service vehicles

AUTH: A/LUCAS, G. G.

CORP: Loughborough Univ. of Technology (England). CSS: (   
Dept. of Transport Technology.) AVAIL:NTIS SAP:   
HC A03/MF A01

MAJS: /\*ENGINE DESIGN/\*LIQUEFIED NATURAL GAS

MINS: / ECONOMIC FACTORS/ ENVIRONMENT EFFECTS/ INTERNAL  
COMBUSTION ENGINES/ MOTOR VEHICLES/ SPARK IGNITION

ABA: Author (ESA)

ABS: An assessment has been made into the viability of  
replacing the usual diesel engine in a public service  
vehicle with a spark ignition engine designed to  
operate on liquefied petroleum gas (LPG). The  
advantages of the LPG engine are less smoke, less  
noise, less odor, greater power for acceleration and  
less initial cost. The disadvantages are an increased  
fuel consumption in terms of miles per gallon and  
slightly higher emissions of carbon monoxide and  
unburnt hydrocarbons. The former may be alleviated  
however if the cost of LPG to the consumer is  
proportionately less than that of diesel fuel. In this  
the excise duty and rebate system is very important.  
The availability of LPG is good at present and is  
expected to increase over the next ten years.

77A42166 ISSUE 19 PAGE 3320 CATEGORY 85  
76/00/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Cryogenic fuel systems for motor vehicles

AUTH: A/HIBL, J. J. PAA: A/(Beech Aircraft Corp., Boulder,  
Colo.)

In: Cryogenic Engineering Conference, Kingston,  
Ontario, Canada, July 22-25, 1975, Proceedings.  
(A77-42151 19-33) New York, Plenum Press, 1976. p.  
180-186; Discussion, p. 186.

MAJS: /\*AUTOMOBILES/\*CRYOGENIC FLUIDS/\*FUEL SYSTEMS/\*  
TRANSPORTATION ENERGY

MINS: / FUEL FLOW/ FUEL TANKS/ LIQUEFIED NATURAL GAS/  
PERFORMANCE TESTS/ SYSTEMS ENGINEERING

ABA: G.R.

ABS: The cryogenic fuels considered include liquid  
hydrogen, which is projected to be the fuel of the  
future, and liquid natural gas (LNG) for the near  
term. A design and development program for automotive  
LNG tanks is discussed. In LNG service, the automotive  
cryogenic tank prototype demonstrated a lockup time of  
nearly 14 days in laboratory tests. In conditions of  
actual field use, loss of fluid due to venting rarely  
occurred. On the basis of the program results, it is  
concluded that in areas where LNG is available in  
quantity LNG will continue to be an economical  
alternate fuel for fleet operators. Operation of a  
vehicle which was fueled with liquid hydrogen proved  
that safe and efficient operation is achievable. The  
preliminary system employed did not have the desired  
thermal or mechanical efficiency desired. However, it  
appears that the improvements needed are achievable  
without any major development efforts.

77N20197# ISSUE 11 PAGE 1424 CATEGORY 25 RPT#:  
PB-259351/5 BM-IC-8717 76/09/00 89 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Analysis of natural gases, 1975 TLSP: Information  
Circular 1976

AUTH: A/MOORE, B. J.

CORP: Bureau of Mines, Amarillo, Tex. CSS: (Helium  
Operations.) AVAIL:NTIS SAP: HC A05/MF A01

MAJS: /\*GAS ANALYSIS/\*HELIUM/\*NATURAL GAS

MINS: / INTERNATIONAL COOPERATION/ PIPELINES/ STATISTICAL  
ANALYSIS

ABA: GRA

ABS: Analyses and related source data for 234 natural gas  
samples from wells and pipelines in 21 states and one  
foreign country are presented. These samples were  
collected during 1975 as a part of the Bureau of Mines  
investigations of the occurrences of helium.

78A18827# ISSUE 6 PAGE 1006 CATEGORY 44  
77/00/00 23 PAGES In FRENCH UNCLASSIFIED DOCUMENT

UTTL: Inventory of world energy resources

AUTH: A/VAN RYSSELBERGE, M.

In: International Workshop on Hydrogen and its Perspectives, Liege, Belgium, November 15-18, 1976. Proceedings, Volume 1. (A78-18826 06-44) Liege. Association des Ingenieurs Electriciens sortis de l'Institut Electrotechnique Montefiore, 1977. 23 p. In French.

MAJS: /\*ENERGY SOURCES/\*ENERGY TECHNOLOGY

MINS: / BREEDER REACTORS/ COAL UTILIZATION/ CRUDE OIL/  
GEOTHERMAL RESOURCES/ HYDROGEN-BASED ENERGY/ NATURAL  
GAS/ NUCLEAR FUELS/ SHALE OIL/ SOLAR ENERGY CONVERSION

ABA: J.M.B.

ABS: Worldwide inventories of crude oil, shale oil, natural gas, coal, and nuclear fuels published in the early and mid 1970s are reviewed. These data indicate a rapidly worsening fuel situation for Western Europe and Japan. In addition, alternative energy resources, including liquid hydrocarbons, (produced by the Fischer-Tropsch process), solar energy, hydroelectric power, geothermal energy, fast breeder reactors, and nuclear fusion techniques, are considered. The use of hydrogen as a fuel is also mentioned.

78A17263 ISSUE 5 PAGE 827 CATEGORY 45 77/12/16  
5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Submarine seepage of natural gas in Norton Sound, Alaska

AUTH: A/CLINE, J. D.; B/HOLMES, M. L. PAA: A/(NOAA, Pacific Marine Environmental Laboratory, Seattle, Wash.); B/(U.S. Geological Survey, Seattle, Wash.) Science, vol. 198, Dec. 16, 1977, p. 1149-1153. Research supported by the U.S. Bureau of Land Management.

MAJS: /\*ALASKA/\*ENVIRONMENT MODELS/\*NATURAL GAS/\*OCEAN  
BOTTOM

MINS: / ALKANES/ CONCENTRATION (COMPOSITION)/ CROSSBEDDING  
(GEOLOGY)/ GAS MIXTURES/ HYDROCARBONS/ PETROLOGY/  
PLUMES/ SEDIMENTS

ABA: J.M.B.

ABS: Dissolved two- to four-carbon alkanes detected in the waters of Norton Sound 40 km south of Nome, Alaska are attributed to a hydrocarbon plume. The structural geology of the Norton Basin and dynamic modeling of the initial gas phase composition (probable methane/ethane and ethane/propane ratios of 24 and 1.7 respectively) provide evidence that the seep gas may be of thermochemical origin rather than of recent biogenic origin.

78A11138 ISSUE 1 PAGE 64 CATEGORY 44 CNT#:  
DACA23-74-C-009 77/00/00 15 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: The economics of SNG production by anaerobic digestion of specially grown plant matter --- synthetic natural gas

AUTH: A/FRASER, M. D. PAA: A/(InterTechnology Corp., Warrenton, Va.)

In: Clean fuels from biomass and wastes: Proceedings of the Second Symposium, Orlando, Fla., January 25-28, 1977. (A78-11120 01-44) Chicago, Ill., Institute of Gas Technology, 1977, p. 425-439. Research supported by the American Gas Association;

MAJS: /\*ANAEROBES/\*BIOMASS ENERGY PRODUCTION/\*NATURAL GAS/\*  
ORGANIC WASTES (FUEL CONVERSION)/\*PLANTS (BOTANY)/\*  
SYNTHETIC FUELS

MINS: / CLEAN ENERGY/ COST ANALYSIS/ ECONOMIC FACTORS/  
ENERGY TECHNOLOGY/ PRETREATMENT/ WOOD

ABA: V.P.

ABS: The paper deals with the economics of a method of producing fuels by collecting and storing solar radiation in plants grown purposely for their fuel value. The plant material can be used as a solid fuel, or it can be converted into synthetic natural gas (SNG) by anaerobic digestion (which produces a mixture of methane and carbon dioxide, and biological cell matter). It is pointed out that about 175 million acres of waste land appear to be available in the United States for producing plant matter. Using the SNG production method proposed in the present paper, the yield from this area would amount to more than half of the total annual consumption of natural gas in this country. The necessary capital investment and the potential cost of the gas produced are seen to be competitive, and even better than, the cost associated with coal gasification.

77N23617# ISSUE 14 PAGE 1877 CATEGORY 44 RPT#:  
PB-263505/0 76/07/30 250 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: The phasing out of natural gas and oil for electric power generation, southwest power pool and Electric Reliability Council of Texas. Part 2: Technical and economic evaluation of various possible electric utility natural gas reduction programs, 1975 - 1990

CORP: Federal Power Commission, Washington, D. C. CSS: (Bureau of Power.) AVAILNTIS SAP: HC A11/WF A01

MAJS: /\*CRUDE OIL/\*ELECTRIC POWER/\*NATURAL GAS/\*TEXAS  
MINS: / ECONOMIC ANALYSIS/ ELECTRIC GENERATORS/ FOSSIL FUELS  
/ TECHNOLOGY ASSESSMENT/ UNITED STATES OF AMERICA

ABA: GRA

ABS: The technical and economic feasibility of programs for accelerating the phasing out of natural gas consumption by electric utilities in the southwest U.S. between 1975 and 1990 is evaluated.

77A40682 ISSUE 19 PAGE 3269 CATEGORY 48  
 77/06/00 6 PAGES In GERMAN UNCLASSIFIED DOCUMENT

UTTL: Hydrocarbon deposits beyond the shelf edge of the oceans

AUTH: A/SCHOTT, W. PAA: A/(Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hanover, West Germany)

MAJS: /\*CRUDE OIL/\*HYDROCARBON FUELS/\*NATURAL GAS/\*OFFSHORE ENERGY SOURCES/\*OIL EXPLORATION

MINS: / ATLANTIC OCEAN/ CONTINENTAL SHELVES/ INDIAN OCEAN/ OCEAN BOTTOM/ OCEANOGRAPHIC PARAMETERS

ABA: G.R.

ABS: An investigation is conducted concerning the prospects for an occurrence of petroleum and natural gas deposits on the ocean floor beyond the continental

shelf in the deep ocean regions, taking into account the geological characteristics of the ocean floor related to sediment formation. It is found that the geological structure of the continental margins is frequently affected by the geological conditions on the adjacent mainland. The presence of hydrocarbon deposits on the ocean floor beyond the edge of the 'Atlantic' continental shelves is, therefore, to be expected. Possibilities regarding an economic exploitation of the existing resources will depend on the magnitude of these resources and technological factors related to the development of suitable equipment. With respect to the 'Pacific' Ocean regions, the currently available information is not yet sufficient for predictions concerning the occurrence of hydrocarbon deposits in the involved areas.

77A45325 ISSUE 21 PAGE 3598 CATEGORY 37  
 77/08/00 4 PAGES UNCLASSIFIED DOCUMENT

UTTL: Testing the annular combustor of the NK-8 aero-engine on natural gas --- for stationary gas turbine installation

AUTH: A/TUMANOVSKI, A. G.; B/KOVALEV, V. N.; C/SKURIDIN, V. G.; D/MINGALEEV, F. M. (Teploenergetika, Aug. 1976, p. 60-64.) Thermal Engineering, vol. 23, Aug. 1977, p. 47-50. Translation.

MAJS: /\*AIRCRAFT ENGINES/\*COMBUSTION CHAMBERS/\*ENGINE TESTS /\*GAS TURBINES/\*NATURAL GAS/\*TURBOFAN ENGINES

MINS: / BURNERS/ COMBUSTION STABILITY/ ENERGY TECHNOLOGY/ PRESSURE GRADIENTS/ TECHNOLOGY TRANSFER/ TEMPERATURE DISTRIBUTION

ABS: (For abstract see Issue 24, p. 3822. Accession no. A76-47281)

77A39669 ISSUE 18 PAGE 3066 CATEGORY 44  
 77/06/00 6 PAGES In GERMAN UNCLASSIFIED DOCUMENT

UTTL: Wolfersberg - A subterranean storage place for natural gas at a depth of 3000 m

AUTH: A/STACHEL, A. Energiewirtschaftliche Tagesfragen, vol. 27, June 1977, p. 416-421. In German.

MAJS: /\*ENERGY STORAGE/\*NATURAL GAS/\*UNDERGROUND STORAGE

MINS: / ECONOMIC FACTORS/ ENERGY TECHNOLOGY/ FEASIBILITY ANALYSIS/ GERMANY/ PIPELINES

ABA: G.R.

ABS: The supply of Bavaria, a state of the Federal Republic of Germany, with natural gas requires transportation of the gas over large distances. A pipeline with a capacity which is large enough to transmit gas at peak consumption rates is only partly utilized at times when the gas requirements are lower so it is found to be more economical to employ a pipeline whose capacity corresponds to average consumption rates and to supply additional amounts of gas, when needed, from gas storage facilities. An investigation is conducted regarding the feasibility to use a location of natural gas deposits which are now exhausted as a place for the temporary storage of the gas obtained from the pipeline at times of low gas consumption and a suitable location is found to be at Wolfersberg at a distance of about 20 km from Munich.

77A39670 ISSUE 18 PAGE 3067 CATEGORY 44  
 77/06/00 3 PAGES In GERMAN UNCLASSIFIED DOCUMENT

UTTL: Natural gas storage in salt caverns

AUTH: A/HARMS, W. Energiewirtschaftliche Tagesfragen, vol. 27, June 1977, p. 422-424. In German.

MAJS: /\*ENERGY STORAGE/\*NATURAL GAS/\*UNDERGROUND STORAGE

MINS: / CAVES/ ENERGY REQUIREMENTS/ ENERGY TECHNOLOGY/ FEASIBILITY ANALYSIS/ GERMANY

ABA: G.R.

ABS: Large differences in natural gas consumption for winter and summer together with irregularities concerning the supply with natural gas make it very important to establish gas reservoirs. It is found that an underground storage of the gas has great economic advantages compared to other types of storage and the feasibility to use in the northern part of Germany salt caverns for the storage of natural gas is investigated. Attention is given to questions regarding the preparation of the caverns, and problems with respect to the operation of natural gas storage facilities in caverns.

77A36327 ISSUE 16 PAGE 2778 CATEGORY B3  
77/00/00 12 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Economics of crude oil and natural gas - Cost of  
adding production  
AUTH: A/SPARLING, R. C. PAA: A/(Chase Manhattan Bank,  
North America, New York, N.Y.)  
In: Synthetic fuels processing: Comparative economics;  
Proceedings of the Symposium, New York, N.Y., April  
4-9, 1976. (A77-36326 16-44) New York, Marcel Dekker,  
Inc., 1977, p. 1-12.  
MAJS: /\*CRUDE OIL/\*DOMESTIC ENERGY/\*DRILLING/\*ECONOMIC  
ANALYSIS/\*ENERGY SOURCES/\*NATURAL GAS  
MINS: / COST ANALYSIS/ COST EFFECTIVENESS/ ENERGY POLICY/  
PRODUCTION ENGINEERING/ TECHNOLOGICAL FORECASTING/  
UNITED STATES OF AMERICA

ABA: G.R.  
ABS: U.S. petroleum industry finding and development  
expenditures are examined along with the drilling  
effort reported for the time from 1952 to 1974. It is  
found that in the last two years, almost as much  
footage was drilled for gas as was drilled for oil.  
Attention is given to crude oil production and  
reserves, nonassociated natural gas production and  
reserves, and figures concerning the capital  
expenditures for oil business and gas business. It is  
pointed out that the petroleum industry supplies about  
75% of all the energy in the U.S. and that it will  
continue to be the principal supplier in the  
foreseeable future. The petroleum and the coal  
industries are the only ones with any chance to expand  
rapidly enough to meet the short term needs of this

nation.

77N15208\* ISSUE 6 PAGE 732 CATEGORY 28 RPT#:  
NASA-TM-X-73408 E-8715 76/04/00 654 PAGES  
UNCLASSIFIED DOCUMENT  
UTTL: Bibliography on Liquefied Natural Gas (LNG) safety  
AUTH: A/ORDIN, P. M.  
CORP: National Aeronautics and Space Administration, Lewis  
Research Center, Cleveland, Ohio. AVAIL.NTIS SAP:  
HC A99  
MAJS: /\*BIBLIOGRAPHIES/\*LIQUEFIED NATURAL GAS/\*METHANE/\*  
SAFETY MANAGEMENT  
MINS: / COMPRESSED GAS/ CRYOGENICS/ FIRE PREVENTION/ FUEL  
COMBUSTION/ MATERIALS HANDLING  
ABA: Author  
ABS: Approximately 600 citations concerning safety of  
liquefied natural gas and liquid methane are  
presented. Each entry includes the title, author,  
abstract, source, description of figures, key  
references, and major descriptors for retrieving the  
document. An author index is provided as well as an  
index of descriptors.

77A38786 ISSUE 17 PAGE 2905 CATEGORY 39  
77/06/00 16 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Approaches to extracting potentially recoverable  
hydrocarbons --- nuclear explosive mining of natural  
gas and crude oil  
AUTH: A/STOSUR, J. J. PAA: A/(ERDA, Office of Oil and Gas,  
Washington, D.C.)  
International Journal of Energy Research, vol. 1,  
Apr.-June 1977, p. 99-114.  
MAJS: /\*ENERGY TECHNOLOGY/\*NATURAL GAS/\*NUCLEAR DEVICES/\*OIL  
FIELDS  
MINS: / MINERAL DEPOSITS/ NUCLEAR EXPLOSION EFFECT/  
PERFORMANCE PREDICTION  
ABA: (Author)  
ABS: The current status of nuclear-explosive fracturing to  
improve gas production from tight formations and in  
situ combustion to enhance oil recovery from existing  
reservoirs are assessed. The current status of  
projects Gasbuggy, Rulison and Rio Blanco are  
presented, and it is pointed out that production  
predictions were considerably overestimated. Several  
hypotheses to account for this are presented, but the  
most important seems to be overestimated formation  
permeability. The limitations of the current  
technology are discussed, and the greatest obstacle to  
progress is recognised as public nonacceptability of  
the technique. The basic processes of in situ  
combustion for enhanced oil recovery are presented  
together with a comparison of the recovery efficiency  
with those of other processes. It is shown that the  
method offers the highest percentage of oil recovery  
in heavy oil prospects of any thermal recovery methods  
proposed so far. However, the method is expensive and  
highly complex, but it is likely that it is the most  
widely applicable and that important improvements will  
be made in the next decade.

78N25515# ISSUE 16 PAGE 2133 CATEGORY 43 RPT#:  
TID-28043/2 CNT#: FEA-CR-05-60813-00 77/08/05 294  
PAGES UNCLASSIFIED DOCUMENT  
UTTL: Oil and gas replacement cost: Development and  
production. Volume 2: Exhibits TLSP: Final Report  
CORP: Gruy Federal, Inc., Arlington, Va. AVAIL.NTIS  
SAP: HC A13/MF A01  
MAJS: /\*COST ANALYSIS/\*ENERGY POLICY/\*PRODUCTION PLANNING/\*  
REPLACING/\*VALUE ENGINEERING  
MINS: / CRUDE OIL/ NATURAL GAS/ TABLES (DATA)/ UNITED STATES  
OF AMERICA  
ABA: ERA  
ABS: Data tables are presented relative to the replacement  
cost of petroleum and natural gas in the USA for the  
benchmark years 1980, 1985, and 1990.

ORIGINAL PAGE IS  
OF POOR QUALITY

77N31628# ISSUE 22 PAGE 2963 CATEGORY 44 RPT#:  
UCRL-52180 CNT#: W-7405-ENG-48 76/12/24 239 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Oil, gas, uranium, and thorium: Supply and depletion,  
with special reference to California  
AUTH: A/BORG, I. Y.; B/STONE, R.; C/PUCHLIK, K. P.  
CORP: California Univ., Livermore, Lawrence Livermore Lab.  
CSS: (Energy and Planning Resource Group.)  
AVAIL.NTIS SAP: HC A11/MF A01  
Sponsored in part by State Energy Resources and  
Develop. Comm.  
MAJS: /\*CRUDE OIL/\*ENERGY POLICY/\*INDUSTRIAL ENERGY/\*NATURAL  
GAS/\*THORIUM/\*URANIUM  
MINS: / CALIFORNIA/ CONSUMPTION/ DEMAND (ECONOMICS)/ FOREIGN  
TRADE/ SUPPLYING  
ABA: ERA  
ABS: The assessment of global resources of gas, oil,  
uranium, and thorium with emphasis on California is  
presented. The forecasting of depletion is presented  
for the resources from the historical production data,  
the estimate of future production, and the size of the  
total resource available. Detailed data are provided  
under the following chapters: methodology; oil  
supplies; oil depletion forecasts; natural gas

supplies; natural gas depletion forecast; uranium  
supplies; uranium depletion; thorium supply and  
depletion; and finally, a chapter on new work, new  
appraisals of reserves and undiscovered resources, and  
new studies on pipeline routes that promise to affect  
national and state planning.

78N23588# ISSUE 14 PAGE 1870 CATEGORY 44 RPT#:  
FEA/G-77/357-VOL-2 CNT#: FEA-CR-05-60731-00  
77/07/00 322 PAGES UNCLASSIFIED DOCUMENT

UTTL: US oil and natural gas finding costs. Volume 2:  
Statistical appendix  
CORP: Chase Manhattan Bank, New York. CSS: (Energy  
Consulting Div.) AVAIL.NTIS SAP: HC A14/MF A01  
Sponsored in part by DOE  
MAJS: /\*COSTS/\*NATURAL GAS/\*OFFSHORE ENERGY SOURCES/\*OIL  
EXPLORATION  
MINS: / ALASKA/ CRUDE OIL/ ENERGY POLICY/ ENERGY TECHNOLOGY

ABA: ERA  
ABS: Costs were established for U.S. oil and gas  
exploration efforts historically, and the level of  
such costs in 1980, 1985, and 1990 were projected.  
Data were developed for 17 onshore and 2 offshore  
regions in the Continental U.S. where the petroleum  
industry had traditionally focused its operations.  
Onshore and offshore sectors of Alaska as well as the  
offshore Atlantic Coast region that are the focal  
points of exploratory activity, were also examined.  
The research results are presented in terms of total  
dollar costs per foot drilled for oil and gas wells.

77A36336 ISSUE 16 PAGE 2779 CATEGORY 83  
77/00/00 36 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fuel gas production via Koppers-Totzek gasification -  
An economic analysis  
AUTH: A/MICHAELS, H. J.; B/KAMODY, J. F. PAA: B/(Koppers  
Co., Inc., Pittsburgh, Pa.)  
In: Synthetic fuels processing: Comparative economics:  
Proceedings of the Symposium, New York, N.Y., April  
4-9, 1976. (A77-36326 16-44) New York, Marcel Dekker,  
Inc., 1977. p. 215-250.  
MAJS: /\*COAL GASIFICATION/\*COST EFFECTIVENESS/\*ECONOMIC  
ANALYSIS/\*GAS GENERATORS/\*NATURAL GAS  
MINS: / CHEMICAL REACTORS/ CLEAN ENERGY/ COST ESTIMATES/

DOMESTIC ENERGY/ ENERGY SOURCES/ ENERGY TECHNOLOGY/  
INDUSTRIAL ENERGY

ABA: G.R.  
ABS: The Koppers-Totzek (K-T) process has been used for the  
commercial gasification of coal in the Eastern  
Hemisphere since 1952. The gas produced by the K-T  
process is rich in CO and hydrogen. The gas has a  
gross heating value of 300 Btu per cubic foot and is  
suited for industrial fuel, direct ore reduction, or  
chemical synthesis applications. The national  
importance of coal gasification is examined and the  
capital requirements for a K-T fuel gas plant are  
considered. Attention is given to the effect of  
financial and operating variables on cost, the effects  
of price inflation and escalation on fuel costs, and  
the incentives needed to implement coal gasification.  
It is found that, as a result of current price trends  
concerning natural gas, the cost of energy from  
existing K-T gasification facilities will within a  
relatively short period of time be less than that of  
alternate sources.

77A33174# ISSUE 14 PAGE 2380 CATEGORY 45

77/02/00 6 PAGES In RUSSIAN UNCLASSIFIED DOCUMENT  
UTTL: Formation of sulfuric anhydride and nitrogen oxides in  
boilers at variable operating modes  
AUTH: A/STRIKHA, I. I.; B/KHOMICH, A. S. PAA:  
B/(Gosudarstvennyi Nauchno-Issledovatel'skii  
Energeticheskii Institut, Belorussian SSR)  
Energetika, vol. 20, Feb. 1977, p. 79-84. In Russian.  
MAJS: /\*ANHYDRIDES/\*BOILERS/\*COMBUSTION PRODUCTS/\*  
ENVIRONMENT POLLUTION/\*NITROGEN OXIDES/\*SULFUR OXIDES  
MINS: / AIR POLLUTION/ CHEMICAL REACTIONS/ FUEL COMBUSTION/  
FUEL OILS/ NATURAL GAS/ SMOKE

ABA: A.Y.  
ABS: The formation of SO3 and nitrogen oxides in three  
steam generators (TP230, TP80, and TP87) during  
combustion of sulfur-containing black oil is  
investigated. The results show that the emission of  
toxic nitrogen oxides can be reduced by controlling  
such operational parameters as the load, the excess  
air, and secondary-air turbulence.

77A47848 ISSUE 22 PAGE 3814 CATEGORY 44  
77/09/00 13 PAGES In FRENCH UNCLASSIFIED DOCUMENT

UTTL: The future of hydrogen as an energy source ---  
nuclear-powered water electrolysis  
AUTH: A/HAGENMULLER, P. PAA: A/(Bordeaux I, Université  
CNRS, Laboratoire de Chimie du Solide, Talence,  
Gironde, France)  
La Recherche, vol. 8, Sept. 1977, p. 756-768. In  
French.  
MAJS: /\*ELECTROLYSIS/\*ENERGY TECHNOLOGY/\*HYDROGEN PRODUCTION  
/\*HYDROGEN-BASED ENERGY  
MINS: / CARBON DIOXIDE/ ENERGY STORAGE/ HALIDES/ METAL  
OXIDES/ NATURAL GAS/ OXIDATION/ THERMOCHEMISTRY/  
TRANSITION METALS  
ABA: M.L.  
ABS: Procedures for using hydrogen as an energy source are  
discussed with attention to economic costs. A general  
scheme for obtaining hydrogen from the nuclear-powered  
electrolysis of water is presented, and the advantages  
and disadvantages of electrolytic and thermochemical  
procedures are examined. Among the thermal cycles  
considered are the oxidation of steam by chlorine, the  
oxidation of CO by steam, processes using transition  
element oxides, the hydrolysis of halides, and hybrid  
cycles. The characteristics of hydrogen and hydrides  
are compared. Techniques for shipping and storing  
hydrogen are described, and problems of energy  
transmission are considered.

78N25514# ISSUE 16 PAGE 2133 CATEGORY 43 RPT#:  
TID-28043/1 CNT#: FEA-CR-05-60813-00 77/08/05 101  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Oil and gas replacement cost: Development and  
production. Volume 1: Discussion of methodology,  
exhibits, and projections TLSP: Final Report  
CORP: Gruy Federal, Inc., Arlington, Va. AVAIL.NTIS  
SAP: HC A06/MF A01  
MAJS: /\*COST ANALYSIS/\*CRUDE OIL/\*ENERGY POLICY/\*NATURAL GAS  
MINS: / OIL EXPLORATION/ STATISTICAL ANALYSIS/ WELLS  
ABA: ERA  
AES: The development and production costs by region and  
well depth interval were projected for the benchmark  
years 1980, 1985, and 1990. The identification and  
collection of reliable and consistent historical  
series disaggregate to these levels are considered  
essential to the generation of accurate and viable  
forecasts of replacement costs for oil and gas  
production systems. Twenty-four geographical regions  
were specified and six depth classes. A clear  
delineation is drawn between the cost of drilling and  
completing development wells and the cost of operating  
producing wells. Development well costs are projected  
on a cost per foot basis. Operating costs of producing  
wells are projected on a cost per month basis.

77A32249 ISSUE 14 PAGE 2369 CATEGORY 44  
77/03/00 5 PAGES In GERMAN UNCLASSIFIED DOCUMENT

UTTL: Synthesis of substitute natural gas on the basis of  
coal  
AUTH: A/HAMMER, H. PAA: A/(Rheinisch-Westfaelische  
Technische Hochschule, Aachen, West Germany)  
Erdol und Kohle Erdgas Petrochemie Vereinigt mit  
Brennstoff-Chemie, vol. 30, Mar. 1977, p. 132-136. In  
German.  
MAJS: /\*COAL GASIFICATION/\*ENERGY TECHNOLOGY/\*HYDROCARBON  
FUEL PRODUCTION/\*NATURAL GAS/\*SYNTHANE/\*SYNTHETIC  
FUELS  
MINS: / CARBON MONOXIDE/ CATALYSIS/ CHEMICAL REACTIONS/ COAL  
UTILIZATION/ COST EFFECTIVENESS/ ENERGY CONVERSION/  
HYDROGENATION/ KINETIC ENERGY/ THERMODYNAMIC  
EQUILIBRIUM  
ABA: (Author)  
ABS: The present state of development of processes for  
producing substitute natural gas (SNG) based on coal  
or lignite is discussed. The historical and  
theoretical (thermodynamics, kinetics and reaction  
mechanism) background of the direct hydrogenating  
gasification of coal as well as that of heterogeneous  
catalytic methanation of carbon monoxide is reviewed.  
Processes currently being developed specially in the  
U.S., UK and West Germany are examined. Since the high  
production costs for SNG presently amounts to about 2  
to 3 times the price for natural gas, one hesitates to  
take up the production of SNG in spite of the shortage  
of natural gas in the United States.

78N13559# ISSUE 4 PAGE 499 CATEGORY 44 RPT#:  
PB-270385/B FEA/N-76/414-VOL-4 CNT#:  
FEA-CO-05-50301-00 76/09/00 53 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Project Independence Evaluation System (PIES)  
documentation. Volume 4: FEA model of oil and gas  
supply: Data validation and update  
CORP: ICF, Inc., Washington, D. C. AVAIL.NTIS SAP: HC  
A04/MF A01  
MAJS: /\*CRUDE OIL/\*ENERGY CONSUMPTION/\*MATHEMATICAL MODELS/\*  
NATURAL GAS  
MINS: / ECONOMICS/ EXPLORATION/ OIL RECOVERY/ PRODUCTION  
ENGINEERING/ RESERVES  
ABA: GRA  
ABS: A detailed and comprehensive discussion of the oil and  
gas supply model is presented which is used to  
construct the oil and gas supply curves. It provides  
an overview description of the model and the modeling  
methodology as well as details on the data input  
requirements.

77A31576 ISSUE 13 PAGE 2209 CATEGORY 44  
77/04/00 4 PAGES In GERMAN UNCLASSIFIED DOCUMENT

UTTL: Gas economy - Gas technology --- energy supply and utilization  
AUTH: A/SCHOLAND, E. PAA: A/(Ruhr-Universitaet, Bochum, West Germany)  
Brennstoff-Waerme-Kraft, vol. 29, Apr. 1977, p. 128-131. In German.  
MAJS: /\*COAL GASIFICATION/\*ECONOMIC ANALYSIS/\*ENERGY POLICY  
/\*ENERGY SOURCES/\*ENERGY TECHNOLOGY/\*NATURAL GAS  
MINS: / COAL UTILIZATION/ DOMESTIC ENERGY/ ELECTRIC POWER  
SUPPLIES/ ENERGY DISTRIBUTION/ GAS TRANSPORT/ GERMANY/  
INDUSTRIAL ENERGY  
ABA: G.R.  
ABS: Economic developments concerning the use of natural gas in West Germany are considered along with questions related to the available natural gas reserves, technological aspects concerning the distribution and transportation of natural gas with the aid of pipelines and ships designed for such applications, and the importation of gas from the Netherlands, Norway, Iran, the Soviet Union, and China. The use of natural gas in the German industry is discussed, taking into account a utilization in the iron and steel industry and a use for the generation of electric power. Attention is also given to a use of gas in private households, questions of safety and environmental protection, and the possibility to replace natural gas with gas obtained by the gasification of coal.

Energy, v.2, 1977, p.375-89.

## THE POTENTIAL RISKS OF LIQUEFIED NATURAL GAS

ANDREW J. VAN HORN and RICHARD WILSON

Energy and Environmental Policy Center, Harvard University, Cambridge, MA 02138, U.S.A.

(Received 10 December 1976)

Abstract—Imported liquefied natural gas can provide needed supplements to diminishing domestic gas supplies as well as being a convenient means for the storage and transportation of natural gas. LNG vessels and facilities are, however, costly and present the risk of potentially large accidents. We describe these risks and the impacts of LNG operations, summarize the safety issues, and make several policy recommendations for the responsible use of this premium fossil fuel.

77A28760 ISSUE 12 PAGE 2037 CATEGORY 44  
77/02/00 6 PAGES In FRENCH UNCLASSIFIED DOCUMENT

UTTL: Unconventional petroleum and natural gas resources. II - Additional gas resources  
AUTH: A/GRENON, M.  
Revue de l'Energie, vol. 28, Feb. 1977, p. 123-128. In French.  
MAJS: /\*CRUDE OIL/\*EARTH RESOURCES/\*ENERGY SOURCES/\*NATURAL GAS  
MINS: / ENERGY POLICY/ ENERGY TECHNOLOGY/ INTERNATIONAL TRADE/ OIL EXPLORATION/ PERMEABILITY/ PHYSICAL PROPERTIES/ SHALE OIL/ SOLUBILITY/ TAR SANDS/ TEMPERATURE EFFECTS  
ABA: R.D.V.  
ABS: Hitherto untapped and/or uneconomical reserves of petroleum and natural gas are surveyed, with geographical location, the status of work on exploitation of these resources, and effects of world energy costs considered. Conventional reserves and resources are indicated for comparison, and tabulated by area. Exploitation of organic shale, some heavy oils and tars, and natural gas locked in low-permeability sandstones is at pilot stage or better, and pilot plant exploitation of asphaltic sands, bituminous shale, and fire-damp (coal mine) methane is indicated. Less accessible reserves of methane in geopressurized zones and formations, in swamp gas, or in hydrate form are discussed.

77A27607 ISSUE 11 PAGE 1861 CATEGORY 44  
77/04/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: The importation of liquefied natural gas  
AUTH: A/DRAKE, E.; B/REID, R. C. PAA: A/(Arthur D. Little, Inc., Cambridge, Mass.); B/(MIT, Cambridge, Mass.)  
Scientific American, vol. 236, Apr. 1977, p. 22-29.  
MAJS: /\*FUEL TANKS/\*LIQUEFIED NATURAL GAS/\*SAFETY FACTORS/\* STRUCTURAL DESIGN/\*TANKER SHIPS  
MINS: / CONSTRUCTION MATERIALS/ DESIGN ANALYSIS/ EXPLOSIONS/ FIRE PREVENTION/ LIQUID-GAS MIXTURES/ MASS TRANSFER/ SHIP HULLS/ STORAGE TANKS/ TRANSPORT VEHICLES  
ABA: R.D.V.  
ABS: The safety of tankers and storage tanks for liquefied natural gas (LNG), and fire/explosion hazards, accompanying storage, transfer, and use of LNG, are discussed. Materials for ship and shore tankage, safety measures, and various LNG hazards ('rollover' mixing of tank contents, flameless vapor explosion, methane/water interaction, transport or accidental release of LNG vapor), plus extraneous accidents (sabotage, crashing into tanks, earthquake, fires in vicinity) are discussed. The 1944 Cleveland and 1973 Staten Island (New York) accidents are described. The relevance of available technology for handling rocket fuels is pointed out. Sources of natural gas and large users of LNG are listed.

TJ 163.2 Perspectives on the energy crisis : technical, regulatory, environmental, economic, prospective. / advisory editors, Howard Gordon, Roy Meador. -- Ann Arbor, Mich. : Ann Arbor Science Publishers, c1977.

2 v. : ill. ; 29 cm.

LAKE ERIE NATURAL GAS: ANALYSIS OF SELECTED ISSUES . . . . . 63

(Principal Authors: William Davis, Chief Energy Conservation Planner, and Mark Bagdon, Principal Energy Policy Analyst. Published March 14, 1977, by the New York State Energy Office)

New York state natural gas consumption is 8th in the U.S., yet the state relies overwhelmingly on outside sources. This paper highlights the near critical scarcity of natural gas and the practicality of developing in state sources. Impact of the severe 1977 winter is assessed. Ways to implement development and use of Lake Erie natural gas reserves are explored. This state study concisely presents the natural gas dilemma. By extrapolation it suggests the wide significance of a national problem as a taken-for-granted energy source reaches the point of dangerously short supply.

79N78543# CATEGORY 44 RPT#: PB-292966/9 ENERGY-3/77 77/04/00 53 PAGES UNCLASSIFIED DOCUMENT

UTTL: Historic and projected demand for oil and gas in Alaska: 1972-1995

AUTH: A/OCONNOR, K.

CORP: Alaska State Dept. of Natural Resources, Juneau. CSS: (Div. of Minerals and Energy Management.) AVAIL.NTIS

MAJS: /\*ALASKA/\*CRUDE OIL/\*ENERGY REQUIREMENTS/\*FUEL CONSUMPTION/\*NATURAL GAS

MINS: / DEMAND (ECONOMICS)/ ENERGY CONSUMPTION/ FORECASTING/ HISTORIES/ SUPPLYING

78N74919# CATEGORY 28 RPT#: COO-2991-14 REPT-1594 QPR-3 CNT#: EY-76-C-02-2991 77/03/15 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fuel gas production from animal waste, phase 1 TLSP: Quarterly Progress Report, 1 Dec. 1976 - 1 Mar. 1977

AUTH: A/ASHARE, E.; B/WENTWORTH, R. L.; C/WISE, D. L.; D/AUGENSTEIN, D. C.

CORP: Dynatech R/D Co., Cambridge, Mass. AVAIL.NTIS

MAJS: /\*ANAEROBES/\*BIOMASS ENERGY PRODUCTION/\*ENERGY POLICY /\*NATURAL GAS

MINS: / CARBON DIOXIDE/ ORGANIC WASTES (FUEL CONVERSION)/ WASTE UTILIZATION

TJ 163.9 Energy technology handbook : prepared by 142 specialists / Douglas M. Considine, editor-in-chief. -- New York : McGraw-Hill, c1977. .E54 1874 p. in various pagings : ill. ; 24 cm. Includes index.

GAS TECHNOLOGY\*

Reserves and Demands

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Absorption of Acidic Gases from Natural Gas and SNG	2-133
The Catalytic Rich Gas (CRG) Process for Gasification of Light Hydrocarbons	2-137
Methane-Rich Gas Process for Substitute Natural Gas	2-149
The Fluidized Bed Hydrogenation Process for Substitute Natural Gas Production	2-160
Hydrocracking-Hydrogasification Process for Producing Pipeline Gas from Crude Oil	2-164
Noncatalytic, Partial-Oxidation Gasification Process	2-171

78N71356# CATEGORY 28 RPT#: LA-UR-77-526 CNT#: W-7405-ENG-36 77/00/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Long-term alternatives between production rate and supply of oil and natural gas: Some implications from a simulation study

AUTH: A/MCFARLAND, J. W.; B/SPRINGER, T. E.; C/MONASH, E. A.; D/CUMMINGS, R. G.

CORP: Los Alamos Scientific Lab., N. Mex. AVAIL.NTIS Presented at 2nd Pacific Area Eng. Conf., Denver, 28-31 Aug. 1977

MAJS: /\*CRUDE OIL/\*MATHEMATICAL MODELS/\*NATURAL GAS/\* PRODUCTIVITY/\*REGULATIONS

MINS: / ECONOMIC FACTORS/ OIL FIELDS/ PRODUCTION MANAGEMENT

TJ Ship Technology and Research (STAR)  
 163.2 Symposium, 2d, San Francisco, 1977.  
 .S55 Proceedings ... cl 1977. (Card 2)  
 1977 LNG

A Review of the IMCO Code for Gas Ships .....	385
by J. W. Kimc, R. J. Lakkey and T. R. Dickey	
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by James L. Howard and Rolf Kvamsdal	
The LNG Ship in a Changing Energy Environment.....	419
by William duBarry Thomas	
U.S. Offshore Terminals: If and When.....	435
by Henry S. Marcus and John H. Larson	

### THE LIQUEFACTION OF NATURAL GAS

G. G. Haselden

Contemporary Physics

Vol. 18, no.5 September 1977, p.471-88.

SUMMARY. The history and significance of natural gas liquefaction is traced showing that the main developments have occurred since 1960. The thermodynamics of liquefaction is reviewed paying special attention to the effect of the supply pressure of the gas, and its composition, on the minimum work requirement. It is shown that liquefier design requires highly accurate thermodynamic data for the process mixtures, and this need has occasioned significant advances in equation of state and solution theory.

The main types of liquefier are assessed for the natural gas duty, showing that cascade cycles are generally preferable. The advantages of mixed refrigerant systems are explained.

A description is given of three modern liquefiers: a very large mixed refrigerant plant for base-load liquefaction, a medium-sized turbine expander cycle for reliquefaction of stored LNG, and finally an open-cycle mixed refrigerant unit for peak-shaving duty.

### HOW TO STOP WORRYING ABOUT NATURAL GAS.

E. Faltermayer.

Fortune, Aug.1977, p.156-170.

There is enough of the ultra-clean fuel to last for several decades--and maybe longer.

### INVESTIGATIONS INTO THE SPREADING AND EVAPORATION OF LNG SPILLED ON WATER.

G. Opschoor.

Cryogenics, v.17, no.11, Nov.1977, p.629-632.

*This paper contains the results of a theoretical investigation into the evaporation and spilling of LNG on open water and on a confined water surface. Spreading and evaporation are calculated and compared with experimental results. As little is known about the evaporation of LNG on a confined water surface a model has been derived which describes the evaporation including the formation of an ice layer. It is concluded that results agree well with the available experimental data.*

77N03887# CATEGORY 44 RPT#: NTIS/PS-77/0574/2  
 NTIS/PS-76/0498 77/07/00 169 PAGES UNCLASSIFIED  
 DOCUMENT

Supersedes NTIS/PS-76/0498

UTTL: Natural gas: Supply, demand and utilization. Volume  
 2: 1976 - June 1977 (a bibliography with abstracts)  
 TLSP: Report, 1976 - Jun. 1977

AUTH: A/HUNDEMANN, A. S.

CORP: National Technical Information Service, Springfield,  
 Va. AVAIL:NTIS

MAJS: /\*BIBLIOGRAPHIES/\*ENERGY POLICY/\*NATURAL GAS  
 MINS: / DEMAND (ECONOMICS)/ ENERGY CONSUMPTION/ FUEL  
 CONSUMPTION/ HYDROCARBON FUELS

77N83865# CATEGORY 44 RPT#: AD-A042139 CNT#:  
 N00014-76-C-0309 77/00/00 100 PAGES UNCLASSIFIED  
 DOCUMENT

UTTL: Verification of fixed offshore oil and gas platforms:  
 An analysis of need, scope, and alternative  
 verification systems

CORP: National Academy of Sciences - National Research  
 Council, Washington, D. C. CSS: (Marine Board.)  
 AVAIL:NTIS

MAJS: /\*NATURAL GAS/\*OFFSHORE PLATFORMS/\*OIL EXPLORATION  
 MINS: / GEOLOGICAL SURVEYS/ GOVERNMENTS/ OFFSHORE ENERGY  
 SOURCES/ REGULATIONS/ STRUCTURAL ENGINEERING

77N83686# CATEGORY 31 RPT#: PB-267373/9  
EPA/530/SW-587D CNT#: EPA-S-803396 77/00/00 71  
PAGES UNCLASSIFIED DOCUMENT  
UTTL: Recovery of landfill gas at Mountain View TLSP:  
Final Report  
AUTH: A/CARLSON, J. A. AVAIL.NTIS  
CORP: City of Mountain View, Calif.  
MAJS: /\*METHANE/\*ORGANIC WASTES (FUEL CONVERSION)/\*SOLID  
WASTES  
MINS: / ENERGY CONVERSION/ MATERIALS RECOVERY/ NATURAL GAS/  
WASTE DISPOSAL

77N83812# CATEGORY 43 RPT#: UCID-17369 CNT#:  
W-7405-ENG-48 77/01/00 14 PAGES UNCLASSIFIED  
DOCUMENT  
UTTL: Stimulation of the tight western gas reservoirs  
AUTH: A/HANSON, M. E.  
CORP: California Univ., Livermore. Lawrence Livermore Lab.  
AVAIL.NTIS  
MAJS: /\*NATURAL GAS/\*RESERVOIRS  
MINS: / CRACK INITIATION/ HYDRAULICS/ NUCLEAR EXPLOSIONS

77A33170# ISSUE 14 PAGE 2313 CATEGORY 25  
77/01/00 5 PAGES In RUSSIAN UNCLASSIFIED DOCUMENT  
UTTL: Burnout of gaseous fuel in a tube combustion chamber  
with longitudinally distributed air supply  
AUTH: A/DIDENKO, V. I.; B/BABENKO, I. A.; C/LIUBCHIK, G.  
N.; D/KHRISTICH, V. A.; E/SHEVCHENKO, A. M. PAA:  
E/(Kievskii Politekhnikheskii Institut, Kiev,  
Ukrainian SSR)  
Energetika, vol. 20, Jan. 1977, p. 56-60. In Russian.  
MAJS: /\*BURNOUT/\*COMBUSTION CHAMBERS/\*FUEL COMBUSTION/\*GAS  
TURBINE ENGINES/\*NATURAL GAS  
MINS: / AIR FLOW/ NOMOGRAPHS/ PIPES (TUBES)

77N79971# CATEGORY 28 RPT#: AD-A037928 R-1845-RC  
76/06/00 69 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Hazards associated with the importation of liquefied  
natural gas  
AUTH: A/MURRAY, F. W.; B/JAQUETTE, D. L.; C/KING, W. S.  
CORP: RAND Corp., Santa Monica, Calif. AVAIL.NTIS  
MAJS: /\*ENVIRONMENT EFFECTS/\*LIQUEFIED NATURAL GAS/\*TOXIC  
HAZARDS  
MINS: / AIR POLLUTION/ POLLUTION/ SAFETY FACTORS/ WATER

77A48092 ISSUE 23 PAGE 3913 CATEGORY 25  
77/04/00 5 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Firing systems for combustion of natural gas, crude  
oil and bunker C-oil - Selection of parameters for  
thermal power station units and the applied systems of  
steam generation  
AUTH: A/LAUTENSCHLAEGER, F. W.  
Energy Developments, vol. 1, Apr. 1977, p. 4-8.  
MAJS: /\*BURNERS/\*CRUDE OIL/\*FUEL COMBUSTION/\*FUEL OILS/\*  
NATURAL GAS/\*TURBOGENERATORS  
MINS: / ATOMIZERS/ BOILERS/ BURNERS/ COMBUSTION CHAMBERS/  
ELECTRIC POWER PLANTS/ GAS PRESSURE

79N77989# CATEGORY 28 RPT#: NZERDC-23 77/00/00  
30 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Methanol from natural gas for engine fuel  
AUTH: A/JUDD, B. T.; B/WALKER, B. V.; C/GRAHAM, E. E.;  
D/REES, I. F.; E/GIRARDIN, E. K.  
CORP: New Zealand Energy Research and Development Committee,  
Auckland. AVAIL.NTIS  
MAJS: /\*ENGINE TESTS/\*GASOLINE/\*METHANE/\*NATURAL GAS  
MINS: / CORROSION/ DISTRIBUTION (PROPERTY)/ ECONOMIC  
ANALYSIS/ FUEL SYSTEMS/ MIXTURES/ TECHNOLOGY  
UTILIZATION/ TOLERANCES (MECHANICS)/ VAPOR PRESSURE

77N83888# CATEGORY 44 RPT#: NTIS/PS-77/0573/4  
77/07/00 152 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Natural gas: Supply, demand and utilization. Volume  
1: 1964 - 1975 (a bibliography with abstracts)  
TLSP: Report, 1964-1975  
AUTH: A/HUNDEMANN, A. S.  
CORP: National Technical Information Service, Springfield,  
Va. AVAIL.NTIS  
MAJS: /\*BIBLIOGRAPHIES/\*ENERGY POLICY/\*NATURAL GAS  
MINS: / DEMAND (ECONOMICS)/ ENERGY CONSUMPTION/ FUEL  
CONSUMPTION/ HYDROCARBON FUELS

77N74343# CATEGORY 98 RPT#: FE-2271-1 CNT#:  
E(49-18)-2271 76/00/00 255 PAGES UNCLASSIFIED  
DOCUMENT  
UTTL: Natural gas from unconventional geologic sources  
CORP: National Academy of Sciences - National Research  
Council, Washington, D. C. CSS: (Board on Mineral  
Resources.) AVAIL.NTIS  
MAJS: /\*EARTH RESOURCES/\*NATURAL GAS  
MINS: / CONFERENCES/ METHANE

ORIGINAL PAGE 1  
OF POOR QUALITY

77A29572 ISSUE 12 PAGE 2040 CATEGORY 44  
76/00/00 46 PAGES In GERMAN UNCLASSIFIED DOCUMENT

UTTL: Exergy considerations related to the acquisition, supply, and utilization of solar energy  
AUTH: A/SUTER, P.; B/NICOLESCU, T. PAA: B/(Lausanne, Ecole Polytechnique Federale, Lausanne, Switzerland)  
In: Principles of solar technology I: Meeting, 2nd, Stuttgart, West Germany, October 22, 1976. Reports. (A77-29562 12-44) Munich, Deutsche Gesellschaft fuer Sonnenenergie, 1976, p. 237-282. In German.  
MAJS: /\*CHEMICAL ENERGY/\*ELECTRIC POWER/\*ENERGY CONVERSION EFFICIENCY/\*SOLAR ENERGY CONVERSION/\*SOLAR HEATING/\* THERMAL ENERGY  
MINS: / BLACK BODY RADIATION/ CRUDE OIL/ ENERGY SOURCES/ ENERGY TECHNOLOGY/ NATURAL GAS/ PHASE TRANSFORMATIONS/ SOLAR COLLECTORS/ SPECIFIC HEAT/ STORAGE TANKS/ SYSTEMS ANALYSIS/ TECHNOLOGY TRANSFER  
ABA: G.R.  
ABS: The exergy concept provides an evaluation measure for chemical and thermal energy in its relation to mechanical and electrical energy. A meaningful application of the exergy concept is related to investigations concerning the replacement of oil based heating technology by alternative approaches. Attention is given to the exergy equivalence of various forms of energy, the study of exergy chains, the consideration of the system solar collector-water storage tank on the basis of the exergy concept, and

an example for the evaluation of energy chains.

Q Advances in instrumentation, v. 31, pts. 1-4;  
184 proceedings of ISA Conference and Exhibit,  
.A5 Houston, Texas, October 11-14, 1976. --  
v.31 Pittsburgh : Instrument Society of America,  
pt.1-4 c1976.  
4 v. : ill. ; 29 cm.  
1. Scientific apparatus and instruments--  
Congresses. 2. Engineering instruments--  
Congresses. I. Instrument Society of America.  
ca. II. ISA Conference and Exhibit, Houston,

LNG VALVES - TOPWORKS SYSTEMS, I. R. de Chambeau PN-430.....

77A23099# ISSUE 9 PAGE 1434 CATEGORY 44  
76/12/00 5 PAGES In GERMAN UNCLASSIFIED DOCUMENT

UTTL: On the production of town gas from off-gases of the chemical processing industry  
AUTH: A/WILSDORF, J.; B/HIPPKE, W.; C/REINHARDT, A. PAA: C/(VEB, Ingenieurtechnisches Zentralbuero, Boehlen, East Germany)  
Energie-technik, vol. 26, Dec. 1976, p. 564-568. In German.  
MAJS: /\*CHEMICAL ENGINEERING/\*ENERGY TECHNOLOGY/\*GAS COMPOSITION/\*NATURAL GAS/\*WASTE ENERGY UTILIZATION  
MINS: / CARBON MONOXIDE/ COST EFFECTIVENESS/ DOMESTIC ENERGY / GAS MIXTURES/ HYDROGEN/ OXYGEN  
ABA: R.D.V.  
ABS: Preparation of town gas from residual gases of the CPI is characterized, availability of types of CPI off-takes is outlined, and theoretical and technological fundamentals of the production of town gas, various mixed gas compositions, and domestic and imported natural gas are discussed. Mixing diagrams for important combinations of gases are reproduced, and CIP processes yielding useful off-gases are mentioned. Recent development and future potentialities of town gas production from CPI off-gases are dealt with, and the discussion is extended to investment costs and possible cost savings.

77A26083 ISSUE 10 PAGE 1672 CATEGORY 44  
76/00/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Liquefied natural gas for California  
AUTH: A/ROCHA, E. P. PAA: A/(Southern California Gas Co., Los Angeles, Calif.)  
In: Energy LA: Tackling the crisis; Proceedings of the Second Greater Los Angeles Area Energy Symposium, Los Angeles, Calif., May 19, 1976. (A77-26076 10-44) North Hollywood, Calif., Western Periodicals Co., 1976, p. 167-173.  
MAJS: /\*COST ESTIMATES/\*FUEL SYSTEMS/\*LIQUEFIED NATURAL GAS  
MINS: / LIQUEFACTION/ REFRIGERANTS/ SOUTHERN CALIFORNIA/ SYSTEMS ENGINEERING  
ABA: (Author)  
ABS: Efforts to increase the natural gas supply of California by the transportation of liquefied natural gas are discussed. The scope of the projects, estimated capital and operating costs and system design are covered. Liquefaction process design is described in some detail

Gases, Natural - Liquefied

1976

TP Advances in cryogenic engineering. v, 21 /  
 490 edited by K. D. Timmerhaus and D. H. Weitzel.  
 .A3 -- New York : Plenum Press, [1976]  
 v.21 xv, 549 p. : ill. ; 26 cm.  
 "A Cryogenic Engineering Conference  
 Publication."  
 ISBN 0-306-38021-8  
 1. Low temperature engineering--Con-  
 gresses. I. Timmerhaus, K. D., ed. II.  
 Weitzel, D. H., ed. III. Cryogenic Engi-

Experience of Tokyo Gas with In-Ground LNG Tanks, Y. MIYATA,  
*Tokyo Gas Co., Ltd.* ..... 307

Geometric Stability of Cylindrical, Double-Walled Cryogenic Tank  
 Structures, G. E. PADAWER, *Cabot Corporation* ..... 315

A Model for LNG Tank Rollover, A. E. GERMELES, *Cabot Corpora-  
 tion* ..... 326

Distrigas LNG Barge Operating Experience, N. E. FRANGESH,  
*Consulting Engineer*, and G. A. RANDALL, Jr., *Distrigas Corpora-  
 tion* ..... 337

Inert Gas Generating System for Liquefied Natural Gas Carriers, G.  
 M. MEYER, *Consultant* ..... 346

Running-Film Vaporizer for LNG, H. H. WEST and G. L. PUCKETT,  
*University Engineers, Inc.* ..... 359

Safety Aspects of LNG Spills on Land, D. N. GIDEON, A. A.  
 PUTNAM, and A. R. DUFFY, *Battelle Columbus Laboratories* . 377

Cryogenic Fuel Systems for Motor Vehicles, J. J. HIBL, *Beech  
 Aircraft Corporation* ..... 180

78N77679# CATEGORY 44 RPT#: CONF-731033-10  
 73/00/00 32 PAGES UNCLASSIFIED DOCUMENT  
 UTTL: Dense phase transmission of natural gas.  
 AUTH: A/KATZ, D. L.; B/KING, G.  
 CORP: Calgary Univ. (Alberta). AVAIL.NTIS  
 MAJS: /\*COST ANALYSIS/\*ECONOMIC ANALYSIS/\*NATURAL GAS/  
 TRANSPORTATION  
 MINS: / FLUID MECHANICS/ LOW TEMPERATURE/ MATERIALS HANDLING  
 / METALLURGY/ PIPELINES/ REFRIGERATING

78N18506# ISSUE 9 PAGE 1176 CATEGORY 43 RPT#:  
 PB-273700/5 BLM-ME-78-14-VOL-1 75/07/07 801 PAGES  
 UNCLASSIFIED DOCUMENT  
 UTTL: Proposed increase in oil and gas leasing on the outer  
 continental shelf, volume 1 TLSP: Final  
 Environmental Statement  
 CORP: Bureau of Land Management, Washington, D. C. CSS: (   
 Div. of Minerals Environmental Assessment.)  
 AVAIL.NTIS SAP: HC A99/MF A01; HC also available in  
 set of 3 reports HC E99. PB-273699-Set  
 MAJS: /\*CONTINENTAL SHELVES/\*CRUDE OIL/\*NATURAL GAS  
 MINS: / ALASKA/ CLIMATOLOGY/ ENERGY POLICY/ ENVIRONMENT  
 EFFECTS/ GEOLOGY/ GULF OF MEXICO/ OCEANOGRAPHY  
 ABA: GRA  
 ABS: A proposal of the Department of the Interior is  
 considered which would accelerate its Outer  
 Continental Shelf (OCS) oil and gas leasing in the  
 years 1975 through 1978. The program suggests  
 conducting six lease sales each year. Lease sales in  
 some or all frontier areas by 1978 are proposed. Many  
 of the areas have little or no history of OCS oil and  
 gas development. Volume 1 of the statement includes  
 the description of the proposed action and the  
 description of the environment in which the action  
 would take place.

77A11032 ISSUE 1 PAGE 73 CATEGORY 44 76/00/00  
 21 PAGES UNCLASSIFIED DOCUMENT  
 UTTL: Energy and the gas industry  
 AUTH: A/GRAY, J. A. PAA: A/(British Gas Corp., London,  
 England)  
 In: Aspects of energy conversion: Proceedings of the  
 Summer School, Oxford, England, July 14-25, 1975.  
 (A77-11026 01-44) Oxford, Pergamon Press, 1976. p.  
 217-236: Discussion, p. 236, 237.  
 MAJS: /\*COAL GASIFICATION/\*ENERGY REQUIREMENTS/\*ENERGY  
 TECHNOLOGY/\*INDUSTRIAL ENERGY/\*NATURAL GAS  
 MINS: / ANNUAL VARIATIONS/ DIURNAL VARIATIONS/ DOMESTIC  
 ENERGY/ GREAT BRITAIN/ HEAT SOURCES/ OILS  
 ABA: B.J.  
 ABS: Some of the energy problems and prospects facing the  
 British Gas Corporation are described. Attention is

given to the natural gas supply system, load matching  
 (seasonal and diurnal), gas reserves, and the market  
 for gas (domestic and industrial). The development of  
 such technologies as substitute natural gas, oil  
 gasification (catalytic rich gas, gas recycle  
 hydrogenator, and fluidized bed hydrogenator), and  
 coal gasification (the Lurgi process, and the slagging  
 gasifier) is examined.

77A22868 ISSUE 8 PAGE 1255 CATEGORY 44  
76/00/00 374 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Applications of cryogenic technology. Volume B ---  
Book  
AUTH: A/BOOTH, S. H.; B/VANCE, R. W. PAA: A/(Kaiser  
Engineers Center, Oakland, Calif.) PAT: A/(ED.)  
SAP: \$22.50  
Flushing, N.Y., Scholium International, Inc., 1976.  
374 p

MAJS: /\*CRYOGENIC FLUIDS/\*ENERGY TECHNOLOGY/\*LIQUEFIED  
NATURAL GAS/\*TECHNOLOGY UTILIZATION

MINS: / ATMOSPHERIC DIFFUSION/ CRYOGENIC EQUIPMENT/  
CRYOGENIC FLUID STORAGE/ LIQUEFACTION/ MARINE  
TECHNOLOGY/ OFFSHORE PLATFORMS/ PIPELINES/  
REFRIGERATING/ TERMINAL FACILITIES/ UNDERWATER  
ENGINEERING

ABA: B.J.

ABS: Papers are presented on the applications of cryogenic  
technology of liquefied natural gas (LNG). Attention  
is given to liquefaction facilities for the  
Trans-Alaska Gas Project, the liquefaction of natural  
gas with auto-refrigerated cascade cycle, an LNG  
containment system for marine transport of LNG, an  
undersea pipeline for off-shore terminals, LNG safety  
in United States ports, and the volume of flammable  
mixture resulting from atmospheric dispersion of a  
leak or spill. Also considered are world trade in LNG,  
environmental aspects of LNG terminals, and the  
operation of LNG carriers from Alaska to Japan.

78N10545# ISSUE 1 PAGE 80 CATEGORY 43 RPT#:  
ORNL/SUB-75/87988 CNT#: W-7405-ENG-26 75/12/17 48  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Preliminary study of the present and possible future  
oil and gas development of areas immediately  
surrounding the Interior Salt Domes Upper Gulf Coast  
Salt Dome basins of east Texas, north Louisiana, and  
Mississippi

CORP: Netherland, Sewell and Associates, Inc., Dallas, Tex.  
AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /\*DOMES (GEOLOGY)/\*NATURAL GAS/\*OIL EXPLORATION

MINS: / FOSSIL FUELS/ GULF OF MEXICO/ RADIOACTIVE WASTES/  
TECHNOLOGICAL FORECASTING

ABA: ERA

ABS: Present and possible future oil and gas development  
was investigated for the purpose of locating those  
salt domes where such oil and gas development would  
not interfere with the possible storage of radioactive  
waste material in the core of the salt dome.  
Preliminary findings indicate that several of the salt  
domes in each of the three basins under study are  
hydrocarbon barren and that the present and/or  
possible future oil and gas development on or in the  
areas immediately surrounding the salt domes should  
not interfere with the possible storage of radioactive  
waste material in the core of these salt domes.

77A10451# ISSUE 1 PAGE 30 CATEGORY 31 76/00/00  
6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Risk management of liquefied natural gas installations  
AUTH: A/FEDGR, O. H.; B/PARSONS, W. N.; C/COUTINHO, J. DE  
C. PAA: A/(NASA, Kennedy Space Center, Cocoa Beach,  
Fla.); B/(Boeing Co., Cocoa Beach, Fla.); C/(U.S.  
Army, Materiel Systems Analysis Activity, Aberdeen  
Proving Ground, Md.)

CORP: Army Materiel Systems Analysis Activity, Aberdeen  
Proving Ground, Md.; Boeing Co., Cocoa Beach, Fla.;  
National Aeronautics and Space Administration, John F.  
Kennedy Space Center, Cocoa Beach, Fla.

In: Annual Reliability and Maintainability Symposium,  
Las Vegas, Nev., January 20-22, 1976, Proceedings,  
(477-10435 01-38) New York, Institute of Electrical  
and Electronics Engineers, Inc., 1976, p. 245-250.

MAJS: /\*FIRE PREVENTION/\*LIQUEFIED NATURAL GAS/\*MANAGEMENT  
SYSTEMS/\*PROJECT PLANNING/\*RISK/\*SAFETY MANAGEMENT

MINS: / ASSURANCE/ CONTINGENCY/ DATA MANAGEMENT/ NEW YORK/  
OPERATORS (PERSONNEL)/ RELIABILITY ANALYSIS/ SYSTEMS  
MANAGEMENT

ABA: G.R.

ABS: In connection with the construction of four major  
liquefied natural gas (LNG) facilities in New York  
City, the New York City Fire Commissioner has asked  
NASA for assistance. It was decided that the Kennedy  
Space Center should develop a risk management system  
(RMS) for the use of the New York Fire Department  
(NYFD). The RMS provides for a published set of safety  
regulations by the NYFD. A description of the RMS is  
presented as an example of an application of aerospace  
technology to a civilian sector, namely LNG  
facilities.

79N77271# CATEGORY 44 RPT#: PB-290111/4 BM-IC-8780  
78/00/00 102 PAGES UNCLASSIFIED DOCUMENT

UTTL: Analyses of natural gases, 1977

AUTH: A/MOORE, B. J.

CORP: Bureau of Mines, Amarillo, Tex. AVAIL.NTIS

MAJS: /\*GAS ANALYSIS/\*NATURAL GAS

MINS: / ETHANE/ HYDROCARBONS/ METHANE/ PIPELINES

NATURAL GAS - METHANE

WHY NOT METHANE? Steve Rattner.

Energy Engineering--Journal of the Association of Energy Engineers. vol 76, no 6, October/November 1979. p. 11-26.

*The Scientists' Institute for Public Information (SIPI) sponsored a Congressional seminar on natural gas in April 1978 in Washington DC, funded by the Educational Foundation of America. This article is a revised and updated version of the seminar papers as published in the magazine Environment, in its January/February, 1979 issue. It is copyright by Heldref Publications, Room 504, 4000 Albemarle Street NW, Washington DC 20016, and reproduced here with its permission.*

ON THE CH<sub>4</sub> FUNDAMENTAL CONTROVERSY: LINE-INTENSITY MEASUREMENTS REVISITED, by Barry L. Lutz and Peter M. Silvaggio and Robert W. Boese. The Astrophysical Journal, vol. 227, no. 1, part 1, January 1, 1979, p.334-337.

AN EVALUATION OF METHANE COMBUSTION MECHANISMS. 2. COMPARISON OF MODEL PREDICTIONS WITH EXPERIMENTAL DATA FROM SHOCK-INITIATED COMBUSTION OF C<sub>2</sub>H<sub>2</sub>, C<sub>2</sub>H<sub>4</sub>, AND C<sub>2</sub>H<sub>6</sub>, by J.N. White and W.C. Gardiner, Jr., The Journal of Physical Chemistry, vol. 83, no. 5, March 1979. p.562-568.

WHY NOT METHANE?, by Steve Rattner, C.J. Mankin, Robert Yeck, Barry Commoner, and Eugene Luntz, Environment, vol. 21, no. 1, Jan/Feb. 1979, p.25-46.

WHY NOT METHANE?

21

THE CASE FOR METHANE

Steve Rattner

GAS RESOURCES AND RESERVES

Charles J. Mankin

METHANE FROM BIOMASS

Robert Yeck

THE ECONOMICS OF METHANE

Barry Commoner

DELIVERING METHANE

Eugene Luntz

HIGH-RESOLUTION COHERENT STOKES RAMAN SPECTROSCOPY OF THE  $\nu_1$  AND  $\nu_3$  BANDS OF METHANE, BY J. R. Boquillon and R. Bregier. Applied Physics, vol. 18, no. 2, Feb. 1979, p.195-198.

79A33753 ISSUE 13 PAGE 2497 CATEGORY E5  
78/00/00 17 PAGES UNCLASSIFIED DOCUMENT

UTTL: The microbial production of methane from the putrescible fractions of sorted household waste

AUTH: A/LE ROUX, N. W.; B/WAKERLEY, D. S. PAA:  
B/(Ministry of Technology, Warren Spring Laboratory, Stevenage, Herts., England)  
(World Recycling Congress, 1st, Basel, Switzerland, Mar. 6-9, 1978.) Conservation and Recycling, vol. 2, no. 2, 1978, p. 163-179.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*MICROORGANISMS/\*ORGANIC WASTES (FUEL CONVERSION)/\*SYNTHANE/\*WASTE UTILIZATION

MINS: / ECONOMIC FACTORS/ ENERGY TECHNOLOGY/ FERMENTATION/ PERFORMANCE TESTS

ABA: (Author)

ABS: Representative mixed samples of the putrescible fractions of sorted household wastes have been fermented at 30 C to produce methane. Fermentation vessels for semicontinuous operation were designed to enable glass, grit and other heavy solids and also floating plastic material to be easily removed. For optimum gas yields water had to be added to the putrescible material to maintain the solids content of the fermentations at less than 9% w/w. In one test liquor recovered by settlement from digested sludge was used successfully in place of water. No requirement for additional nitrogen or other mineral salts could be demonstrated. The highest yield of gas in the semicontinuous tests was 0.307 cu m/kg dry weight of feedstock. This was equivalent to a gas yield of 0.48 cu m/kg fermentable material in the fractions used. The composition of the gas was 65-70% methane plus 30-35% CO<sub>2</sub>. In limited temperature studies at 30, 34 and 36 C the highest gas yields were obtained at 36 C. An economic assessment of the process as it might at present be applied to a refuse sorting plant concluded that the process would be uneconomic. However, if a market for the digested sludge could be found this could alter the economics appreciably.

NASA TP-1150

*Methane*

1978

**FRICTION AND WEAR OF SELECTED METALS AND ALLOYS IN SLIDING CONTACT WITH AISI 440C STAINLESS STEEL IN LIQUID METHANE AND IN LIQUID NATURAL GAS.** Donald W. Wisander, LeRC. Feb. 1978. 16p.

78N2866\* ISSUE 19 PAGE 2563 CATEGORY 44 RPT#:  
COO-2917-7 CNT#: EY-76-S-02-2917 78/01/00 6 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Biological conversion of biomass to methane

AUTH: A/PFEFFER, J. T.

CORP: Illinois Univ., Urbana. CSS: (Dept. of Civil Engineering.) AVAIL:NTIS SAP: HC A02/MF A01

MAJS: /\*BIODEGRADATION/\*BIOMASS ENERGY PRODUCTION/\*ENERGY POLICY/\*METHANE/\*ORGANIC COMPOUNDS/\*SOLID WASTES

MINS: / ANAEROBES/ FERMENTATION/ INDUSTRIAL PLANTS/ SYSTEMS ENGINEERING/ WASTE UTILIZATION

ABA: ERA

ABS: Complete-mix and multistage reactors are evaluated for use in the anaerobic fermentation of organic solids for methane production. Results indicate that if a balanced population of organisms is maintained in the initial stage, multi-stage fermentation is more efficient than a complete-mix system. However, if the system is stressed, failure of the multi-staged system is more rapid. When the first stage was not inhibited due to a short retention time, the waste stabilization in the additional stages was minimal. Further studies on the effect of retention time on reaction rates indicated that the type of reactor design desired depends upon the objective of the system. A staged system will produce more methane per unit volume of reactor for a given quantity of solid substrate. Maximal methane production per unit volume is obtained by a single-stage reactor operating at near minimum retention. Results of studies on the fermentation of manures and corn stover are discussed briefly.

76N33256\* ISSUE 24 PAGE 3197 CATEGORY 28 RPT#:  
DOE/US-0001/1 78/03/00 6 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Department of Energy position paper on alcohol fuels

CORP: Department of Energy, Washington, D. C. AVAIL:NTIS  
SAP: HC A02/MF A01

MAJS: /\*ALCOHOLS/\*ENERGY POLICY/\*FUELS

MINS: / ECONOMICS/ ETHANE/ METHANE/ SUPPLYING

ABA: ERA

ABS: The supply, utilization, and economic characteristics of alcohols (methanol and ethanol) and the major issues associated with their implementation are briefly described. The major elements in the current evaluation of alcohol fuels as a candidate for federally-assisted commercialization of a nonpetroleum fuel are also described.

AICHE Symposium Series, v.74, no.161. 1978

BIOCHEMICAL ENGINEERING: RENEWABLE SOURCES OF ENERGY AND CHEMICAL FEEDSTOCKS. John M. Nystrom and Stanley M. Barnett, eds. (Papers presented at Symposium on Biochemical Sources of Energy held at 2nd Pacific Chemical Engineering Congress, Denver, Colo., Aug.1977 and Symposium on Biological Sources of Energy & Chemical Feedstocks held at 84th National AIChE Meeting, Atlanta, Ga., Feb.1978).

SEPARATE-STAGE FERMENTATION OF BIOMASS TO METHANE .....	E. C. Clausen and J. L. Gaddy	56
STATUS-REFUSE CONVERSION TO METHANE (REFCOM) .....	D. Walter and C. Rines	69
of Energy	1977	
Symposium on Biological Sources	Feb.	
of Energy & Chemical Feedstocks	1978	

A79-44242 # The future of methane supply. C. G. Matthews (Brooklyn Union Gas, Brooklyn, N.Y.). In: Energy: A close look at the energy business; Proceedings of the Second International Conference, Washington, D.C., November 30, December 1, 1978. Stamford, Conn., Business Communications Co., Inc., 1979, p. 170-176.

Recent developments in the natural gas industry are surveyed. Advantages of methane are stressed, and include its ability to be utilized in many energy applications with minimal environmental impact, and that an effective distribution network already exists. Sources discussed include geopressure zones, tight formations, and biomass. A study is cited which concludes that for its existing systems, coal-based gas would provide a cheaper and more efficient energy form than coal-based electricity while another study found that coal gasification would be up to 50% more efficient than coal electrification and result in lower air pollution, lower solid waste generation, and lower water requirements. M.E.P.

METHANE FROM THE BOWELS OF THE EARTH.  
David Paterson  
Newscientist, Vol. 78, No. 1109, June 29,  
1978, p. 196-198.

Cornell University astrophysicist Thomas Gold has been working out the detail of a new theory suggesting that the world may contain sufficient reserves of natural gas (methane) to sustain our present level of hydrocarbon consumption for at least a million years. Gold's theory also goes a considerable way towards explaining many of the diverse events that forewarn of earthquake activity—including for example, the Chinese claims that odd animal behaviour often precedes earthquakes.

METHANE FROM BELOW RISES IN PRIORITY.  
Guy E. Weismantel  
Chemical Engineering, Vol. 85, No. 11, May 1978,  
p. 114-116

No one knows exactly how much methane can be recovered from the geothermal brines of Texas and Louisiana, but studies to assess this resource are under way.

ORIGINAL PAGE IS  
OF POOR QUALITY

The Fast Production of Methane by Anaerobic Digestion  
2 volumes. Final Report, May 24, 1976-December 31, 1978.  
by C.D. Finney, R.S. Evans, II, & K.A. Finney

Dept. of Energy Document COO-2900-17 (Vol. 1) and  
COO-2900-17 (Vol. 2). Contract no. EY-76-C-02-2900

**A premium fuel, methane gas, is produced as the organic fraction of solid refuse is rendered inert by anaerobic digestion. Objectives of this research were to show: (i) product gases are inhibiting and their transfer is rate-limiting; (ii) anaerobic digesters can be optimized to promote faster methane production; and (iii) optimal performance requires separation of hydrolysis from gasification.**

78A11120 ISSUE 1 PAGE 62 CATEGORY 44 77/00/00  
528 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Clean fuels from biomass and wastes: Proceedings of  
the Second Symposium, Orlando, Fla., January 25-28,  
1977 SAP: \$40  
Symposium sponsored by the Institute of Gas  
Technology, Chicago, Ill. Institute of Gas  
Technology, 1977. 528 p (For individual items see  
A78-11121 to A78-11129)  
WAJS: /-BIOMASS ENERGY PRODUCTION/\*CONFERENCES/\*ENERGY  
TECHNOLOGY/\*ORGANIC WASTES (FUEL CONVERSION)/\*WASTE  
UTILIZATION  
WINS: / ANAEROBES/ CLEAN ENERGY/ ECONOMIC FACTORS/ ENERGY  
CONVERSION EFFICIENCY/ HYDROGEN-BASED ENERGY/ PLANTS  
(BOTANY)/ SEAWEEDES/ SOLID WASTES/ SYNTHETIC FUELS  
ABA: J.M.B.  
ABS: The use of biomass and wastes as a source of fuel is  
studied, with attention given to land requirements of  
biomass plantations, the application of forest biomass  
to energy production, hydrogen production through  
photolysis, ethanol-gasoline automotive fuels, the  
conversion of solid-waste cellulose to glucose,  
genetic engineering to improve plant photosynthesis  
rates, and the operation of a 100,000-gallon anaerobic  
digester to treat municipal solid wastes. Other topics  
discussed include the design of a compact reactor to  
produce methane from solid wastes, the efficiency of  
several pyrolytic processes, the gasification of  
biomass and wastes with a rotary kiln, the production  
of methane through fermentation of microalgae in waste  
water treatment ponds, and the culture and processing  
of waterhyacinths.

810  
A79  
1977

Aspen Energy Forum, 4th, Aspen Institute for  
Humanistic Studies, 1977.  
Solar architecture : proceedings of the  
Aspen Energy Forum 1977, May 27, 28, and  
29, 1977, Aspen, Colorado / editors, Gregory  
E. Franta, Kenneth R. Olson ; graphics, T.  
Michael Manchester. — Ann Arbor, Mich. :  
Ann Arbor Science Publishers, c1978.  
ix, 331 p. : ill. ; 24 cm.

ENERGY INDEPENDENCE THROUGH METHANE  
C. E. Tomson, Jr.

255

78N15487 ISSUE 6 PAGE 765 CATEGORY 37 77/00/00  
168 PAGES UNCLASSIFIED DOCUMENT

UTTL: Experimental and analytical comparisons of the performance and combustion characteristics of gasoline, methane, and methanol in a Wankel engine  
TLSP: Ph.D. Thesis  
AUTH: A/RAUT, P. K.  
CORP: Georgia Inst. of Tech., Atlanta. SAP: Avail: Univ. Microfilms Order No. 77-20597  
MAJS: /\*COMBUSTION EFFICIENCY/\*ENGINE TESTS/\*GASOLINE/\*METHANE/\*WANKEL ENGINES  
MINS: / BURNING RATE/ COMBUSTION PRODUCTS/ INTERNAL COMBUSTION ENGINES/ PERFORMANCE PREDICTION/ THERMODYNAMIC EFFICIENCY  
ABA: Dissert. Abstr.  
ABS: Experiments were performed on a Wankel engine to obtain engine performance and emission data as well as chamber pressure time diagrams for gasoline, natural gas, and methanol fuels. A thermodynamic model of a Wankel engine was developed which accounts for Apex-seal leakage, heat transfer and wall quenching. The mass fraction burned as a function of crank angle was calculated from a measured pressure-time diagram. The predictions of heat loss to cooling water gave good agreement with the measurements for the three fuels. The predictions of oxides of nitrogen also gave good agreement with measurements for lean mixtures of gasoline and natural gas fuels. For methanol, the predictions of oxides of nitrogen were about 50% lower than measurements and results show it burns at lower temperatures than gasoline or natural gas.

78N25251# ISSUE 16 PAGE 2098 CATEGORY 28 RPT#:  
FE-2447-12 CNT#: EF-77-C-01-2447 77/12/00 10  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Research guidance studies to assess gasoline from coal by methanol-to-gasoline and sasol-type Fischer-Tropsch technologies TLSP: Monthly Report, Nov. 1977  
AUTH: A/SCHREINER, M., JR.  
CORP: Mobil Research and Development Corp., Princeton, N. J. AVAIL:NTIS SAP: HC 402/MF A01  
MAJS: /\*COAL/\*ENERGY CONVERSION/\*GASOLINE/\*METHANE  
MINS: / BEDS (PROCESS ENGINEERING)/ ENERGY DISSIPATION/ TECHNOLOGY ASSESSMENT  
ABA: Author (ERA)  
ABS: The results of an economic comparative evaluation of the methanol-to-gasoline and Fischer-Tropsch syntheses are reported. It was concluded that the methanol conversion technology is superior to the F-T technology. The thermal energy loss converting the methanol to gasoline is not excessive. The fluid-bed process is somewhat better than its fixed-bed process. The results of the evaluation are tabulated.

77A44396 ISSUE 21 PAGE 3610 CATEGORY 44  
77/06/19 2 PAGES UNCLASSIFIED DOCUMENT

UTTL: Photosynthetic solar energy - Rediscovering biomass fuels  
AUTH: A/HAMMOND, A. L.  
Science vol. 197, Aug. 19, 1977, p. 745, 746.  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ORGANIC WASTES (FUEL CONVERSION)/\*WASTE UTILIZATION  
MINS: / ECONOMIC ANALYSIS/ ETHYL ALCOHOL/ HYDROGEN PRODUCTION/ METHANE/ WOOD  
ABA: F.G.M.  
ABS: Possibilities for using biomass as an energy source are considered, noting that biomass is potentially a renewable source of a full range of liquid and gaseous fuels for which domestic sources of their fossil counterparts are increasingly in short supply. Biomass fuels discussed include wood products, gas derived from walnut shells, manure, crop residues, biomass ethanol, forest wastes, and aquatic plants. Some research projects are described which involve the development of biomass gasifiers, ethanol fermentation from sugarcane and sweet sorghum, cultivation of blue-green algae and kelp as methane sources, and a proposal for a biomass refinery in which hydrogen would be produced from organic wastes with steam generated by solar heat concentrated on a boiler. The extent of biomass resources in the United States and the economics of biomass energy systems are assessed.

78A11144 ISSUE 1 PAGE 65 CATEGORY 44 77/00/00  
6 PAGES In GERMAN UNCLASSIFIED DOCUMENT

UTTL: Methane production from waste  
AUTH: A/RASCH, R.  
In: Materials and energy from refuse: Proceedings of the First International Symposium, Antwerp, Belgium, October 21, 22, 1976. (A78-11140 01-44) Leiden, Spruyt, Van Mantgem en De Does, 1977, p. 31-36. In German.  
MAJS: /\*BIODEGRADATION/\*GASOUS FUELS/\*HYDROCARBON FUEL PRODUCTION/\*METHANE/\*ORGANIC WASTES (FUEL CONVERSION) /\*WASTE UTILIZATION  
MINS: / BIOMASS ENERGY PRODUCTION/ DEGASSING/ GASIFICATION/ MATERIALS HANDLING/ PYROLYSIS  
ABA: B.J.  
ABS: Techniques for the production of methane from organic wastes are reviewed with emphasis on biological degradation and a technique (called 'geordnote Deponie') involving the treatment of waste deposits. Special emphasis is put on thermal methods of methane production from organic refuse, including a method of degassing (i.e., pyrolysis) and a method of gasification (i.e., oxidative gas generation).

78N26224# ISSUE 17 PAGE 2230 CATEGORY 28 RPT#:  
COO-2917-5 CNT# : EY-76-S-02-2917 77/06/00 79  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Biological conversion of biomass to methane ---  
systems engineering ILSP: Annual Progress Report, 1  
Jun. 1976 - 31 May 1977

AUTH: A/PFEFFER, J. T.

CORP: Illinois Univ., Urbana. CSS: (Dept. of Civil  
Engineering.) AVAIL.NTIS SAP: HC A05/MF A01

MAJS: /\*BIODEGRADATION/\*BIOMASS ENERGY PRODUCTION/\*CHEMICAL  
REACTORS/\*METABOLIC WASTES/\*METHANE/\*SYSTEMS  
ENGINEERING

WINS: / CATTLE/ FEED SYSTEMS/ FERMENTATION/ PH FACTOR/  
SEWAGE/ SYSTEM EFFECTIVENESS/ VOLATILITY

ABA: ERA

ABS: A large scale laboratory system was constructed to  
evaluate the methane yields from various organic  
materials. The initial substrate used was beef feed  
lot manure. Methane yields ranged from 0.11 to 0.259  
so m per kg volatile solids fed with a fermentation  
temperature of 58 C. The gas yield for a given manure  
was a function of retention time. However, fresh  
manure produced substantially more gas than manure  
that had lain on the lot for several months. Reaction  
times of 3.7 days and loadings of 8.76 kg per cu m per  
day resulted in stable operation.

TA Society of Engineering Science.  
5 Recent advances in engineering science;  
.S63 proceedings of the 14th annual meeting of  
1977 the Society of Engineering Science, Inc. /  
edited by G. C. Sih. — Bethlehem, Pa. :  
Lehigh University, c1977.  
Held November 14-16, 1977 at Bethlehem.  
Includes bibliographical references and  
index.

1. Engineering—Congresses. I. Lehigh  
University, Bethlehem, Pa. II.

Tit+to  
Recovery and utilization of landfill gas  
by S. C. James

1341

Energy, v.2, 1977, p.365-73.

## BIOCONVERSION OF SOLAR ENERGY TO METHANE

JOHN D. KEENAN

Department of Civil and Urban Engineering, University of Pennsylvania, Philadelphia, PA 19174, U.S.A.

(Received 13 September 1976)

**Abstract**—The purpose of this paper is to report the results of an investigation of the energy conversion efficiency of an aquatic based fuel-from-biomass system. The bases of the system are the biochemical conversions of solar energy to algal biomass to methane which is, in turn, used as auxiliary fuel for a fossil-fuel-fired steam-electric power plant. The alga used in the research was *Anabaena flos-aque*, a blue-green alga possessing many of the characteristics desired in an energy crop. The results of the research indicate that renewable methane can significantly reduce the imported fossil fuel requirement of the power station; that an overall efficiency of the conversion of solar energy to methane of one percent is attainable; and that energy inputs account for 12% of the methane fuel value.

## AN EVALUATION OF METHANE COMBUSTION MECHANISMS

D. B. Olson and W. C. Gardiner, Jr.  
The Journal of Physical Chemistry  
Vol. 81 no. 25 Dec. 15, 1977  
p. 2514-2519

## THE VISCOSITY AND THERMAL CONDUCTIVITY COEFFICIENTS FOR DENSE GASEOUS AND LIQUID METHANE.

H.J.M. Hanley, et al.

J. Phys. Chem. Ref. Data, v.6, no.2, 1977, p.597-

TP Microbial energy conversion ... 1976. (Card 2)  
360 Includes bibliographies and index.  
.M5 ISBN 0-080217-91-5

1. Biomass energy—Congresses.

Methane formation and cellulose digestion

R. A. MAH, R. E. HUNGATE and K. OHWAKI  
Acetate, a key intermediate in methanogenesis . . . p. 97 . . . . .

M. P. BRYANT  
The microbiology of anaerobic degradation and methanogenesis with special reference  
to sewage . . . . . p. 107 . . . . .

W. C. BOYLE  
Energy recovery from sanitary landfills - a review . . . p. 119 . . . . .

J. T. PFEFFER  
Methane from urban wastes - process requirements . . . p. 139 . . . (cover)

L. A. SPANO  
Enzymatic hydrolysis of cellulosic materials . . . . . p. 157 . . . . .

P. L. McCARTY, L. Y. YOUNG, D. C. STUCKEY and J. B. HEALY Jr.  
Heat treatment for increasing methane yields from organic materials . . . p. 179 . . .

Engineering, operation and economics of biodigesters

R. E. HUNGATE  
Suitability of methanogenic substrates, health hazards, and terrestrial conservation of  
plant nutrients . . . . . p. 339 . . . . .

M. P. BRYANT, V. H. VAREL, R. A. FROBISH and H. R. ISAACSON  
Biological potential of thermophilic methanogenesis from cattle wastes . . . p. 347 . . .

U. LOLL  
Engineering, operation and economics of biodigesters . . . p. 361 . . . . .

H. G. KONSTANDT  
Engineering, operation and economics of methane gas production . . . p. 379 . . .

AICHE Symposium Series, v. 72, no. 158 1976

BIOCHEMICAL ENGINEERING - ENERGY RENEWABLE RESOURCES  
AND NEW FOODS. S.M. Barnett, J.P. Clark and J.M.  
Nystrom, eds.

Production of methane thru energy farming  
Fuel gas from solid wastes  
Methane production from manure in small scale units.

TD International Symposium on Materials and  
794.5 Energy from Refuse, 1st, Antwerp, 1976.  
.I67 Proceedings ... [1976?] (Card 2)  
1976 ISBN 90-238-0834-7

Attention is given to the Garrett pyrolysis process, the Andco-Torrax slagging pyrolysis solid waste conversion system, partial oxidation of refuse using the Purox system, and the prospects of materials and energy from refuse in India. Consideration is also given to methane production from wastes, the combination of refuse incineration with electric power production, combined refuse and sludge incineration, and refuse incineration with heat recovery. Metals from urban refuse, recycling of tin from secondary waste, and materials recovery from shredded junked cars are also discussed. B.J. VAN DER  
resses.  
3.  
I.  
earing.

Production of methane using offshore wind energy  
Young, B. et al., AAI Corp, Md, SAE Report 769015, Sept. 12-17, 76, (6), technical report. The feasibility of using offshore wind turbine generators to produce significant quantities of high Btu methane SNG through seawater electrolysis and calcining of sea sands is established. Projected costs of the system are presented. Wind energy potential of two candidate sites is assessed. Advantages of the system are described, including a conversion efficiency of 56%, availability of abundant raw materials, gas production regardless of wind, and the absence of waste disposal problems.  
EIC 78-01/16-5005

ON-102,037 Methane 1967  
ADVANTAGES OF METHANE AS AN AIRCRAFT FUEL.  
Oct. 1, 1967. 14p. Not to be disclosed or  
reproduced.

Pratt & Whitney Aircraft, PDS-2436  
West Palm Beach, Fla., Florida Section 1  
Research & Development Center

Methane, Liquid  
Fuel, Jet - Properties  
Engines, Jet - Performance  
Aircraft, Jet - Performance

77N79091 CATEGORY 28 RPT#: GPO-75-B27 76/00/00  
431 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Methanol  
CORP: Committee on Science and Technology (U. S. House),  
SAP: Avail: Subcomm. on Energy Res., Development and  
Demonstration  
Washington GPO Hearings before Subcomm. on Energy  
Res., Development and Demonstration of the Comm. on  
Sci. and Technol., 94th Congr., 1st Sess., No. 55-A,  
17 and 19 Jun. 1975  
WAJS: /\*CONGRESSIONAL REPORTS/\*ENERGY POLICY/\*METHANE  
WINS: / ENERGY CONSERVATION/ HYDROCARBON FUELS/ LIQUEFIED  
NATURAL GAS

79N74877# CATEGORY 28 RPT#: PB-287999/7 PAPER-74-8  
74/10/00 33 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Energy carriers in space conditioning and automotive  
applications: A comparison of hydrogen, methane,  
methanol and electricity  
AUTH: A/DAVITIAN, H.  
CORP: Cornell Univ., Ithaca, N. Y. CSS: (Energy Proj.)  
AVAIL: NTIS  
Sponsored by NSF  
WAJS: /\*AIR CONDITIONING/\*AUTOMOBILE FUELS/\*ELECTRIC CURRENT  
/\*HYDROGEN FUELS/\*METHANE/\*METHYL ALCOHOLS  
WINS: / COSTS/ PETROLEUM PRODUCTS/ THERMODYNAMIC EFFICIENCY

OTL SHALE AND TAR SAND

BON10209\*# ISSUE 1 PAGE 27 CATEGORY 7 79/00/00  
19 PAGES UNCLASSIFIED DOCUMENT

UTTL: Alternative jet aircraft fuels

AUTH: A/GROBMAN, J.

CORP: National Aeronautics and Space Administration, Lewis  
Research Center, Cleveland, Ohio. AVAIL.NTIS SAP:  
HC A20/MF A01

In Its Aeropropulsion 1979 p 129-148 (SEE N80-10205  
01-07)

MAJS: /\*AIRCRAFT FUELS/\*CRUDE OIL/\*JET ENGINE FUELS/\*QUALITY  
CONTROL/\*SHALE OIL

MINS: / CONCENTRATION (COMPOSITION)/ EXHAUST EMISSION/ FUEL  
SYSTEMS/ HYDROGEN/ THERMAL STABILITY

ABA: J.M.S.

ABS: Potential changes in jet aircraft fuel specifications  
due to shifts in supply and quality of refinery  
feedstocks are discussed with emphasis on the effects  
these changes would have on the performance and  
durability of aircraft engines and fuel systems.  
Combustion characteristics, fuel thermal stability,  
and fuel pumpability at low temperature are among the  
factors considered. Combustor and fuel system  
technology needs for broad specification fuels are  
reviewed including prevention of fuel system fouling  
and fuel system technology for fuels with higher  
freezing points.

77Y12132 1974 ISS: 48 KF1865.A25 1974B 333.82 LC-  
75-308104

UTTL: Energy from U.S. and Canadian tar sands. ILSP:  
Technical, environmental, economic, legislative, and  
policy aspects. Report prepared for the Subcommittee  
on Energy of the Committee on Science and  
Aeronautics, Ninety-third Congress, second session,  
U.S. Library of Congress, Congressional Research  
Service, U.S. Congress, House, Committee on Science  
and Aeronautics, Subcommittee on Energy,  
GPO, Washington, D.C., 90 p.

LC: Oil sands.

NASA: / CANADA/ ECONOMIC FACTORS/ ENERGY POLICY/ TAR  
SANDS/ UNITED STATES OF AMERICA

MAIN-CORP TRACE-CORP\*TITL\* CATLG BY-JPL

76/11/18 AVAIL: / JPL

A79-43575 Model of the economic efficiency of the  
exploitation of oil shale in comparison with other mineral sources of  
energy. B. Gurfel (Negev, University, Beersheba, Israel). *Applied  
Energy*, vol. 5, July 1979, p. 205-213. 9 refs.

A model for determining the optimal structure of energy  
production from oil shale is presented. It is based on the following  
points. A source of energy raw materials is a production complex of  
an output, processing and utilization of the reserves, and manufac-  
ture of by-products. Each type of production has its own character-  
istics. Direct and feedback production links exist between the  
existing and newly created production capacities. The model reviews  
the influence of scientific and technical progress. The model is  
designed largely for energotechnologic utilization towards the pro-  
duction of essential energy products. The model foresees a discrete  
variation of power capacity. This way the non-linear function of  
expense is taken into account. The worked out model makes it  
possible to ground the rational structure and volume of oil shale use,  
to draw into production more from its enormous reserves and in this  
way to favor the relative autonomy of the national energy economy.

[Author]

79A10045 ISSUE 1 PAGE 54 CATEGORY 28 78/00/00  
7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Jet fuels from shale oil - A near term technology

AUTH: A/HARNEY, B. M.; B/RAMSEY, J.; C/HILDEBRAND, R.  
PAA: C/(U.S. Department of Energy, Washington, D.C.)

In: Intersociety Energy Conversion Engineering  
Conference, 13th, San Diego, Calif., August 20-25,  
1978, Proceedings, Volume 1. (A79-10001 01-44)  
Warrendale, Pa., Society of Automotive Engineers,  
Inc., 1978, p. 322-328.

MAJS: /\*JET ENGINE FUELS/\*OIL RECOVERY/\*SHALE OIL

MINS: / COST ANALYSIS/ DOMESTIC ENERGY/ ENERGY TECHNOLOGY/  
PILOT PLANTS/ REFINING

ABA: B.J.

ABS: The paper reviews the production of shale oil by  
surface and in situ retorting technology. Past and  
present-day programs on shale oil refining to obtain  
transportation fuels are discussed with emphasis on  
jet fuel production. Tables characterizing aircraft  
turbine fuels and the properties of dewatered Paraho  
shale oil are presented.

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✓ 79A25900 ISSUE 9 PAGE 1561 CATEGORY 28 RPT#:  
SAE PAPER 781027 78/11/00 11 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Shale oil - The answer to the jet fuel availability  
question  
AUTH: A/ANGELLO, L. C.: B/CHURCHILL, A. V.: C/DELANEY, C.  
L.: D/LANDER, H. R. PAA: D/(USAF, Aero Propulsion  
Laboratory, Wright-Patterson AFB, Ohio)  
Society of Automotive Engineers, Aerospace Meeting,  
San Diego, Calif., Nov. 27-30, 1978. 11 p.  
MAJS: /\*AIRCRAFT FUELS/\*JET ENGINE FUELS/\*MILITARY AIRCRAFT  
/\*SHALE OIL/\*SYNTHETIC FUELS  
MINS: / COST REDUCTION/ ENERGY REQUIREMENTS/ ENERGY  
TECHNOLOGY/ FUEL CONSUMPTION/ MILITARY TECHNOLOGY  
ABA: A. L. W.  
ABS: The Air Force began in 1974 a program to investigate  
the possibility of using alternative domestic liquid  
hydrocarbons, primarily shale oil, as sources for the  
standard jet fuel, JP-4, in order to ensure adequate  
fuel availability at an acceptable cost. The paper  
discusses the results of this program and its future  
goals. Results of processing studies on alternative  
hydrocarbon sources from shale oil are presented; it  
is found that shale oil processing resulted in  
specification turbine fuel when hydrotreated at 1500  
psi, while coal liquids failed to meet specifications  
even when hydrotreated to 2200 psi. Fuel derived from  
shale oil was also found to be economically  
competitive under proper conditions. Results from  
shale oil-derived fuel combustion studies are  
presented, showing the effects of hydrogen and  
nitrogen content on combustor liner temperature, smoke  
and NOx emission. A projection of future  
specifications of Air Force aviation fuels is then  
presented.

✓ 79N13548# ISSUE 4 PAGE 483 CATEGORY 44 RPT#:  
PB-284480/1 EPA-600/7-78-020 CNT#: EPA-68-01-4337  
78/02/00 57 PAGES UNCLASSIFIED DOCUMENT

UTTL: EPA program status report: Oil shale  
AUTH: A/ECKSTEIN, L.  
CORP: Cameron Engineers, Inc., Denver, Colo. AVAIL.NTIS  
SAP: HC A04/MF A01  
MAJS: /\*ENERGY POLICY/\*ENVIRONMENT PROTECTION/\*POLLUTION  
MONITORING/\*SHALE OIL  
MINS: / CARCINOGENS/ ECOLOGY/ GEOCHEMISTRY/ VEGETATION/  
WASTE DISPOSAL  
ABA: GRA  
ABS: An overview of oil shale research and development  
efforts performed by EPA, or funded by EPA monies  
passed through to other federal agencies under the  
interagency Energy/Environment R and D Program is  
presented. Topics included are: the purpose,  
background, and rationale behind EPA's efforts; EPA  
program goals and fiscal year 1977 program funding;  
and the scope-of-work for 55 projects. A table  
summarizes these projects by presenting project title,  
sponsoring agency, performing organization, and  
project duration.

✓ 79A10824\*# ISSUE 1 PAGE 54 CATEGORY 28  
78/04/00 21 PAGES UNCLASSIFIED DOCUMENT

UTTL: Alternative aircraft fuels  
AUTH: A/LONGWELL, J. P.: B/GROBMAN, J. PAA: A/(MIT,  
Cambridge, Mass.): B/(NASA, Lewis Research Center,  
Cleveland, Ohio)  
CORP: Massachusetts Inst. of Tech., Cambridge.; National  
Aeronautics and Space Administration, Lewis Research  
Center, Cleveland, Ohio.  
American Society of Mechanical Engineers, Gas Turbine  
Conference and Products Show, London, England, Apr.  
9-13, 1978, Paper, 21 p.  
MAJS: /\*AIRCRAFT FUELS/\*COAL UTILIZATION/\*JET ENGINE FUELS/\*  
SHALE OIL  
MINS: / AIRCRAFT FUEL SYSTEMS/ BOILING/ COMBUSTION CHAMBERS/  
ENGINE DESIGN/ MELTING POINTS/ REFINING/ THERMAL  
STABILITY  
ABA: G. R.  
ABS: In connection with the anticipated impossibility to  
provide on a long-term basis liquid fuels derived from  
petroleum, an investigation has been conducted with  
the objective to assess the suitability of jet fuels  
made from oil shale and coal and to develop a data  
base which will allow optimization of future fuel  
characteristics, taking energy efficiency of  
manufacture and the tradeoffs in aircraft and engine  
design into account. The properties of future aviation  
fuels are examined and proposed solutions to problems  
of alternative fuels are discussed. Attention is given  
to the refining of jet fuel to current specifications,  
the control of fuel thermal stability, and combustor  
technology for use of broad specification fuels. The  
first solution is to continue to develop the necessary  
technology at the refinery to produce specification  
jet fuels regardless of the crude source.

JET FUEL FROM SHALE OIL?, by L.C. Angelo, A.V. Church-  
ill, C.L. Delaney and H.R. Lander.  
Automotive Engineering, vol. 86, no. 12, December 1978,  
p.58-60.

79N14168# ISSUE 5 PAGE 570 CATEGORY 24 RPT#:  
UCRL-52000-78-6 CNT#: W-7405-ENG-48 78/06/00 35  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy and Technology Review, June 1978 --- composite materials for flywheels, shale oil recovery, and seismic safety at nuclear power plants  
AUTH: A/SHAY, H. D.; B/LIEN, P. L.; C/PRONO, J. K.; D/STAEHLE, J. T. PAT: A/ed.; B/ed.; C/ed.; D/ed.  
CORP: California Univ., Livermore. Lawrence Livermore Lab. AVAIL.NTIS SAP: HC A03/MF A01  
MAJS: /\*COMPOSITE MATERIALS/\*ENERGY TECHNOLOGY/\*FLYWHEELS/\*OIL RECOVERY/\*REACTOR SAFETY/\*SEISMIC ENERGY/\*SHALE OIL  
MINS: / COMPUTERIZED SIMULATION/ LASER OUTPUTS/ NEUTRONS/ NUCLEAR POWER PLANTS/ REINFORCING FIBERS/ SAFETY  
ABA: A.R.H.  
ABS: A yield of  $7.3 \times 10$  to the 9th power neutrons and a 6 keV ion temperature was recorded for Shiva's first 20 beam shot on target. The laser delivered a record 26TW in less than 0.1 ns. The development of lightweight fiber composite materials for various applications is discussed with emphasis on their use in energy storage flywheels. Methods for preheating the rubble bed with hot inert gas as a startup means for controlled combustion retorting of oil shale are examined as well as efforts to improve and update the technical basis for assessing seismic safety at nuclear power facilities.

### WHAT PRICE OIL SHALES?

Ramues Gallois  
New Scientist

Vol.77 no. 1091 Feb. 23, 1978  
p.490-493

Major deposits of oil shale occur on every continent and have, at one time or another, been worked in most industrialised countries. However, these workings have never been on a large scale for a number of reasons. First, oil shales have to be retorted to about 500°C before they yield oil in commercial quantities. The energy profit from this process is small because of the inefficiency of the retorting and the cost of winning, retorting, refining and land reinstatement; shale oil could therefore only be competitive with naturally occurring oils if worked on a vast scale. Secondly, because the spent shale after retorting has a similar volume to the raw shale, has few uses and may include small quantities of carcinogens, its disposal presents formidable environmental problems.

TJ Perspectives on the energy crisis : technical,  
163.2 regulatory, environmental, economic, pro-  
P4P spective. / advisory editors, Howard Gordon,  
Roy Meador. -- Ann Arbor, Mich. : Ann Arbor  
Science Publishers, c1977.  
2 v. : ill. ; 29 cm.

### OIL SHALES OF UNITED STATES--A REVIEW . . . . 49

(From *Science and Technology of Oil Shale*, By T. F. Yen, Associate Professor of Chemical Engineering, Environmental Engineering Sciences and Medicine, University of Southern California. Published by Ann Arbor Science Publishers, Inc., 1976)

The long-range importance of oil shale in the full energy profile of the U.S. makes this information significant and useful. Dr. Yen's study is the most comprehensive and technically authoritative on the subject in half a century. In this review, the nature and location of oil shale are discussed as well as the technology of economical recovery. A considerable reference list supplements and supports the author's data.

77N15499# ISSUE 6 PAGE 770 CATEGORY 44 RPT#:  
UCRL-77831 CONF-760443-2 CNT#: W-7405-ENG-48  
76/04/27 32 PAGES UNCLASSIFIED DOCUMENT

UTTL: Pyrolysis of oil shale: The effects of thermal history on oil yield  
AUTH: A/STOUT, N. D.; B/KOSKINAS, G. J.; C/RALEY, J. H.; D/SANTOR, S. D.; E/OPILA, R. J.; F/ROTHMAN, A. J.  
CORP: California Univ., Livermore. Lawrence Livermore Lab. AVAIL.NTIS SAP: HC A03/MF A01  
Presented at 9th Oil Shale Symp., Golden, Colo., 29-30 Apr. 1976  
MAJS: /\*ASSAYING/\*OIL RECOVERY/\*PYROLYSIS/\*SHALE OIL  
MINS: / CHARRING/ FLOW VELOCITY/ GAS ANALYSIS/ INERT ATMOSPHERE  
ABA: Author (ERA)  
ABS: The effect of thermal history on the oil yield of a powdered, 22-gallon-per-ton Colorado shale was studied by heating to test temperature at Fischer assay rate, holding a test temperature for varying times up to 33 d, and finally heating to 500 C at 12 C/min. Test temperatures covered the range of 150 to 450 C. Both autogenous and inert sweep gas atmospheres were used. Under autogenous atmospheres at test temperatures of 250 C or below, yields obtained were 100 percent of Fischer assay. Heating at 300 to 425 C resulted in yield losses, maximizing at 19 percent after a 33 d exposure at 350 C. Yield losses were accompanied by increased char in the retorted shale and by production of oil that was lower in density and nitrogen content, and higher in hydrogen. In the inert gas sweep experiments, increasing flow rates gave increased oil yields, approaching 100 percent assay.

77N13231# ISSUE 4 PAGE 449 CATEGORY 28 RPT#:  
AD-A025417 NAPTC-PT-82 76/05/00 47 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Evaluation of a JP-5 type fuel derived from oil shale  
TLSP: Interim Report

AUTH: A/SOLASH, J.; B/NOWACK, C. J.; C/DELFOSE, R. J.  
CORP: Naval Air Propulsion Test Center, Trenton, N.J. CSS:  
(Dept. of Propulsion Technology and Projection

Engineering.) AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /\*JP-5 JET FUEL/\*KEROSENE/\*SHALE OIL

MINS: / CARBON MONOXIDE/ EXHAUST GASES/ HELICOPTER ENGINES/  
HYDROCARBONS/ NITROGEN OXIDES/ PROPULSION SYSTEM  
PERFORMANCE

ABA: Author (GRA)

ABS: A kerosene fuel derived from oil shale was evaluated  
for suitability as a substitute for petroleum derived  
JP-5. Engine performance and gaseous emissions were  
evaluated using a T63-A-5A engine. Specification  
analyses were performed to determine conformance with  
the MIL-T-5624J specification for JP-5 grade fuel.  
Engine performance of the oil shale derived fuel was  
equivalent to that of a typical petroleum derived  
JP-5. While carbon monoxide (CO) and unburned  
hydrocarbon (THC) emissions of the oil shale fuel were  
equivalent to those of petroleum fuels, the nitrogen  
oxides were higher for the oil shale fuel. A high  
concentration of fuel bound nitrogen was implicated as  
the cause for the high nitrogen oxide emissions. The  
oil shale derived fuel was found not to conform to  
specifications for contamination, existent gums,  
thermal stability, freeze point and viscosity at -34.5  
C (-30 F). A program of post-refinery upgrading  
studies was initiated in order to improve these  
deviant properties. This program included filtration,  
distillation, clay and acid treatment and urea  
extraction. It was found that no one single  
post-refinery treatment could improve all deviant  
properties.

77V17356 1975 ISS: 03 KF16.U69 1975

UTTL: A bill to amend the Clayton Act to preserve and  
promote competition among corporations in the  
production of oil, natural gas, coal, oil shale, tar  
sands, uranium, geothermal steam, and solar energy.  
U.S. Laws, Statutes, Etc. U.S. Congress. House.  
Committee on the Judiciary. Interfuel Competition Act  
of 1975.

GPO, Washington, D.C., 5 p. (H.R. 4907)

LC: Competition. Power resources.

NASA: / COAL/ COMPETITION/ ECONOMIC FACTORS/ ENERGY  
CONSERVATION/ ENERGY POLICY/ ENERGY SOURCES/ GASES/  
GEOTHERMAL RESOURCES/ LAW (JURISPRUDENCE)/ OILS/  
PRODUCTION PLANNING/ SOLAR ENERGY/ TAR SANDS/ UNITED  
STATES OF AMERICA/ URANIUM

MAIN-CORP TRACE-CORP\*TITL\* CATLG BY-JPL

76/12/21 AVAIL: / JPL

78A25225 ISSUE 9 PAGE 1601 CATEGORY 44  
77/00/00 261 PAGES UNCLASSIFIED DOCUMENT

UTTL: Oil Shale Symposium, 10th, Colorado School of Mines,  
Golden, Colo., April 21, 22, 1977. Proceedings

AUTH: A/REUBENS, J. B. PAT: A/(ED.) SAP: \$7.50  
Symposium sponsored by the Colorado School of Mines  
Golden, Colo., Colorado School of Mines Press, 1977.  
261 p

MAJS: /\*CONFERENCES/\*ENERGY TECHNOLOGY/\*SHALE OIL

MINS: / ADIABATIC CONDITIONS/ CARBONIZATION/ ECONOMIC  
FACTORS/ GASOLINE/ LAW (JURISPRUDENCE)/ MATERIALS  
HANDLING/ MICROWAVE SENSORS/ MINING/ PROCESSING/  
PURIFICATION/ PYROLYSIS/ SCRUBBERS/ TRANSPORT  
PROPERTIES/ WASTE DISPOSAL

ABA: J.M.B.

ABS: Oil shale research is presented, with emphasis on in  
situ retorting to minimize solid materials handling  
problems, as well as toxic substances control and  
environmental planning needed for large-scale  
commercial oil shale operations. Topics discussed  
include production of gasoline from oil shale, the  
economics of combined in situ and surface retorting,  
pillar and longwall mining of oil shale, the dynamics  
of oil generation and degradation during oil shale  
retorting, microwave radiation assays of oil shale,  
the partitioning of As, Cd, Cu, Hg, Pb and Zn during  
oil shale retorting, legal problems involved in water  
usage for oil shale development in Colorado, and the  
effects of gas introduced during retorting.

TN  
858

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1977

Symposium on Oil Shale, 10th, Colorado School  
of Mines, 1977.

Proceedings of the Tenth Oil Shale Sym-  
posium / James H. Garv, editor ; symposium  
sponsored by Colorado School of Mines, April  
21-22, 1977. — Golden : Colorado School of  
Mines, c1977.

v, 256 p. : ill. ; 28 cm.

Includes bibliographical references.

ISBN 0-018062-01-2

✓ 77A48502 ISSUE 23 PAGE 3979 CATEGORY 44  
76/00/00 232 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Science and technology of oil shale --- Book  
AUTH: A/YEN, T. F. PAA: A/(Southern California,  
University, Los Angeles, Calif.) PAT: A/(ED.) SAP:  
\$32.50  
Ann Arbor, Mich., Ann Arbor Science Publishers, Inc.,  
1976. 232 p  
MAJS: /\*ENERGY TECHNOLOGY/\*MATERIALS RECOVERY/\*SHALE OIL/\*  
TECHNOLOGY ASSESSMENT  
MINS: / CARCINOGENS/ CATALYSTS/ DEGRADATION/ ETHANE/  
ETHYLENE/ KEROGEN/ LEACHING/ MINERAL DEPOSITS/ NUCLEAR  
MAGNETIC RESONANCE/ OXIDATION-REDUCTION REACTIONS/

ABSA: PYROLYSIS/ SULFUR

ABA: S.C.S.

ABS: A systematic review of oil shale research is presented including papers which discuss U.S. oil shale deposits, modification of the mineral matrix by bioleaching, mild oxidation procedures for bioleaching oil shale, electrolytic oxidation and reduction of oil shale, and pulsed nuclear magnetic resonance for the estimation of potential oil yields. Retorting of oil shale is presented with regard to indexes for oil shale pyrolyses from ethylene/ethane ratios of product gases, and polycondensed aromatic compounds and carcinogens in shale ash of carbonaceous spent shale. Environmental concerns are outlined along with sulfur recovery in a biochemical method of oil shale production, microbial degradation of oil shale, and structural investigations of kerogen's hydrogen structure.

Oils, Shale *TN858. A1595 1977* ?

Symposium on Oil Shale, 10th, Colorado School of Mines, 1977.

Tenth Oil Shale Symposium proceedings / symposium sponsored by Colorado School of Mines, April 21-22, 1977, Golden, Colorado : John B. Reubens, proceedings editor. — Golden : Colorado School of Mines Press, 1977.

v, 256 p. : ill. : 28 cm.

Includes bibliographies.

ISBN 0-918062-01-2 : \$7.50

Oil shale research is presented, with emphasis on in situ retorting to minimize solid materials handling problems, as well as toxic substances control and environmental planning needed for large-scale commercial oil shale operations. Topics discussed include production of gasoline from oil shale, the economics of combined in situ and surface retorting, pillar and longwall mining of oil shale, the dynamics of oil generation and degradation during oil shale retorting, microwave radiation assays of oil shale, the partitioning of As, Cd, Cu, Hg, Pb and Zn during oil shale retorting, legal problems involved in water usage for oil shale development in Colorado, and the effects of gas introduced during retorting.

J.M.B.

Colorado. School of

77-152996

MARC

✓ 77N28603# ISSUE 19 PAGE 2553 CATEGORY 44 RPT#:  
CONF-760602 CNT#: W-7405-ENG-26 76/00/00 152  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Sampling strategy and characterization of Potential Emissions from Synfuel Production Symposium

CORP: Radian Corp., Austin, Tex. AVAIL.NTIS SAP: HC A08/MF A01

Symp. held at Austin, Tex., 8-10 Jun. 1976

MAJS: /\*COAL/\*ENERGY CONVERSION/\*SHALE OIL

MINS: / ENVIRONMENT PROTECTION/ LAW (JURISPRUDENCE)/ SAMPLING

ABA: GRA

ABS: The rapidly increasing energy demand has brought increased emphasis on the conversion of coal and oil shale to fluid fuels. These solid fuels provide a significantly greater pollution potential than petroleum. For the conversion program to be successful, effort must be directed toward the establishment of meaningful emissions standards. Yet meaningful regulations cannot be established for these processes without reliable emission stream data that are not now available. While the need for stream composition data is widely recognized, the complexity of the technology and the absence of representative equipment combined with the need for complex sampling and analytical procedures have limited progress in data acquisition.

TP

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.H4

Heavy oil gasification / edited by Arnold H. Pelofsky. — New York : M. Dekker, c1977. x, 163 p. : ill. ; 26 cm. — (Energy, power and environment ; 1) Includes bibliographical references and indexes.

ISBN 0-824766-38-5

1. Oil gasification. I. Pelofsky, Arnold H. II. Series.

NASA TM X-3551

Oils, Shale

1977

THERMAL STABILITY OF SOME AIRCRAFT TURBINE FUELS DERIVED FROM OIL SHALE AND COAL. Thaine W. Reynolds, LeRC. June 1977. 32p.

77A23551 ISSUE 9 PAGE 1439 CATEGORY 44

76/00/00 191 PAGES UNCLASSIFIED DOCUMENT

UTTL: Shale oil, tar sands, and related fuel sources ---  
Book

AUTH: A/YEN, T. F. PAA: A/(Southern California  
University, Los Angeles, Calif.) PAT: A/(ED.) SAP:  
\$21.50

Washington, D. C., American Chemical Society (Advances  
in Chemistry Series, No. 151). 1976. 191 p

MAJS: /\*CHEMICAL FUELS/\*ENERGY SOURCES/\*HYDROCARBON FULL

PRODUCTION/\*SHALE OIL/\*SYNTHETIC FUELS/\*TAR SANDS  
MINS: / BIOCHEMISTRY/ BITUMENS/ CANADA/ DESULFURIZING/  
HYDROGENATION/ MATERIALS RECOVERY/ SILICON DIOXIDE/  
SULFUR COMPOUNDS/ ZINC COMPOUNDS

ABA: B.J.

ABS: Attention is given to sulfur compounds in oils from  
the Western Canada Tar Belt, solutions of silica in  
Green River oil shale, characterization of the Utah  
Tar Sand bitumen, and the hydrogasification of oil  
shale. Also considered are the rate of dissolution of  
carbonate mineral matrix in oil shale by dilute acids,  
fracturing oil shale with explosives for in situ  
recovery, feasibility studies of a microbial method  
for the desulfurization of petroleum, the  
characterization of synthetic liquid fuels, and direct  
zinc chloride hydrocracking of sub-bituminous coal and  
regeneration of spent melt. Individual items are  
announced in this issue.

HD

Hagel, John

9502

Alternative energy strategies : constraints  
and opportunities / John Hagel III, -- New  
York : Praeger, c1976,

.052

H332

1976

xii, 165 p. ; 25 cm. -- (Praeger special  
studies in international economics and  
development)

STATUS OF RESEARCH AND DEVELOPMENT:

NONCONVENTIONAL CRUDE OIL SOURCES

Tar Sands

Oil Shale

Notes

15

19

21

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.A355  
no.151

Shale oil, tar sands, and related fuel sources:  
a symposium co-sponsored by the Division of  
Fuel Chemistry and the Division of Petroleum  
Chemistry, Inc. at the 167th Meeting of the  
American Chemical Society, Los Angeles,  
Calif., April 3-5, 1974 / Teh Fu Yen, editor.  
-- Washington, D. C. : American Chemical  
Society, 1976,  
vii, 184 p. : ill. ; 24 cm. -- (Advances  
in chemistry series ; 151)

(Continued on next page)

78V29810 1976 ISS: 00 TN858.035 0-444414-08-8 553.282  
LC-75-4.048

AUTH: A/Yen, Teh Fu.; B/Chillingar, George V. A/1927-  
UTTL: Oil shale / edited by Teh Fu Yen and George V.  
Chillingar.

Elsevier Scientific Pub. Co., Amsterdam : New York :  
Elsevier energy series : 1 Includes bibliographies and  
indexes.

LC: Oil-shales.

NASA: / FUEL OILS/ FUELS/ SHALE OIL

JPL: / TN858.Y45

MAIN-AUTH TRACE-SERS\*AUTH\* CATLG BY-LC  
/ / Publ In NETHERLANDS AVAIL: / JPL

77N75753# CATEGORY 44 RPT#: CONF-760342-5  
76/00/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Motor gasoline from shale oil

AUTH: A/COTTINGHAM, P. L.

CORP: Energy Research and Development Administration,  
Laramie, Wyo. CSS: (Energy Research Center.)  
AVAIL:NTIS

Presented at Symp. on Alternate Fuel Resources, Santa  
Maria, Calif., 25 Mar. 1976

MAJS: /\*CRUDE OIL/\*GASOLINE/\*MOTOR VEHICLES/\*SHALES  
MINS: / ENERGY TECHNOLOGY/ PYROLYSIS/ THERMAL DEGRADATION

✓ 78N76078# CATEGORY 44 RPT#: LERC/RI-77/7  
77/09/00 53 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Bibliography of publications dealing with oil shale  
and shale oil from US Bureau of Mines, 1917 - 1974,  
and the ERDA Laramie Energy Research Center, 1975 -  
1976  
CORP: Energy Research and Development Administration,  
Laramie, Wyo. AVAIL:NTIS  
MAJS: /\*LITERATURE/\*OIL RECOVERY/\*SHALE OIL  
MINS: / BIBLIOGRAPHIES/ ENERGY POLICY/ ENERGY SOURCES

✓ 77N75752# CATEGORY 44 RPT#: CONF-760342-3  
76/00/00 17 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Diesel fuels from shale oil  
AUTH: A/COTTINGHAM, P. L.  
CORP: Energy Research and Development Administration,  
Laramie, Wyo. AVAIL:NTIS  
Presented at Symp. on Alternate Fuel Resources, Santa  
María, Calif., 25 Mar. 1976  
MAJS: /\*DIESEL FUELS/\*SHALE OIL  
MINS: / COKE/ CRUDE OIL/ MOLECULAR WEIGHT

✓ 77V16033 1974 ISS: 01 HD9545.U83  
UTTL: Potential future role of oil shale. Project  
Independence. TLSP: Prospects and constraints.  
Project Independence blueprint. Final task force  
report.  
U.S. Interagency Task Force on Oil Shale. U.S. Dept.  
of the Interior. @U.S. Federal Energy Administration.  
GPO, Washington, D. C., 495 p.  
LC: Oil-shales.  
NASA: / SHALE OIL  
MAIN-CORP TRACE-CORP\*TITL\* CATLG BY-JPL  
76/12/16 AVAIL: / JPL

## Oils, Shale

TN  
858  
.S35

Science and technology of oil shale / edi-  
ted by T. F. Yen. -- Ann Arbor, Mich. :  
Ann Arbor Science Publishers, c1976.  
vi, 226 p. : ill. ; 24 cm.  
Includes bibliographical references and  
index.

ISBN C-250400-92-8

1. Oil-shales--Addresses, essays, lec-  
tures. 2. Oil-shale industry. 3. Oil-  
shales--Analysis. I. Yen, Teh Fu, 1927-

622.3382

OIL SHALE AND TAR SAND - MINING, PROCESSING AND CONVERSION

✓ 79A23830 ISSUE 8 PAGE 1435 CATEGORY 44  
79/01/00 4 PAGES In GERMAN UNCLASSIFIED DOCUMENT

UTTL: Oil shale in the U.S. - Current state of technology  
and research

AUTH: A/SCHMITZ, H. -H. PAA: A/(Bundesanstalt fuer  
Geowissenschaften und Rohstoffe, Hanover, West  
Germany)

Endoel und Kohle Erdgas Petrochemie vereinigt mit  
Brennstoff-Chemie, vol. 32, Jan. 1979, p. 31-34. In  
German.

MAJS: /\*ENERGY TECHNOLOGY/\*SHALE OIL/\*TECHNOLOGY ASSESSMENT  
/\*UNITED STATES OF AMERICA

MINS: / ENERGY CONVERSION EFFICIENCY/ ENVIRONMENT EFFECTS/  
RESEARCH AND DEVELOPMENT

ABA: G.R.

ABS: Programs have been undertaken by agencies of the U.S.  
Government with the objective to develop and  
demonstrate technologies for obtaining energy from oil  
shale by means of economical, operationally reliable,  
and environmentally acceptable approaches. Data for  
economically feasible methods are to be obtained until  
1980. The results of the investigations, which are  
funded by the U.S. Government, are to be made  
available to private industry. A description is  
presented of the main research institutes which are  
engaged in the programs of the U.S. Government  
concerned with oil shale, taking into account the  
Laramie Research Center, the Lawrence Livermore  
Laboratory, the Sandia Laboratories, and the Los  
Alamos Scientific Laboratory. Attention is also given  
to the activities of private firms and the current  
economical situation.

ORIGINAL PAGE IS  
OF POOR QUALITY

✓ 79N33552# ISSUE 24 PAGE 3224 CATEGORY 43 RPT#:  
PB-295665/4 EPA-600/7-79-075 CNT#: EPA-68-02-1681  
79/03/00 115 PAGES UNCLASSIFIED DOCUMENT

UTTL: Technology overview reports for eight shale oil  
recovery processes --- for evaluation of pollution  
control and environmental impact technologies

AUTH: A/SHIH, C. C.; B/COTTER, J. E.; C/PRIEN, C. H.;  
D/NEVENS, T. D.

CORP: TRW Energy Systems, Redondo Beach, Calif.

AVAIL.NTIS SAP: HC A06/MF A01

Prepared in cooperation with Denver Research Inst.,

Colo.

MAJS: /\*ENVIRONMENT POLLUTION/\*ENVIRONMENTAL MONITORING/\*OIL  
RECOVERY/\*POLLUTION CONTROL/\*SHALE OIL/\*TECHNOLOGY  
ASSESSMENT

MINS: / COMBUSTION PRODUCTS/ ENERGY TECHNOLOGY/ LAND USE/  
SOLID WASTES/ WASTE DISPOSAL/ WASTE WATER

ABA: A.W.H.

ABS: Information for the evaluation of environmental  
impacts and pollution control technologies in  
connection with oil shale development is presented.  
General process descriptions, shale preparation  
requirements, equipment types, operating conditions,  
and process products and byproducts are reported. The  
physical and chemical characteristics of shale oil  
recovery, the energy and water requirements, the waste  
disposal, and site specific environmental aspects are  
examined.

79N33538# ISSUE 24 PAGE 3223 CATEGORY 43 RPT#:  
PB-29499B/O EPA-600/7-79-089 CNT#: EPA-R-806156  
79/03/00 71 PAGES UNCLASSIFIED DOCUMENT  
UTTL: EPA program status report: Oil shale, 1979 update  
AUTH: A/PRESSEY, R. E.; B/WESTCOTT, P. A.  
CORP: Denver Research Inst., Colo. AVAIL NTIS SAP: HC  
A04/MF A01  
MAJS: /\*ECOLOGY/\*ENVIRONMENT EFFECTS/\*ENVIRONMENT POLLUTION  
/\*POLLUTION CONTROL/\*SHALE OIL  
MINS: / AIR POLLUTION/ CARCINOGENS/ DUST/ GEOCHEMISTRY/  
HEALTH/ POLLUTION MONITORING/ SOLID WASTES/ WASTE  
DISPOSAL/ WATER POLLUTION  
ABA: GRA  
ABS: EPA studies related to the development and

commercialization of oil shale are providing information on health and ecological effects from pollutants created by the extraction and processing of oil shale, and on technological methods that can be used to control the release of those pollutants. The program is also assessing the environmental impact of the use of the fuels refined from shale oil. The reader with an overview of current oil shale research and development (R and D) efforts being performed by EPA, or being funded by EPA monies passed through to other Federal agencies under the five-year old 17 agency Interagency Energy Environment R and D Program. It covers extraction and handling, processing, energy-related processes and effects, and overall assessments. Project title, sponsoring agency, performing organization, project duration, and project contact are given.

### CANADA GOES AFTER THE ENERGY IN THE TAR SANDS.

Peter Nulty

Fortune. vol.97, no. 10, May 22, 1978, p 72-78

In the chilly thaw of spring, a brigade of construction workers in yellow hard hats is painting the last handrails of Syncrude, a citadel-like oil mine and processing plant in the midst of these frustrating sands. After four and a half years of building, the workmen of Bechtel Canada Ltd. are being replaced by Syncrude personnel in orange helmets, girding to wrest their first barrels of synthetic crude oil from the stubborn grit below. Over the next quarter century they will be taking out a billion barrels.

### TAR SANDS: A NEW FUELS INDUSTRY TAKES SHAPE

Thomas H. Maugh II

Science

Vol. 199 no. 4330 February 17, 1978  
p. 756-760

Canada has the largest confirmed deposits of tar sands in the world—the equivalent of more than 900 billion barrels of oil, not counting some large, unexplored deposits in the Northwest Territories. By the 1990's, production of oil from tar sands could approach 1 million barrels per day (bpd), or nearly a third of Canada's domestic requirements. Little or none of this oil will reach the United States, but the experience gained in Canada will have application here and elsewhere. The United States has the equivalent of more than 30 billion barrels of oil embedded in tar sands, 90 percent of it in Utah. The equivalent of some 200 billion barrels of oil is known to lie in tar sands along the north bank of the Orinoco River in Venezuela, and some geologists speculate that there may be as much as 2 trillion barrels. Smaller deposits are scattered throughout the world, and it is thought that a substantial deposit exists in the Soviet Union.

BON70149# CATEGORY 43 RPT#: NTIS/PS-79/0513/6  
79/06/00 169 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Oil shale mining processing, uses, and environmental impacts. Citations from the American Petroleum Institute Data Base TLSP: Progress Report, 1977 - Mar. 1979  
AUTH: A/HUNDEMANN, A. S.  
CORP: National Technical Information Service, Springfield, Va. AVAIL NTIS SAP: HC \$28.00/MF \$28.00  
MAJS: /\*BIBLIOGRAPHIES/\*ENERGY POLICY/\*ENVIRONMENTAL SURVEYS  
/\*MINING/\*SHALE OIL  
MINS: / CHEMICAL COMPOSITION/ ECONOMIC FACTORS/ PRODUCTION  
ENGINEERING/ SYNTHETIC FUELS/ THERMODYNAMIC PROPERTIES

79A41813 ISSUE 17 PAGE 3259 CATEGORY 44  
78/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Oil shale technologies and the potential for oil shale development

AUTH: A/DECORA, A. W.; B/CARPENTIER, H. C.; C/JENSEN, H. B. PAA: C/(U.S. Department of Energy, Laramie Energy Research Center, Laramie, Wyo.)  
In: INOVA: Industrial Innovation Conference, Paris, France, June 13-17, 1977, Proceedings, Volume 2, (A79-41801 17-44) Paris, Ministere de l'Industrie, 1978, p. 137-146.

MAJS: /\*ENERGY SOURCES/\*HYDROCARBON FUEL PRODUCTION/\*SHALE OIL

MINS: / CHEMICAL ENGINEERING/ ENERGY TECHNOLOGY/ PROCESS CONTROL (INDUSTRY)

ABA: B.J.

ABS: The technical feasibility of producing liquid hydrocarbon products from aboveground retorts has been established on a pilot plant scale. Many of these processes - the gas-combustion process, the Paraho process, the Union Oil process, and the TOSCO II process - have operated successfully at rates as high as 1000 tons per day. However, these processes must be scaled up by 10 to 20 times to contribute significantly to future energy supplies. Successful operation of commercial-sized modules is needed to provide realistic data for an economic analysis of an oil shale retorting process. This development will require several years if oil shale is to contribute significantly to near-term energy supply in the U.S.

#### GIANT OIL SANDS PLANT COMES ONSTREAM.

H.C. McIntyre.

Chem. Engineering, v.85, no.20, Sept.11,1978,  
p.123-125.

The largest oil-sands extraction and processing plant officially opens this month. Despite some startup woes in the new unit, planners feel that the technology is sound; construction of a third facility is being considered.

79A14698# ISSUE 3 PAGE 420 CATEGORY 44  
78/00/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Recovery of oil from oil shale - An overall technological perspective

AUTH: A/AHMAD, A.; B/HASAN, S. PAA: A/(Owens-Corning Fiberglas Technical Center, Granville, Ohio); B/(Control Data Corp., Houston, Tex.)  
In: Annual Conference on Energy, 4th, Rolla, Mo., October 11-13, 1977, Proceedings, (A79-14676 03-44) Rolla, Mo., University of Missouri-Rolla, 1978, p. 437-441.

MAJS: /\*ENERGY TECHNOLOGY/\*HYDROCARBON FUEL PRODUCTION/\*OIL RECOVERY/\*PETROLEUM PRODUCTS/\*PYROLYSIS/\*SHALE OIL/\* TECHNOLOGY ASSESSMENT

MINS: / ENERGY POLICY/ KEROGEN/ MINING/ PRODUCTION ENGINEERING/ THERMAL DEGRADATION

ABA: (Author)

ABS: The hydrocarbon content of oil shale can be converted into liquid oil which is a possible energy resource for the future. Different aspects of shale oil recovery are briefly discussed. The technology of modified in situ oil shale retorting, which is receiving increasing attention for commercialization, is discussed in a little more detail.

Oils, shale

1978

TJ Energy Technology Conference, 5th, Washington, D.C., 1978.

153 .E4787

1978

Energy technology V : challenges to technology : proceedings of the fifth Energy Technology Conference, February 27-March 1, 1978, Washington, D.C. / edited by Richard F. Hill. -- Washington : Government Printing Office, 1978.

FEDERAL EFFORTS TO PROMOTE OIL SHALE p.979

Paul Petrick, Acting Assistant Director, Division of Commercial Applications, Department of Energy

STATE AND LOCAL PERSPECTIVE OF OIL SHALE DEVELOPMENT

Frank G. Cooley, Attorney at Law p.990

LRC-69

78A41521 ISSUE 17 PAGE 3123 CATEGORY 44 CNT#: W-7405-ENG-48 78/00/00 47 PAGES UNCLASSIFIED DOCUMENT

UTTL: Oil shale retorting - Effects of particle size and heating rate on oil evolution and intraparticle oil degradation  
AUTH: A/CAMPBELL, J. H.; B/KOSKINAS, G. H.; C/STOUT, N. D.; D/COBURN, T. T. PAA: C/(California University, Livermore, Calif.); D/(Boston, University, Boston, Mass.)

In Situ, vol. 2, no. 1, 1978, p. 1-47.  
MAJS: /\*EVOLUTION (LIBERATION)/\*PYROLYSIS/\*SHALE OIL/\*TEMPERATURE EFFECTS/\*THERMAL DEGRADATION  
MINS: / COKE/ ENERGY TECHNOLOGY/ MATHEMATICAL MODELS/ PARTICLE SIZE DISTRIBUTION/ REACTION KINETICS  
ABA: M. L.  
ABS: A study of the evolution of oil during pyrolysis of cylindrical blocks and powders of oil shale shows that coking reactions are the major source of intraparticle oil degradation and that particle size (up to 17.2 cm) and grade (14 to 49 gal/ton) have little effect on the degree of intraparticle oil degradation during shale retorting. The degree of coking depends strongly on the heating rate - for example, for both powders and 17.2-cm diameter blocks, a heating rate of 2 C/hr led to the collection of 83% of Fischer assay oil, while a heating rate of 180 C/hr produced a yield of 99%. The experimental results are analyzed by means of a simple mathematical model, and model calculations for the rate of oil production, the degree of oil degradation, and the thermal profile through the material are found to agree very closely with the experimental data.

78N31584# ISSUE 22 PAGE 2965 CATEGORY 44 RPT#: ERG-023 78/02/00 25 PAGES UNCLASSIFIED DOCUMENT DCAF E090993

UTTL: Energy analysis and oil shale reserves  
AUTH: A/HEMMING, D. F.  
CORP: Open Univ., Milton (England). CSS: (Energy Research Group.) AVAIL.NTIS SAP: HC A02/MF A01; Sec., Energy Res. Group, Walton Hall, Milton Keynes, Engl.  
MAJS: /\*ENERGY POLICY/\*OIL EXPLORATION/\*OIL RECOVERY/\*SHALES  
MINS: / ECONOMIC ANALYSIS/ ENERGY SOURCES/ ENERGY TECHNOLOGY / RESERVES/ SHALE OIL  
ABA: ESA  
ABS: Resources and reserves of shale oil throughout the world are reviewed with the United States having the largest known resources. Locations in the U.S. of these reserves are noted. An assessment of the ultimate recoverable reserves of oil available from oil shales in the world and in the U.S. is made with the economically and efficiently recoverable reserves also being given.

## OIL SANDS PUT CANADA ON FIRMER GROUND.

S. Ramachandra Rao.

New Scientist, v.79, no.1116, Aug.17,1978, p.462-64.

S. Ramachandra Rao Tar sands in the Alberta province is at the Department of Chemistry, University of Lethbridge, Alberta, Canada

of Canada are estimated to contain a potential 900 billion barrels (a barrel is 42 US gallons) of oil in the form of bitumen, which far exceeds Saudi Arabia's proven reserves of 132 billion barrels.

Present methods of extraction require huge open cast mines and subsequent processing plants are large, polluting and very costly. At present only 60 000 barrels per day are produced, though new plants coming on stream this year and in 1980 will boost the figure first to 185 000 and then to 285 000 barrels per day. Under present plans two further plants will raise this again to a total of 510 000 barrels per day by the early 1980s.

But such recovery methods have access to little more than 10-12 per cent of the total, insignificant when compared with the most conservative estimates of 100 billion barrels that would be within reach if in-situ extraction methods could be perfected. This means that if a production rate of 1 million barrels per day is ever reached, the reserves would last for over 300 years.

For this reason research and development is now concentrating on ways of releasing the bitumen on the sand bed itself, and pumping it up to the surface for upgrading and processing into synthetic crude oil. The energy future of Canada and maybe all North America could depend on its success.

79N20272# ISSUE 11 PAGE 1416 CATEGORY 28 RPT#: AD-A062420 AD-E000240 NAL-MR-3844 78/08/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Aging behavior of crude shale oil TLSP: Progress Report  
AUTH: A/HAZLETT, R. N.; B/HALL, J. M.; C/BURNETT, J. C.  
CORP: Naval Research Lab., Washington, D. C. AVAIL.NTIS  
SAP: HC A02/MF A01  
MAJS: /\*AGING (MATERIALS)/\*CRUDE OIL/\*SHALE OIL  
MINS: / ACCELERATED LIFE TESTS/ AMBIENT TEMPERATURE/ MOLECULAR WEIGHT/ STORAGE STABILITY/ VISCOSITY  
ABA: Author (GRA)  
ABS: Crude shale oil produced by the Paraho retort was heated for eight weeks at 50 C. This corresponds to at least one year of storage at ambient conditions. Increases in oil viscosity and in the content of high molecular weight compounds were observed, but pour point changes were minimal. The overall changes at the experimental conditions used are modest.

79N28658# ISSUE 19 PAGE 2566 CATEGORY 43 RPT#:  
UCRL-81717 CONF-790423-2 CNT#: W-7405-ENG-48  
78/09/00 22 PAGES UNCLASSIFIED DOCUMENT

UTTL: Multiphase flow analysis of oil shale retorting  
AUTH: A/GIDASPOW, D.; B/LYCZKOWSKI, R. W.  
CORP: California Univ., Livermore, Lawrence Livermore Lab.  
AVAIL.NTIS SAP: HC A02/MF A01  
Presented at 2d Multiphase Flow and Heat Transfer  
Symp. Workshop, Miami Beach, Fla., 16 Apr. 1979

MAJS: /\*MULTIPHASE FLOW/\* SHALE OIL  
MINS: / FRACTURE MECHANICS/ GEOLOGY/ ROCKS/ SPECIFIC HEAT  
ABA: DOE

ABS: Several multiphase phenomena occur during oil shale retorting. An analysis is presented of two of these processes including condensation of oil shale vapor and oscillations of pressure in oil shale blocks through cracked bedding planes. Energy conservation equations for oil shale retorting, which include the effects associated with condensation of oil, are derived on the basis of two phase flow theory. It is suggested that an effective heat capacity associated with the latent heat of condensation should be included in the modeling of simulated modified in situ oil shale retorting. A pressure propagation equation for fast transients in oil shale cracks has been derived and examined in view of existing experimental data. For slow processes, a limiting solution for maximum pressure in oil shale rocks has been obtained. Generation of high pressures in rocks by thermal or other means may lead to rock fracture which may be taken advantage of in modified in situ oil shale processing.

## ELECTRICAL EXTRACTION OF OIL FROM TAR SAND

Fred E. Vermeulen and F. Stephen Chute  
IEEE Trans. on Industry Applications  
Vol. IA-13 No. 6 Nov/Dec 1977  
p. 604-607

*Abstract*—A new technique for the separation of bitumen from tar sand is described. In this technique an electrical current is passed through a quantity of tar sand which is positioned in a vessel beneath a column of water. The passage of current causes the tar sand and the lower portion of the water column to become violently agitated and to eject particles of bitumen and sand. The bitumen particles rise to the surface of the water where they combine to form a froth. The sand particles rise only a short distance and then fall back towards the bottom of the vessel. Figures for energy balance and for the composition of the extracted bitumen and the tailings are given for laboratory scale experiments. The technique is compared to the commercially used hot-water separation process.

78N24370\*# ISSUE 15 PAGE 1976 CATEGORY 28  
RPT#: NASA-TM-78865 E-9596 78/00/00 26 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Characteristics and combustion of future hydrocarbon fuels --- aircraft fuels  
AUTH: A/RUDEY, R. A.; B/GROBMAN, J. S.  
CORP: National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A03/MF A01

Proposed for presentation at Lecture Series 96, Paris, Munich, London, 12-20 Oct. 1978; sponsored by AGARD  
MAJS: /\*AIRCRAFT FUELS/\*COMBUSTION PRODUCTS/\*FUEL COMBUSTION  
/\*HYDROCARBON FUELS/\*THERMODYNAMIC PROPERTIES  
MINS: / COMBUSTION PHYSICS/ CRUDE OIL/ FUEL CONSUMPTION/  
SHALE OIL/ SOOT/ SYNTHETIC FUELS

ABA: Author

ABS: As the world supply of petroleum crude oil is being depleted, the supply of high-quality crude oil is also dwindling. This dwindling supply is beginning to manifest itself in the form of crude oils containing higher percentages of aromatic compounds, sulphur, nitrogen, and trace constituents. The result of this trend is described and the change in important crude oil characteristics, as related to aircraft fuels, is discussed. As available petroleum is further depleted, the use of synthetic crude oils (those derived from coal and oil shale) may be required. The principal properties of these syncrudes and the fuels that can be derived from them are described. In addition to the changes in the supply of crude oil, increasing competition for middle-distillate fuels may require that specifications be broadened in future fuels. The impact that the resultant potential changes in fuel

properties may have on combustion and thermal stability characteristics is illustrated and discussed in terms of ignition, soot formation, carbon deposition, flame radiation, and emissions.

SHALE OIL: ALL DRESSED UP AND NO PLACE TO GO.  
Exxon USA, 2nd Quarter, 1977, p.22-25.

After a century of waiting, the shale oil industry resigns itself to more delays.

ORIGINAL PAGE IS  
OF POOR QUALITY

78A27784 ISSUE 10 PAGE 1790 CATEGORY 44  
77/09/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Oil shale - Its time has come  
AUTH: A/BRADSHAW, T. F. PAA: A/(Atlantic Richfield Co.,  
Los Angeles, Calif.)  
(Conference Mondiale de l'Energie, 10th, Istanbul,  
Turkey, Sept. 19-23, 1977.) Revue de l'Energie, vol.  
28, Aug.-Sept. 1977, p. Sp. 106-Sp. 115. In English  
and French.  
MAJS: /\*DOMESTIC ENERGY/\*OIL RECOVERY/\*RESEARCH AND  
DEVELOPMENT/\*SHALE OIL  
MINS: / BY-PRODUCTS/ COST ESTIMATES/ ECONOMIC IMPACT/ ENERGY  
POLICY/ ENERGY TECHNOLOGY/ ENVIRONMENT EFFECTS/  
RESERVES/ SOCIAL FACTORS/ SYNTHETIC FUELS  
ABA: S.C.S.  
ABS: Shale oil is considered a potential wide-scale  
alternative to conventional petroleum and natural gas  
reserves. Over half of the world's known oil shale  
reserves are located in the U.S., and it is estimated  
that a developed shale industry could produce about 12  
percent of the current U.S. demand. Various techniques  
for extracting oil from shale are currently available,  
and it is noted that valuable by-products may also be  
yielded, including ammonia, sulfur, and coke.  
Environmental concerns associated with the development  
of oil shale have been identified, along with the  
projected socioeconomic impact on the regions  
surrounding the oil shale reserves. The restraints to  
the commercial development of oil shale include rising  
development costs and governmental regulations.

79N70869# CATEGORY 44 RPT#: TID-28053/1-VOL-1  
CNT#: EF-77-A-043873 77/11/00 233 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Occidental vertical modified in situ process for the  
recovery of oil from oil shale: Phase 1, volume 1  
TLSP: Summary Report, 1 Nov. 1976 - 31 Oct. 1977  
AUTH: A/LOUCKS, R. A.  
CORP: Occidental Oil Shale, Inc., Grand Junction, Colo.  
AVAIL.NTIS  
MAJS: /\*CRUDE OIL/\*SHALE OIL  
MINS: / GEOLOGY/ HYDROLOGY/ MINES (EXCAVATIONS)

78A41518 ISSUE 17 PAGE 3123 CATEGORY 44 CNT#:  
W-7405-ENG-48 77/00/00 10 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Experimental work on oil shale at Lawrence Livermore  
Laboratory and predictions of retorting  
characteristics of oil shales  
AUTH: A/ROTHMAN, A. J.; B/LEWIS, A. E. PAA:  
B/(California, University, Livermore, Calif.)  
(Israel Conference on Mechanical Engineering, 11th,  
Haifa, Israel, July 11, 12, 1977.) Israel Journal of  
Technology, vol. 15, no. 4-5, 1977, p. 273-282.  
MAJS: /\*DISTILLATION/\*ENERGY TECHNOLOGY/\*RESEARCH AND  
DEVELOPMENT/\*SHALE OIL  
MINS: / CARBON DIOXIDE/ CHEMICAL REACTIONS/ KEROGEN/ MINING  
ABA: (Author)  
ABS: An experimental program is being carried out to  
advance oil-shale retorting technology. This paper  
summarizes some results of laboratory and pilot  
retorting and gives the reactions of oil-shale char  
with gases. A computer model of the retorting process  
has been compared with retort experiments and has been  
used to predict in situ retorts under various  
operating conditions. Finally, the results of a retort  
using Negev (Israel) oil shale are compared with those  
using Colorado oil shale.

78N25649# ISSUE 16 PAGE 2149 CATEGORY 44 RPT#:  
ZE-2346-16 DOW/SRPR-16 CNT#: EX-76-C-01-2346  
77/10/18 39 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy from in situ processing of antrim oil shale  
TLSP: Quarterly Technical Progress Report, Jul. - Sep.  
1977  
AUTH: A/HUMPHREY, J. P.  
CORP: Dcw Chemical Co., Midland, Mich. CSS: (Hydrocarbons  
and Energy Research Dept.) AVAIL.NTIS SAP: HC  
A03/MF A01  
MAJS: /\*ENERGY SOURCES/\*EXTRACTION/\*OIL RECOVERY/\*SHALE OIL  
MINS: / ENERGY POLICY/ GAS ANALYSIS/ OIL FIELDS/ SOIL  
MECHANICS  
ABA: ERA  
ABS: The first in situ extraction trial has been completed  
using an electrical heater to initiate combustion.  
Evidence of oxidation was obtained by analysis of  
gases from the production well. An attempt to induce  
horizontal fractures, was halted when vertical  
fractures were induced by the pressure applied to seal  
off a zone with a packer. Shale characterization work  
and resource inventory activity are well underway.

78N30261# ISSUE 21 PAGE 2779 CATEGORY 28 RPT#:  
SAND-77-6014 77/05/00 93 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Study of the production of shale oil from oil shale in  
Wuerttemberg TLSP: Final Report

AUTH: A/REED, F. H.

CORP: Sandia Labs., Albuquerque, N. Mex. AVAIL.NTIS

SAP: HC A05/MF A01

Sponsored by DOE Transl. into ENGLISH of German  
report FIAT-447, 31 Oct. 1945

MAJS: /\*ENERGY SOURCES/\*GERMANY/\*OIL RECOVERY/\*SHALE OIL/\*  
SHALES

MINS: / DISTILLATION/ ENERGY POLICY/ INDUSTRIAL PLANTS/  
MINES (EXCAVATIONS)/ PRODUCTION ENGINEERING

ABA: ERA

ABS: The geology of the Wuertemberg oil shale deposits is  
described and development of oil shale processing  
plants during World War in that area is reviewed. It  
is noted that of ten planned plants four were  
producing at the time of allied occupation.  
Experimental underground distillation of oil shale  
near Schorzingen is described. Test results showed  
that it is possible to distill Pasidonia oil shale  
underground. Underground distillation experiments are  
described in which the effects of distillation chamber  
cross section were evaluated. In experiments conducted  
to evaluate underground oil shale distillation in very  
large chambers are detailed.

78N25653# ISSUE 16 PAGE 2150 CATEGORY 44 RPT#:  
SAND-77-1497 QR-6 CNT#: EY-76-C-04-0789 77/10/00  
64 PAGES UNCLASSIFIED DOCUMENT

UTTL: Oil shale programs TLSP: Quarterly Report, Apr. -  
Jun. 1977

AUTH: A/BOADE, R. R. PAT: A/ed.

CORP: Sandia Labs., Albuquerque, N. Mex. AVAIL.NTIS

SAP: HC A04/MF A01

MAJS: /\*ENERGY POLICY/\*OIL RECOVERY/\*PRODUCTION ENGINEERING  
/\*SHALE OIL

MINS: / BEDS (PROCESS ENGINEERING)/ FRACTURES (MATERIALS)/

#### OIL EXPLORATION

ABA: Author

ABS: The operating characteristics of an oxygen probe (to  
monitor oxygen concentration in the effluent gases of  
a retort) were enhanced by improvements in the sensing  
electrodes and seals of the unit. Three hydrofractures  
were formed for the rubblelization experiment scheduled  
for later this year. The dependence of the fracture  
properties of oil shale on rate of deformation was  
examined through an analysis in which theoretical  
predictions were compared with experimental  
observations.

78N25646# ISSUE 16 PAGE 2149 CATEGORY 44 RPT#:  
LBL-6855 CONF-780305-6 CNT#: W-7405-ENG-48  
77/11/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Anaerobic fermentation of simulated in-situ oil shale  
retort water

AUTH: A/OSSIO, E. A.; B/FOX, J. P.; C/THOMAS, J. F.;

D/POULSON, R. E. PAA: D/(DOE, Laramie, Wyo.)

CORP: California Univ., Berkeley, Lawrence Berkeley Lab.

AVAIL.NTIS SAP: HC A02/MF A01

Presented at the Meeting of the Am. Chem. Soc.,  
Anaheim, Calif., 22-23 Mar. 1978

MAJS: /\*ANAEROBES/\*FERMENTATION/\*ORGANIC WASTES (FUEL  
CONVERSION)/\*SHALE OIL

MINS: / MATERIALS RECOVERY/ METHANE/ PH/ SEWAGE TREATMENT/  
TOXICITY

ABA: ERA

ABS: The feasibility of removing soluble organics from oil  
shale retort water by anaerobic digestion with methane  
production was experimentally investigated. The  
following conclusions were made. The retort water  
studied had to be pretreated to remove toxic and add  
deficient constituents before it could be successfully  
treated with the anaerobic fermentation process.  
Pretreatment included pH adjustment to 7, ammonia  
reduction, and nutrient addition. A digested sludge  
from a conventional municipal sewage treatment plant  
was successfully acclimated to the retort water  
studied. A major fraction of the organics in the  
retort water studied was stabilized by conversion to  
CH4 and CO2 using the anaerobic fermentation process.

78N21322# ISSUE 12 PAGE 1560 CATEGORY 28 RPT#:  
UCRL-52313 CNT#: W-7405-ENG-48 77/07/11 18 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Alternative fuels for transportation: Implications of  
the broad-cut option

AUTH: A/ANDERSON, C. J.

CORP: California Univ., Livermore, Lawrence Livermore Lab.  
AVAIL.NTIS SAP: HC A02/MF A01

MAJS: /\*FUEL OILS/\*HYDROCARBON FUELS/\*TRANSPORTATION ENERGY

MINS: / COAL/ CRUDE OIL/ DIESEL FUELS/ GASOLINE/ SHALE OIL

ABA: ERA

ABS: Broad-cut liquid hydrocarbon fuels could lead to  
important fuel savings through more efficient engines  
and fuel production. Broad-cut fuels could be made  
initially from petroleum and ultimately from coal, oil  
shale, or other economical sources. Engines designed  
for the fuels might include direct-injected,  
stratified, turbine, stirling, or spark-assisted  
diesel engines.

78N25579# ISSUE 16 PAGE 2140 CATEGORY 44 RPT#:  
CONF-770814-9 CNT#: EX-76-C-01-2315 77/00/00 42  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Catalytic hydroprocessing of shale oil to produce  
distillate fuels

AUTH: A/SULLIVAN, R. F.; B/STANGELAND, B. E.

CORP: Chevron Research Co., Richmond, Calif. AVAIL.NTIS

SAP: HC A03/MF A01

Presented at the 174th Natl. Am. Chem. Soc. Symp.,

Chicago, 28 Aug. - 2 Sep. 1977

MAJS: /\*DENITROGENATION/\*DISTILLATION/\*FUEL OILS/\*  
HYDROGENATION/\*SHALE OIL

MINS: / CATALYTIC ACTIVITY/ CRUDE OIL/ DEHYDROGENATION/  
REFINING/ SULFUR

ABA: ERA

ABS: Results are presented of a study to demonstrate the  
feasibility of converting whole shale oil to a  
synthetic crude resembling a typical petroleum  
distillate. The synthetic crude thus produced can then  
be processed, in conventional petroleum-refining  
facilities, to transportation fuels such as high  
octane gasoline, diesel, and jet fuel. It is shown  
that whole shale oil can be catalytically  
hydrodenitrified with the resulting synthetic crude  
resembling a petroleum distillate that can be  
fractionated and further processed. Shale oil contains  
about 0.6% sulfur. Sulfur is more easily removed by  
hydrofining than is nitrogen. Oxygen contained in the  
shale oil is also reduced to low levels during  
hydrodenitrification. The shale oil contains  
appreciable quantities of iron and arsenic which are  
removed by a guard bed placed upstream from the  
hydrofining catalyst. The naphthas from the shale oil  
hydrofiner can readily be upgraded to high octane  
gasoline by catalytic reforming. The middle distillate  
fraction may require some additional hydrofining to  
produce salable diesel or jet fuel.

77N25345\*# ISSUE 16 PAGE 2112 CATEGORY 28  
RPT#: NASA-TM-X-3551 E-9070 77/06/00 33 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Thermal stability of some aircraft turbine fuels  
derived from oil shale and coal

AUTH: A/REYNOLDS, T. W.

CORP: National Aeronautics and Space Administration, Lewis  
Research Center, Cleveland, Ohio. AVAIL.NTIS SAP:

HC A03/MF A01

Washington

MAJS: /\*COAL/\*JET ENGINE FUELS/\*SHALE OIL/\*THERMAL STABILITY

MINS: / AIRCRAFT ENGINES/ HYDROGENATION/ SYNTHETIC FUELS

ABA: Author

ABS: Thermal stability breakpoint temperatures are shown  
for 32 jet fuels prepared from oil shale and coal  
syncrudes by various degrees of hydrogenation. Low  
severity hydrotreated shale oils, with nitrogen  
contents of 0.1 to 0.24 weight percent, had breakpoint  
temperatures in the 477 to 505 K (400 to 450 F) range.  
Higher severity treatment, lowering nitrogen levels to  
0.008 to 0.017 weight percent, resulted in breakpoint  
temperatures in the 505 to 533 K (450 to 500 F) range.  
Coal derived fuels showed generally increasing  
breakpoint temperatures with increasing weight percent  
hydrogen, fuels below 13 weight percent hydrogen  
having breakpoints below 533 K (500 F). Comparisons  
are shown with similar literature data.

78N24694# ISSUE 15 PAGE 2021 CATEGORY 45 RPT#:  
EDP/F-01(77) 77/06/00 56 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Oil shale, FY 1977

AUTH: A/POWDERLY, J. D.; B/FRANKLIN, R.

CORP: Energy Research and Development Administration,  
Washington, D. C. AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /\*ENVIRONMENT EFFECTS/\*SHALE OIL

MINS: / ECONOMIC ANALYSIS/ SAFETY FACTORS/ SOCIAL FACTORS

ABA: ERA

ABS: The environmental, health, safety, and socioeconomic  
issues concerning the development of the program were  
identified and examined, and the requirements and  
actions needed to resolve these issues, and a time  
phased action plan for the evaluation and mitigation  
of environmental impacts is presented. The plan  
addressed the oil shale energy system including  
mining, crushing and sizing, fracturing, in situ and  
surface retorting, product recovery and upgrading,  
transportation, and end use.

77A23556 ISSUE 9 PAGE 1439 CATEGORY 44  
76/00/00 22 PAGES UNCLASSIFIED DOCUMENT

**UTTL:** Hydrogasification of oil shale  
**AUTH:** A/WEIL, S. A.; B/FELDKIRCHNER, H. L.; C/TARMAN, P. B. PAA: C/(Institute of Gas Technology, Chicago, Ill.)  
In: Shale oil, tar sands, and related fuel sources. (A77-23551 09-44) Washington, D.C., American Chemical Society, 1976, p. 55-76. Research sponsored by the American Gas Association.  
**MAJS:** /\*GASIFICATION/\*HYDROCARBON FUEL PRODUCTION/\*HYDROGENATION/\*SHALE OIL/\*SYNTHANE  
**MINS:** / AROMATIC COMPOUNDS/ CHEMICAL ANALYSIS/ CHEMICAL COMPOSITION/ CHEMICAL REACTORS/ COLORADO/ ECONOMIC ANALYSIS/ KEROGEN/ ORGANIC COMPOUNDS/ PRESSURE DISTRIBUTION/ TEMPERATURE EFFECTS/ THERMAL STABILITY (Author)  
**ABA:** (Author)  
**ABS:** Colorado oil shale was hydrogasified at temperatures up to 1400 F and pressures up to 500 psia. Both laboratory thermobalance tests and bench-scale moving-bed reactor tests were conducted. The thermobalance tests showed that at elevated hydrogen partial pressures with controlled slow shale heating, over 95% of the shale's organic carbon could be recovered. These results were verified in the bench-scale tests in which countercurrent hydrogen-shale contacting achieved organic carbon recoveries as high as 95%. Mineral carbonate decomposition was suppressed significantly by adding carbon dioxide to the feed gas.

77N77883# CATEGORY 43 RPT#: PB-256516/6  
BM-OFR-92-76 CNT#: DI-BM-S0241129 76/03/00 98  
PAGES UNCLASSIFIED DOCUMENT

**UTTL:** The production of oil from intermountain West tar sands deposits TLSP: Final Report  
**AUTH:** A/GLASSETT, J. M.; B/GLASSETT, J. A.  
**CORP:** Eyring Research Inst., Provo, Utah. AVAIL.NTIS  
**MAJS:** /\*CRUDE OIL/\*TAR SANDS/\*UTAH  
**MINS:** / GEOLOGY/ OIL EXPLORATION/ OIL FIELDS

77A27348 ISSUE 11 PAGE 1860 CATEGORY 44  
76/00/00 8 PAGES UNCLASSIFIED DOCUMENT

**UTTL:** Field experiment of in-situ oil recovery from a Utah tar sand by reverse combustion  
**AUTH:** A/CUPPS, C. O.; B/LAND, C. S.; C/MARCHANT, L. C. PAA: C/(ERDA, Laramie Energy Research Center, Laramie, Wyo.)  
AICHE Symposium Series, vol. 72, no. 155, 1976, p. 61-68.  
**MAJS:** /\*AIR FLOW/\*ENERGY TECHNOLOGY/\*MINERAL OILS/\*OIL RECOVERY/\*TAR SANDS  
**MINS:** / ASPHALT/ BURNING RATE/ FLAME PROPAGATION/ FLOW DISTRIBUTION/ HYDROCARBON COMBUSTION/ RESEARCH AND DEVELOPMENT/ UTAH  
**ABA:** B...  
**ABS:** Research in oil recovery from tar sands at the ERDA Laramie Energy Research Center is reviewed. Attention is given to the 1975 field experiment in the Northwest Asphalt Ridge near Vernal, Utah, to test in situ oil recovery by reverse combustion, which has two main advantages over forward combustion for tar sands: (1) vaporized fluids move through the hot, burned-out part of the reservoir with no possibility of plugging, and (2) the oil produced is of higher quality than the original bitumen.

77N21706# ISSUE 12 PAGE 1625 CATEGORY 44 RPT#:  
PB-260835/4 CNT#: EQ5AC007 EQ5AC008 SRI PROJ. 4000  
76/11/00 277 PAGES UNCLASSIFIED DOCUMENT

**UTTL:** A western regional energy development study: Economics. Volume 1: SRI energy model results TLSP: Final Report  
**CORP:** Stanford Research Inst., Menlo Park, Calif. AVAIL.NTIS SAP: HC A13/MF 401  
Sponsored in part by EPA, ERDA and Dept. of Interior  
**MAJS:** /\*COAL UTILIZATION/\*ECONOMIC ANALYSIS/\*ENERGY CONSUMPTION/\*ENERGY POLICY/\*SHALE OIL  
**MINS:** / DEMAND (ECONOMICS)/ FUEL OILS/ METHANE/ MODELS/ RESEARCH AND DEVELOPMENT/ SUPPLYING/ SYNTHETIC FUELS/ URANIUM  
**ABA:** GRA  
**ABS:** The economics of 38 energy resource development scenarios are examined. The supply analysis looks at capital investments and operating costs for extracting, converting, and transporting all forms of energy. The data were placed in a computer model along with a projection of U.S. energy demands to the year 2000. Vol. 1 presents the results and the Executive Summary.

77A27345 ISSUE 11 PAGE 1860 CATEGORY 44  
76/00/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Shale matrix plays important role in energy from oil shale

AUTH: A/SCHULMAN, B. L. PAA: A/(Oil Shale Corp., Golden, Colo.)  
AICHE Symposium Series, vol. 72, no. 155, 1976, p. 39-43.

MAJS: /\*CATALYTIC ACTIVITY/\*CHEMICAL REACTIONS/\*GASIFICATION  
/\*KEROGEN/\*SHALE OIL

MINS: / ADSORPTIVITY/ ASHES/ ENERGY TECHNOLOGY/ OIL  
EXPLORATION/ SYNTHANE/ SYNTHETIC FUELS/ TARS

ABA: B.J.

ABS: The paper examines several roles that the oil shale matrix (spent shale) can play as an integral part of a process scheme. The shale matrix can be a reagent for retaining sulfur in a solid form and act as a catalyst for gasification reactions. The availability of large amounts of alkaline solids should help eliminate sulfur plants with their emissions problems; the ability of the shale solids to provide a clean synthesis gas may also be used to simplify the ultimate conversion of the synthesis gas to synthetic methane. Raw shale may also be used directly as a source of fuel by direct combustion or gasification at controlled conditions.

77N12232# ISSUE 3 PAGE 316 CATEGORY 28 RPT#:  
AD-A025684 NRL-MR-3294 CNT#: WF57571301 76/05/00  
9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Electrostatic properties of JP-5 jet fuel from alternate sources

AUTH: A/LEONARD, J. T.  
CORP: Naval Research Lab., Washington, D. C. AVAIL.NTIS  
SAP: HC A02/MF A01

MAJS: /\*ELECTROSTATICS/\*JP-5 JET FUEL

MINS: / COAL/ CRUDE OIL/ ELECTRICAL RESISTIVITY/  
ELECTROSTATIC CHARGE/ IGNITION/ SAFETY

ABA: Author (GRA)

ABS: The electrostatic properties of JP-5 fuel from alternate sources were determined. Two properties electrical conductivity and electrostatic charging tendency - were measured on seven samples. Five coal-derived fuels and one sample derived from tar sands exhibited properties similar to jet fuels - derived from petroleum and hence should not develop unusual ignition hazards in field handling. A JP-5 produced from shale had higher values of conductivity and charging tendency than petroleum-derived fuels, but the combination of the two properties indicates that no abnormal electrostatic hazards should be encountered.

77A12693 ISSUE 2 PAGE 234 CATEGORY 44 76/00/00  
5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Oil shale development

AUTH: A/WELLMAN, P. PAA: A/(Ashland Oil, Inc., Ashland, Ky.)  
In: Intersociety Energy Conversion Engineering Conference, 11th, State Line, Nev., September 12-17, 1976. Proceedings, Volume 1. (A77-12662 02-44) New York, American Institute of Chemical Engineers, 1976, p. 331-335.

MAJS: /\*ENERGY POLICY/\*OIL EXPLORATION/\*RESOURCES MANAGEMENT  
/\*SHALE OIL

MINS: / GEOLOGICAL SURVEYS/ INDUSTRIES/ MINERAL DEPOSITS/  
TECHNOLOGY ASSESSMENT

ABA: S.N.

ABS: The almost fourfold increase in the world oil prices over the last three years and the growing dependence of the U.S. on oil imports (a 58% increase in oil imports in 1976 alone) makes an urgent development of alternate energy sources imperative. The paper examines the potential and possible ways of development for one of those sources, commercial U.S. oil shale deposit exploitation. According to the United States Geological Survey estimates, only in the Piceance Creek oil shale basin (Western Colorado) the total in-place reserves of oil assaying 15 gallons or more per ton is 1.8 trillion barrels or about three times the proven world reserves of oil. The major problems confronting oil shale industry development are discussed, including economic and financial, environmental political aspects, including those connected with the OPEC oil price politics, prospects for new discoveries of oil shale, conservation problems, technological problems, and social impact of the oil shale industry development. Government support is considered necessary for oil shale development in the near future.

77A12690 ISSUE 2 PAGE 186 CATEGORY 28 CNT#: F33615-74-C-2036 76/00/00 5 PAGES UNCLASSIFIED DOCUMENT

**UTTL:** A preliminary engineering assessment of jet fuel production from domestic coal and shale derived oils  
**AUTH:** A/KALFADELIS, C. D.; B/SHAW, H.; C/TAYLOR, W. F.  
**PAA:** C/(Exxon Research and Engineering Co., Linden, N.J.)  
**In:** Intersociety Energy Conversion Engineering

Conference, 11th, State Line, Nev., September 12-17, 1976, Proceedings, Volume 1. (A77-12662 02-44) New York, American Institute of Chemical Engineers, 1976, p. 315-319.

**MAJS:** /\*COAL LIQUEFACTION/\*JET ENGINE FUELS/\*SHALE OIL/\*SYNTHETIC FUELS

**MINS:** / ENERGY TECHNOLOGY/ HYDROGENATION/ JP-4 JET FUEL/ KEROSENE/ PILOT PLANTS

**ABA:** (Author)

**ABS:** A pilot plant program was recently completed that demonstrated that specification JP-4 and Jet A can be produced from domestic shale oils and coal liquids. Three shale oils and two coal liquids were evaluated in this study. All crude oil samples received were analyzed in our laboratories. The kerosene range (IBP-570 F/300 C) fraction was utilized as feed to our coal and shale hydrogenation (CASH) unit. Experimental runs with synthetic crudes have been made at liquid hourly space velocities (LHSV) of 0.5 to 1.0 at 700 F (370 C), using Ni/Mo or Co/Mo catalysts with target inlet hydrogen rate equivalent to 4000 SCF per barrel of liquid feed. Operations have been conducted at total pressures of 1500 psig (normal severity), 800 psig (low severity), and 2200 psig (high severity).

77A12692 ISSUE 2 PAGE 234 CATEGORY 44 76/00/00 6 PAGES UNCLASSIFIED DOCUMENT

**UTTL:** Hydrocarbon fuels from oil shale  
**AUTH:** A/SCHORA, F. C.; B/TARMAN, P. B.; C/FELDKIRCHNER, H. L.; D/WEIL, S. A. **PAA:** D/(Institute of Gas Technology, Chicago, Ill.)

**In:** Intersociety Energy Conversion Engineering Conference, 11th, State Line, Nev., September 12-17, 1976, Proceedings, Volume 1. (A77-12662 02-44) New York, American Institute of Chemical Engineers, 1976, p. 325-330. Research sponsored by the American Gas Association.

**MAJS:** /\*BEDS (PROCESS ENGINEERING)/\*ENERGY TECHNOLOGY/ HYDROCARBON FUEL PRODUCTION/\*SHALE OIL

**MINS:** / CHEMICAL REACTORS/ CLEAN ENERGY/ GASIFICATION/ HYDROGENATION/ SYNTHANE

**ABA:** S.D.

**ABS:** A new process based on controlled countercurrent heating of oil shale in the presence of hydrogen at moderate pressure levels is described for producing substitute natural gas and/or middle distillate type oils from oil shale. Before testing in large-scale experimental equipment, extensive testing was conducted in laboratory thermobalance to determine the effects of primary process variables on the rate and ultimate extent of kerogen removal measured as organic carbon removal. Moving-bed hydrogasification test were then performed in a 10-cm diam bench-scale reactor to

obtain results in large-scale equipment. Organic carbon recoveries as high as 95% were obtained at shale flow rates of up to 57 kg/hr. Temperature is found to be the most significant operating variable in the range of shale space velocities studied.

77N12230\*# ISSUE 3 PAGE 316 CATEGORY 28 RPT#:  
NASA-CR-135112 M1.76-1 CNT#: NAS3-19747 76/11/17  
64 PAGES UNCLASSIFIED DOCUMENT

UTTL: Synthesis and analysis of jet fuel from shale oil and coal syncrudes

AUTH: A/GALLAGHER, J. P.; B/COLLINS, T. A.; C/NELSON, T. J.; D/PEDERSEN, M. J.; E/ROBISON, M. G.; F/WISINSKI, L. J.

CORP: Atlantic Richfield Co., Harvey, Ill. CSS: (Technical Center.) AVAIL NTIS SAP: HC A04/MF A01

MAJS: /\*COAL LIQUEFACTION/\*HYDROGENATION/\*JET ENGINE FUELS/\* SHALE OIL

MINS: / COKE/ ENERGY POLICY/ FUEL TESTS/ HYDROCARBONS/ REFINING

ABA: Author

ABS: Thirty-two jet fuel samples of varying properties were produced from shale oil and coal syncrudes, and analyzed to assess their suitability for use. 105CO II shale oil and H-COAL and COED syncrudes were used as starting materials. The processes used were among those commonly in use in petroleum processing-distillation, hydrogenation and catalytic hydrocracking. The processing conditions required to meet two levels of specifications regarding aromatic, hydrogen, sulfur and nitrogen contents at two yield levels were determined and found to be more demanding than normally required in petroleum processing. Analysis of the samples produced indicated that if the more stringent specifications of 13.5% hydrogen (min.) and 0.02% nitrogen (max.) were met, products similar in properties to conventional jet fuels were obtained. In general, shale oil was easier to process (catalyst deactivation was seen when processing coal syncrudes), consumed less hydrogen and yielded superior products. Based on these considerations, shale oil appears to be preferred to coal as a petroleum substitute for jet fuel production.

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OF POOR QUALITY

77A35155 ISSUE 15 PAGE 2530 CATEGORY 44 CNT#:  
N00014-75-C-0055 75/00/00 7 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: The production of shale oil crude and its refining into military operational fuels

AUTH: A/BARTICK, H. PAA: A/(Applied Systems Corp., Arlington, Va.)

In: Energy and the environment; Proceedings of the Third National Conference, Oxford, Ohio, September 29-October 1, 1975. (A77-35146 15-42) Dayton, Ohio, American Institute of Chemical Engineers, 1975, p. 93-99.

MAJS: /\*CRUDE OIL/\*HYDROCARBON FUELS/\*PRODUCTION ENGINEERING /\*REFINING/\*SHALE OIL

MINS: / DIESEL FUELS/ JP-4 JET FUEL/ JP-5 JET FUEL/ MILITARY TECHNOLOGY/ PILOT PLANTS

ABA: (Author)

ABS: The production of 5,765 bbl of various military fuels (JP-4, JP-5/Jet-A, DFM/DF-2, gasoline, Heavy Fuel Oil) from 10,000 bbl of crude shale oil was accomplished in a commercial small-scale refinery having a capacity of about 9,000 BPSD. The 10,000 bbl of crude shale oil was produced by the Paraho process using the shale mined from the Naval Oil Shale Reserve located at Anvil Points, Colorado. The various fuels produced met a majority of the military, federal, and commercial specifications' requirements. However, these fuels tended to exhibit storage and thermal instabilities. In addition, the fuels contained a high wax content, high particulate matter, and high gum content. It is believed that a higher pressure in the hydrogenation stage (about 1500-3,000 psi), along with clay treatment of the final products, would reduce or eliminate some or most of these problem areas.

OIL SHALE AND TAR SAND - PROPERTIES, ANALYSIS AND COMPOSITION

79A49401 ISSUE 22 PAGE 4181 CATEGORY 44  
79/09/00 28 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Review - Thermophysical properties of oil shales  
AUTH: A/RAJESHWAR, K.; B/NOTTENBURG, R.; C/DUBOW, J.  
PAA: C/(Colorado State University, Fort Collins,  
Colo.)  
Journal of Materials Science, Vol. 14, Sept. 1979, p.  
2025-2052. Research supported by the U.S. Department  
of Energy and NSF.  
MAJS: /\*ENERGY SOURCES/\*KEROGEN/\*SHALE OIL  
MINS: / ELECTRICAL PROPERTIES/ ENERGY TECHNOLOGY/ MECHANICAL  
PROPERTIES/ MINERALOGY/ THERMODYNAMIC PROPERTIES  
ABA: (Author)  
ABS: Recent developments in the characterization of the  
thermophysical properties of various types of oil  
shales are reviewed. Changes in the thermal,  
mechanical and electrical properties of these  
technologically important materials are discussed,  
with temperature and organic content as the  
experimental variables. Structural models are  
presented to aid in predicting the variation of  
thermophysical parameters with organic content in the  
shale. Comparison of calculated results with  
experimental data are shown with thermal diffusivity  
as a representative parameter. Areas where further  
research of a fundamental nature would be of a  
particular relevance are also highlighted in the  
review.

IN-SITU COMBUSTION RETORTING OF OIL SHALE. M. C.  
Branch.

Progress in Energy and Combustion Science, vol 5, no 3,  
1979, p. 193-206.

79N28653# ISSUE 19 PAGE 2565 CATEGORY 43 RPT#:  
UCRL-81622 CONF-790405-8 CNT#: W-7405-ENG-48  
79/01/00 51 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Reaction kinetics for remodeling oil shale retorting  
AUTH: A/CAMPBELL, J. H.; B/BURNHAM, A. K.  
CORP: California Univ., Livermore. Lawrence Livermore Lab.  
AVAIL.NTIS SAP: HC A04/MF A01

Presented at the Am. Inst. of Chem. Eng. Meeting,  
Houston, Tex., 1-5 Apr. 1979

MAJS: /\*CHEMICAL REACTIONS/\*DECOMPOSITION/\*REACTION KINETICS  
/\*SHALE OIL  
MINS: / CARBON DIOXIDE/ GASIFICATION/ HYDROCARBONS/ HYDROGEN  
PRODUCTION/ METHANE/ MINERALS/ PYROLYSIS  
ABA: DOE  
ABS: Results from recent laboratory kinetic studies on  
gasification, pyrolysis, and mineral reactions in oil  
shale are presented. The specific pyrolysis reactions  
investigated include the decomposition of kerogen, the  
evolution of oil, hydrogen and C2 plus C3 hydrocarbons  
and the formation of a carbonaceous residue. Data  
describing the evolution of H2 and CH4 during  
secondary pyrolysis of the carbonaceous residue are  
also presented. The mineral reaction kinetics  
discussed include the decomposition and/or reaction  
(with silica or silicates) of calcite, dolomite,  
dawsonite and nahcolite. Rate equations describing the  
effects of CO2 and steam on the reactions of calcite  
and dolomite are presented. Kinetics describing  
gasification of the carbonaceous residue by CO2 and  
H2O are examined.

INORGANIC SULFUR SPECIES IN WASTE WATERS FROM IN SITU OIL SHALE PROCESSING, by Harold A. Stuber, Jerry A. Leenheer and David S. Farrier. Journal of Environmental Science and Health, vol. A13, no. 9, 1978, p. 663-675.

Thiosulfate and thiocyanate were found to be important solutes in four waste waters derived from combustion type in situ processing of oil shale.

SOLVENT SOLUBILIZATION, CHARACTERIZATION, AND QUANTITATION OF ALIPHATIC CARBOXYLIC ACIDS IN OIL SHALE RETORT WATER FOLLOWING CHEMICAL DERIVATIZATION WITH BORON TRIFLUORIDE IN METHANOL

BY: Robert G. Riley; et. al.

Anal Chem Vol 51 No 12 Oct. 1979, P. 1995-1998  
Boron trifluoride in methanol (BF<sub>3</sub>/MeOH) is an excellent reagent for transforming organic solvent insoluble components of oil shale retort water into derivatives which are easier to characterize and quantitate by classical analytical techniques. Treatment of a sample of freeze-dried retort water from the Paraho Oil Shale Demonstration Project (Rifle, Colo.) with BF<sub>3</sub>/MeOH converted 28% of the organic carbon in the sample to a benzene soluble form.

## NET ENERGY ANALYSIS OF IN SITU OIL SHALE PROCESSING

Gregg Marland, Alfred M. Perry and David B. Reister

Energy, Vol. 3, no. 1, Feb. 1978, p. 31-41.

Abstract—Although the domestic resources of shale oil are large, there has been some question regarding the magnitude of the energy subsidy that must be committed in order to extract the contained oil. This study shows that for a 50,000-bbl-per-day, modified *in situ* extraction facility in 20-gal-per-ton Green River Shale, the energy yield is about 8.6 times the energy subsidy and that about 21% of the in-place oil can be thus recovered. If the mined-out shale is retorted at the surface rather than being discarded, the recovery factor rises to 37% and the net energy ratio should rise significantly as well. It is difficult to compare these figures with those for aboveground retorts because oil burned in place for retorting never enters the energy accounts. However, the resource commitment per unit of recovered energy is more easily compared and is essentially indicated by the reciprocal of the recovery fraction.

78A47205 ISSUE 21 PAGE 3802 CATEGORY 44  
78/08/10 3 PAGES UNCLASSIFIED DOCUMENT

UTTL: Oil-shale kerogen - Low temperature degradation in molten salts

AUTH: A/BUGLE, R. C.; B/WILSON, K.; C/OLSEN, G.; D/WADE, L. G., JR.; E/OSTERYOUNG, R. A. PAA: E/(Colorado State University, Fort Collins, Colo.)

Nature, vol. 274, Aug. 10, 1978, p. 578-580. Research

supported by the U.S. Department of Energy.

MAJS: /\*CHEMICAL EFFECTS/\*HYDROLYSIS/\*KEROGEN/\*SHALE OIL/\*THERMAL DEGRADATION

MINS: / AROMATIC COMPOUNDS/ CATALYSIS/ ENERGY TECHNOLOGY/ LOW TEMPERATURE/ ORGANIC COMPOUNDS/ SODIUM COMPOUNDS

ABA: M.L.

ABS: The degradation of Green River oil shale, principally at 320 C, with use of a sodium chloride-saturated tetrachloro-aluminate melt is studied. Yield data are presented, and it is found that, while aromatic moieties are relatively inert to the solvent system, aliphatic materials containing carbon in other than sp<sup>3</sup> hybridization are especially reactive. It is suggested that the mechanism of degradation involves intramolecular disproportion catalyzed by the tetrachloroaluminate melt's ability to stabilize the resulting short-lived intermediates until the participating macromolecules have been sufficiently reduced in size to become soluble in conventional solvents.

78N33552# ISSUE 24 PAGE 3236 CATEGORY 44 RPT#:  
LERC-78/1 78/00/00 21 PAGES UNCLASSIFIED DOCUMENT

UTTL: Thermal conversion of oil-shale kerogen using CO and water at elevated pressures

AUTH: A/CUMMINGS, J. J.; B/ROBINSON, W. E.  
CORP: Department of Energy, Laramie, Wyo. CSS: (Energy Research Center.) AVAIL.NTIS SAP: HC A02/MF A01

MAJS: /\*CARBON MONOXIDE/\*ENERGY POLICY/\*HEAT TREATMENT/\*  
KEROGEN/\*PRESSURE VESSELS/\*REFINING/\*SHALE OIL

MINS: / ENERGY TECHNOLOGY/ HYDROCARBON FUELS/ SOLVENTS/  
THERMAL DEGRADATION

ABA: ERA

ABS: Temperature, heating time, pressure, presence or absence of mineral carbonates, shale particle size, shale grade, presence of organic solvents and amount of water were investigated as variables affecting kerogen conversion. Higher conversions of kerogen at low temperatures were obtained by using the CO-H<sub>2</sub>O reaction and CO-H<sub>2</sub>O-solvent reaction than by dry thermal processes. The soluble degradation products from the kerogen have elemental compositions similar to shale oils and would be suitable materials for hydrocracking and refining feedstocks. Other advantages are good conversion of extremely rich oil shales and good conversion of finely ground oil shale. Water-soluble minerals are removed from the shale residue during the reaction and are recovered as a valuable byproduct with significant environmental advantage.

#### IGNITING IN SITU OIL SHALE RETORTS

James F. Carley

Energy Technology, v. , no. , June 1978, p13-20

For controlled-combustion retorting of oil-shale rubble *in situ*, preheating with hot inert gas appears to be a promising method to prepare the rubble for ignition. By establishing an initial separation between the combustion and retorting fronts, this method should reduce oil burning and keep temperatures below those at which spent shale fuses. We have investigated inert-gas preheating with the Laboratory's computer model of *in situ* retorting. Our simulations show that retort temperatures can be kept below 1000°C (the soften-

79N15203# ISSUE 6 PAGE 715 CATEGORY 28 RPT#:  
AD-A060322 AFML-TR-78-100 CNT#: F33615-76-C-5034 AF  
PROJ. 2421 78/07/00 84 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Behavior of nonmetallic materials in shale oil derived jet fuels and in high aromatic and high sulfur petroleum fuels --- compatibility of aircraft materials to fuels TLSP: Final Report, Jan. 1975 - Aug. 1977

AUTH: A/BERNER, W. E.; B/ANGELLO, L. C.  
CORP: Dayton Univ. Research Inst., Ohio. AVAIL.NTIS  
SAP: HC A05/MF A01

MAJS: /\*AIRCRAFT CONSTRUCTION MATERIALS/\*COMPATIBILITY/\*  
HYDROCARBON FUELS/\*JET ENGINE FUELS/\*SHALE OIL/\*SULFUR  
/\*THIOLS

MINS: / ADHESIVES/ CLAMPS/ COATINGS/ DIAPHRAGMS (MECHANICS)/  
FOAMS/ FUEL TANKS/ SEALS (STOPPERS)

ABA: A.R.H.

ABS: Aircraft materials that are normally in contact with or exposed to fuels were evaluated in order to determine their compatibility with fuels previously considered unacceptable, such as those derived from shale oil or those having high levels of aromatics, sulfur, and mercaptan sulfur. Adhesives, coatings, sealants, O ring seals, and clamps were studied in ten fuel formulations.

#### DISTRIBUTION OF TRACE METALS DURING OIL SHALE RETORTING.

Arun D. Shendrikar & Gerald R. Faudei

Environmental Science & Technology, Vol. 12, No. 3, March 1978, p. 332-334

■ Three samples of raw oil shale from the Green River formation of Western Colorado were retorted under conditions simulating a potentially commercial process. The raw shales and all resulting retort products were analyzed for various trace metals in an attempt to ascertain migratory patterns and resulting distributions through the retort system. Some evidence of low-level fluoride, boron, and copper partitioning to the water fraction was found. Similar behavior of arsenic and zinc partitioning to the shale oil product was observed with the remainder of the metals investigated predominantly retained in the spent shale fraction.

78N13233# ISSUE 4 PAGE 455 CATEGORY 28 RPT#:  
NASA-TM-73829 E-9416 77/00/00 13 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Hydrocarbon group type determination in jet fuels by high performance liquid chromatography  
AUTH: A/ANTOINE, A. C.  
CORP: National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A02/MF A01  
Presented at 4th Ann. Meeting of the Federation of Analytical Chem. and Spectroscopy Soc. (FACSS 4), Detroit, Mich., 7-11 Nov. 1977  
MAJS: /CHEMICAL ANALYSIS/HYDROCARBONS/JET ENGINE FUELS/LIQUID CHROMATOGRAPHY  
MINS: /ABSORPTIVITY/COAL LIQUEFACTION/FLUORESCENCE/SHALE OIL/SYNTHETIC FUELS  
ABA: Author  
ABS: Thirty-two jet and diesel fuel samples of varying chemical composition and physical properties were prepared from oil shale and coal syncrudes. Hydrocarbon types in these samples were determined by a fluorescent indicator adsorption analysis, and the results from three laboratories are presented and compared. Two methods of rapid high performance liquid chromatography were used to analyze some of the samples, and these results are also presented and compared. Two samples of petroleum-based Jet A fuel are similarly analyzed.

DETERMINATION OF STRESS LEVELS FOR DYNAMIC FRACTURE OF OIL SHALE.

M.P. Felix.

Experimental Mechanics, v.17, no.10, Oct.1977, p.381-84.

A technique to determine dynamic-stress thresholds for complete spall in oil shale is presented along with the results for two representative grades of shale

78N30641# ISSUE 21 PAGE 2833 CATEGORY 43 RPT#:  
LERC/RI-77/6 77/00/00 20 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Thermal analysis on oil shale: Determination of potential oil yields and dawsonite, nahcolite, and nordstrandite content  
AUTH: A/JOHNSON, D. R.; B/YOUNG, N. B.; C/SMITH, J. W.  
CORP: Energy Research and Development Administration, Laramie, Wyo. CSS: (Energy Research Center.) AVAIL.NTIS SAP: HC A02/MF A01  
MAJS: /SHALE OIL/WYOMING  
MINS: /DIFFERENTIAL THERMAL ANALYSIS/MINERALS/THERMOGRAVIMETRY  
ABA: ERA  
ABS: Thermal analysis was applied to Green River Formation oil shales to demonstrate the method's capabilities for estimating oil yields and for determining dawsonite, nahcolite and nordstrandite. A single sample heated in thermal analysis apparatus incorporating differential thermal analysis and thermogravimetry will produce quantitative data on the three oil shale minerals and excellent oil yield estimates. Coefficients of determination ranged from 0.88 for dawsonite and nordstrandite determinations to 0.998 for nahcolite. Requirements to be met by thermal analysis equipment to obtain accurate oil shale compositional data are outlined. The method is especially useful where minerals are encountered that interfere with other analytical techniques.

INVESTIGATIONS INTO THE STRUCTURE OF KEROGEN - I.  
LOW TEMPERATURE OZONOLYSIS OF MESSSEL SHALE KEROGEN.  
M. L. J. Van Berg, G. J. Mulder, J. W. De Leeuw,  
and P. A. Schienck

GEOCHIMICA ET COSMOCHIMICA ACTA, vol. 41, no. 7,  
July 1977, p. 903 - 908

TN  
858  
.835

Science and technology of oil shale / edited by T. F. Yen. — Ann Arbor, Mich. : Ann Arbor Science Publishers, c1976.

vi, 226 p. : ill. ; 24 cm.

Includes bibliographical references and

Oil Shales of United States—A Review . . . . . 1  
T. F. Yen

COLOR MICROGRAPH SECTION  
following page 10

Modification of the Mineral Matrix of Green River Oil, Shale by Bioleaching . . . . . 19  
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78N75067# CATEGORY 44 RPT#: SAND-75-0154  
75/01/00 21 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Effect of heating rate on the pyrolysis of oil shale  
AUTH: A/ARNOLD, C., JR.  
CORP: Sandia Labs., Albuquerque, N. Mex. AVAIL:NTIS  
Sponsored by ERDA  
MAJS: /\*BURNING RATE/\*OIL RECOVERY/\*PYROLYSIS/\*SHALE OIL  
MINS: / COMBUSTION PRODUCTS/ DECOMPOSITION/ ENERGY  
CONVERSION/ ORGANIC WASTES (FUEL CONVERSION)

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79N74384# CATEGORY 28 RPT#: LWEC/RI-75/3  
75/07/00 23 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Hydrodenitrification of crude shale oil  
AUTH: A/FROST, C. M.; B/JENSEN, H. B.  
CORP: Energy Research and Development Administration, Laramie, Wyo. CSS: (Laramie Energy Research Center.)  
AVAIL:NTIS  
MAJS: /\*DENITROGENATION/\*HYDROGENATION/\*NITROGEN COMPOUNDS/\*  
SHALE OIL  
MINS: / CATALYSTS/ CHEMICAL REACTORS/ INFRARED SPECTROSCOPY

78N77178# CATEGORY 46 RPT#: CONF-740806-3  
74/00/00 22 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Reverse combustion in tar sands  
AUTH: A/LAND, C. S.  
CORP: Energy Research and Development Administration,  
Laramie, Wyo. CSS: (Energy Research Center.)  
AVAIL:NTIS  
Presented at Gordon Res. Conf. on Subsurface Fluids,  
Tilton, N. H., 12-16 Aug. 1974  
MAJS: /\*COMBUSTION/\*TAR SANDS  
MINS: / DEPOSITION/ OIL FIELDS/ SEDIMENTS

78N77545# CATEGCRY 46 RPT#: BM-RI-7984 74/00/00  
52 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Pulsed nuclear magnetic resonance studies of oil  
shales: Estimation of potential oil yields  
AUTH: A/MIKNIS, F. P.; B/DECORA, A. W.; C/COOK, G. L.  
CORP: Bureau of Mines, Laramie, Wyo. CSS: (Laramie Energy  
Research Center.) AVAIL:NTIS

79V18705 1969 ISS: 72 TN23.U43 7303  
AUTH: A/Ruark, Jabe R.  
UTTL: Gas combustion retorting of oil shale under Anvil  
Points lease agreement: TLSP: stage I, by J. R. Ruark  
and others.  
U. S. Dept. of the Interior, Washington, 109 p.  
illus.  
U. S. Bureau of Mines. Report of Investigation 7303  
NASA: / GAS RECOVERY/ HYDROCARBON COMBUSTION/ SHALE  
OIL  
JSC: / TN23.U43 7303  
MAIN-AUTH TRACE-SERS\*TITL\* CATLG BY-JOHNSON  
79/02/27 AVAIL: / JOHNSON

79V18692 1970 ISS: 72 TN23.U43 7397  
AUTH: A/Campbell, George G.  
UTTL: Evaluation of oil shale fracturing tests near Rock  
Springs, Wyo., by George G. Campbell and others.  
U. S. Dept. of the Interior, Washington, 21 p. illus.  
U. S. Bureau of Mines. Report of Investigations 7397  
NASA: / EVALUATION/ FRACTIONATION/ SHALE OIL/ WYOMING  
JSC: / TN23.U43 7397  
MAIN-AUTH TRACE-SERS\*TITL\* CATLG BY-JOHNSON  
79/02/27 AVAIL: / JOHNSON

79V19906 1969 ISS: 73 TN23.U43 7248  
AUTH: A/Smith, John Ward  
UTTL: Theoretical relationship between density and oil yield  
for oil shales.  
U. S. Dept. of the Interior, Washington, 14 p. illus.  
U. S. Bureau of Mines. Report of Investigations 7248  
NASA: / DENSITY (MASS/VOLUME)/ DRILLING/ OIL  
EXPLORATION/ SHALE OIL  
MAIN-AUTH TRACE-SERS\*TITL\* CATLG BY-JOHNSON  
79/03/05 AVAIL: / JOHNSON

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OF POOR QUALITY

OIL SHALE AND TAR SAND - ENVIRONMENTAL ASPECTS

LOW NO<sub>x</sub> COMBUSTION OF PARAHO SHALE OIL IN A 45 MW UTILITY BOILER, by D. G. Jones and M. N. Mansour  
Journal of Engineering for Power, vol. 100, no. 3  
July 1978, p. 393-398

*Combustion tests of crude Paraho shale oil (0.7 percent sulfur and 2 percent nitrogen) were conducted in a 45 MW boiler equipped with six frontface mounted burners each rated at 85 million Btu/hr. Shale oil was blended in various proportions with low sulfur oil and natural gas so that the sulfur content of the fuel did not exceed 0.5 percent. The fuel piping system was modified to allow blending the fuels in the furnace, and this blending technique was called dual fuel combustion. NO<sub>x</sub> emissions were compared using tank blending and dual fuel combustion, and it was found that significant levels of NO<sub>x</sub> reduction were obtained using dual fuel combustion. This result was confirmed during further testing of the two blending methods at various combustion stoichiometries using both conventional and steam-atomized low NO<sub>x</sub> burners. The maximum reductions in NO<sub>x</sub> emissions occurred during fuel-rich combustion of shale oil in the bottom row of burners followed by combustion of a low-nitrogen fuel in the top row of burners.*

AICHE Symposium Series, v.73, no.166 1977

WATER--1976: I. PHYSICAL, CHEMICAL WASTEWATER TREATMENT, Gary F. Bennett, ed.

American Inst. of Chemical Engineers

A7. EVALUATION OF THE POLLUTION ABATEMENT TECHNOLOGIES AVAILABLE FOR TREATMENT OF WASTEWATER FROM OIL SHALE PROCESSING ..... p. 322 ..... R. D. Sung, Jack Cotter, L. G. Neal

Shale, Oil

1977

TA  
1  
.I39913  
1977  
Institute of Environmental Sciences,  
Environmental technology '77: proceedings,  
— Mt. Prospect, Ill. : The Institute, c1977.  
xviii, 437 p.  
23rd annual technical meeting held in Los  
Angeles, Calif. April 25-27, 1977.  
ISBN 0-915414-17-1  
1. Environmental testing. 2.  
Environmental engineering—Societies, etc.  
I. Th+  
MARINE KEROGEN AND BITUMEN AS ENERGY RESOURCES  
By James I. S. Tang and T. F. Yen . . . . .

NTIS-24684/ Energy Research and Development Administration,  
Washington, D. C.

OIL SHALE, FY 1977

J. D. Powderly and R. Franklin Jun. 1977 56 p  
(EDP/F-01(77)) Avail: NTIS HC A04/MF A01

The environmental, health, safety, and socioeconomic issues concerning the development of the program were identified and examined, and the requirements and actions needed to resolve these issues, and a time phased action plan for the evaluation and mitigation of environmental impacts is presented. The plan addressed the oil shale energy system including mining, crushing and sizing, fracturing, in situ and surface retorting, product recovery and upgrading, transportation, and end use.  
ERA

Pg 174

78N26529# ISSUE 17 PAGE 2272 CATEGORY 43 RPT#:  
PB-278159/9 EPA-908/4-77-007 CNT# EPA-68-01-4337  
77/05/00 79 PAGES UNCLASSIFIED DOCUMENT

UTTL: Oil shale research overview

AUTH: A/HOOK, C. O.

CORP: Cameron Engineers, Inc., Denver, Colo. AVAIL.NTIS  
SAP: HC A05/MF A01

MAJS: /ENERGY POLICY/ ENVIRONMENTAL MONITORING/ SHALE OIL

MINS: / AIR POLLUTION/ ECOLOGY/ TOXICITY/ WASTE DISPOSAL/  
WATER POLLUTION

ABA: GRA

ABS: A compilation is given of some federally sponsored oil shale research, both current and recently completed. A breakdown of funding levels and number of projects in the areas of (1) general environmental research, (2) water research, (3) atmospheric research, (4) land and revegetation research, (5) health effects research, and (6) miscellaneous oil shale research is shown.

77N28575# ISSUE 19 PAGE 2549 CATEGORY 43 RPT#:  
PB-266266/6 EPA-600/7-76-035 CNT# EPA-68-02-132J  
76/12/00 92 PAGES UNCLASSIFIED DOCUMENT

UTTL: Production and processing of US tar sands: An environmental assessment TLSP: Final Report

AUTH: A/FRAZIER, N. A.; B/HISSONG, D. W.; C/BALLANTYNE, W. E.; D/NAZEY, E. J.

CORP: Battelle Columbus Labs., Ohio. AVAIL.NTIS SAP: HC  
A05/MF A01

MAJS: /ENERGY SOURCES/ ENVIRONMENT POLLUTION/ TAR SANDS

MINS: / COMBUSTION PRODUCTS/ GEOLOGY/ PRODUCTION ENGINEERING  
/ WASTE DISPOSAL

ABA: GRA

ABS: Factors traceable to the increasing shortfall in U.S. production of natural crude have rekindled interests in U.S. tar sands as a sources of synthetic fuel.

Reported are the results of a preliminary study to assess the potential primary environmental impacts of production and processing of U.S. tar sands bitumen. With the possible exception attributable to chemical differences between tar sand bitumen and coal, potential environmental impacts of producing tar sands by mining methods would be similar in type to those of mining coal by the same method and in the same area as the tar sand deposit. Processes for extracting bitumen from the mined tar sand would generate solid waste in the form of spent sand. Constituents and quantities of emissions to air and water are process dependent but existing control technology and good environmental practices are technically applicable. A viable in situ production technology for producing tar sand reservoirs has not yet been demonstrated. On the basis of methods tested to date, potential environmental impacts of producing tar sands by in situ methods would be very similar to those of conventional oil field production. Technical and economic factors will determine if in situ methods, or possibly underground methods, are an alternative to surface mining in environmentally sensitive areas.

Oils, Shale

1975

*Oil shale*

TA Institute of Environmental Sciences.

1 Technical division proceedings including

.I39813 career guidance forum notes. Mt. Prospect,

1975 Ill., IES [1975]

v.1 xx, 184 p. illus. 28 cm.

"21st annual im,

Calif., April :

Vol. 2 of 2

Energy and the



3 1176 00044 7186

ENVIRONMENTAL CONSIDERATIONS OF BIOLEACHING AS A CONDITIONING STEP IN RETORTING  
OF OIL SHALE

By M. Moussavi and T. F. Yen

*P. H. B.*

*1-20-75 Hester, C. E. (AK) 463 (KJFL)*

III. HYDROGEN AND OTHER FUELS . . . . .	271
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B. Hydrogen . . . . .	286
1. Production . . . . .	326
2. Storage (Including Metal Hydrides) . . . . .	345
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HYDROGEN AND OTHER FUELS - GENERAL

COMBUSTION PERFORMANCE OF GAS TURBINE COMBUSTORS  
BURNING ALTERNATIVE FUELS, by D.R. Ballal and A.H.  
Lefebvre.

Journal of Energy, vol. 3, no. 1, Jan/Feb 1979,  
p.50-54.

Equations for predicting and correlating the combustion efficiencies of gas turbine combustors are derived for conditions where the heat release is limited either by chemical reaction, mixing or evaporation, or by a combination of reaction and evaporation. Methods for calculating the critical mean drop size,  $D_{crit}$ , above which evaporation becomes the rate-controlling step are presented. It is shown that  $D_{crit}$  increases with increase in combustion volume, combustion pressure, liner pressure drop, and fuel volatility, and diminishes with increase in gas velocity. It is also shown that the ignition energy requirements of liquid hydrocarbon fuels are influenced mainly by their viscosity and volatility, which together govern the rate of fuel evaporation in the ignition zone.

AEROPROPULSION 1979. (Proceedings of conf. held LERC,  
May 15-16 1979) 1979. 467p.

Conference on Aeropropulsion

May 15-16  
1979

ALTERNATIVE JET AIRCRAFT FUELS

Jack Grobman . . . . . p.129 . . . . .

NEW FUELS FOR YOUR FARM -FROM YOUR FARM.

Farm Journal, vol 103, no 10, September 1979  
p. 22-24.

We are just beginning to tap farm sources of fuel, say farmers and scientists trying out methane, ethanol, methanol, hydrogen and other "synthetic" fuels.

ALTERNATE FUELS MAKE BETTER AIRPLANES: LET'S  
DEMONSTRATE NOW. Willis M. Hawkins and  
G. Daniel Brewer.

Astronautics and Aeronautics. vol 17, no 9,  
September 1979. p. 42-46.

Through promptly executed civil or military experimental programs, aerospace can deliver and demonstrate the technology to use a clean new fuel when the petroleum retreat begins in earnest.

$LH_2$ ,  $LCH_4$ , and Kerosene

N80-15279# Department of Energy, Washington, D. C. Office of Conservation and Solar Applications

**PROJECT PLANNING DOCUMENT: HIGHWAY VEHICLE ALTERNATIVE FUELS UTILIZATION PROGRAM (AFUP)**

Jul 1979 66 p

(DOE/CS-0093) Avail: NTIS HC A04/MF A01

Criteria and guidelines for the evaluation and development of nonpetroleum based highway vehicle fuels derived from domestic resources are developed. Five basic classes of alternative fuels are presented. Within each class, general areas of R & D that were addressed are illustrated in terms of a matrix format, while specific project relationships are identified by a corresponding flow chart. An overview of the evaluation of and relationships between these several alternative fuels classes intended to progress toward a uniform and independent domestic highway transportation system is presented. The mechanism for implementation is outlined.

DOE

Power, v.123, no.2, p.s.1-s.24.

Feb.  
1979

**BURNING TOMORROW'S FUELS. Special Report.**

Robert G. Schwieger.

**GASES:**

Low-Btu .....	S • 2
Medium-Btu .....	S • 7
Hydrogen .....	S • 8
High-Btu .....	S • 9

**LIQUIDS:**

Coal-derived oil .....	S • 10
Methanol .....	S • 14
Pyrolytic oil .....	S • 15
Shale oil .....	S • 17

**SOLIDS:**

Clean coal .....	S • 19
Uniform-quality RDF .....	S • 21

**SLURRIES:**

Coal/oil .....	S • 22
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RESEARCH ON SYNTHETIC FUELS INTENSIFIED. W. C. Wetmore.

Aviation Week and Space Technology, vol 111, 24, December 10, 1979, p. 37-42.

PEAT POWER: FUEL BY THE BOG. Robert B. Aronson

Machine Design, Vol 51, No 23, October 11, 1979 p. 20-25.

Peat can do more than nourish flower gardens. It is a good source of fuel for heat and power, as the Finns and Russians are already proving. The U.S. is a late starter in the peat-power sweepstakes, but we're borrowing foreign technology to catch up and begin utilizing the nation's vast bog lands.

AN ALCOHOL FUEL ALTERNATIVE. R. K. Pefley.

Mechanical Engineering, vol 101, no 11, November 1979, p. 52-53.

FUEL FOR THE 1980S. G. Larson.

Business and Commercial Aviation, vol 45, no 6, December 1979, p. 66-71.

As we prepare for a new decade, just months after our second fuel "crunch" in six years, concern over our future fuel supply is great. Precise predictions are impossible, but you can guard against sudden surprises by tracking fuel's vital signs.

*Fuels, Alternative*

**BURNING TOMORROW'S FUELS. Special Report.**

Robert G. Schwieger.

**GASES:**

Low-Btu .....	S • 2
Medium-Btu .....	S • 7
Hydrogen .....	S • 8
High-Btu .....	S • 9

**LIQUIDS:**

Coal-derived oil .....	S • 10
Methanol .....	S • 14
Pyrolytic oil .....	S • 15
Shale oil .....	S • 17

**SOLIDS:**

Clean coal .....	S • 19
Uniform-quality RDF .....	S • 21

**SLURRIES:**

Coal/oil .....	S • 22
----------------	--------

BURNING TOMORROW'S FUELS, by Robert G. Schwieger.  
Power, vol. 123, no. 2, February 1979, p. s. 1-s. 24.

**Burning tomorrow's fuels is this month's special feature.** Keynote of the report is challenge of designing flexible energy systems to handle the range of future fuels with reasonable capital investment. Fuel forms are gases, liquids and solids derived from coal and biomass, plus hydrogen, shale oil and coal/oil slurries. Aspects examined are experience in fuel production, equipment availability or ongoing research, and economics. Review of combustion experience encompasses system compatibility, efficiency, polluting emissions.

HAWAII: ALTERNATIVE-ENERGY LAB.

Chemical Engineering, vol 86, no 12, June 12, 1979, p. 86-90.

Blessed with consistently strong winds, geothermal activity, copious amounts of sunshine and abundant biomass resources, the island state holds promise as an ideal testing ground for natural-energy technology development.

JET FUEL FROM SHALE OIL?, by L.C. Angelo, A.V. Churchill, C.L. Delaney and H.R. Lander.  
Automotive Engineering, vol. 86, no. 12, December 1978 p. 58-60.

Future jet fuels may be based on crude oil extracted from shale deposits.

IMPACT OF GOVERNMENT SUBSIDIES ON MARKET PENETRATION OF SYNTHETIC FUELS, by Ali Ezzati.  
Energy Policy, vol. 6, no. 3, September 1978, p. 196-208.

This paper assesses the impacts of various levels of government subsidies on the degree of US dependency on imported energy for the period 1977-2001 and on the reduction of energy bills under the 'base case', 'conservation', and 'most likely' scenarios using the Gulf/SRI US energy model. If the US government subsidizes synfuel production by 50 cents/MMBtu (10<sup>6</sup> Btu), total synthetic fuel

production and market penetration could be 15.1-16.9 quads (10<sup>15</sup> Btu) in 2001 against 8.3-9.8 quads given no subsidy. This will result in a reduction of oil and gas imports by 3.8-4.3 quads by 2001. The analyses indicate that during the period 1977-2001, for every 1 MMBtu desired reduction in imported oil, each MMBtu of synfuel produced should be subsidized by \$1.50-1.88.

79N77201 CATEGORY 31 79/00/00 25 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: A review of fire incidents related to wood-burning appliances  
AUTH: A/PEACOCK, R. D.  
CORP: National Bureau of Standards, Washington, D.C. CSS:  
(Center for Fire Research.) AVAIL. NTIS  
Presented at Wood-Heating Seminar, 4, Portland, Oreg.  
21-24 Mar. 1979  
MAJS: /\*ENERGY POLICY/\*ENERGY TECHNOLOGY/\*FIRES/\*HEATING  
EQUIPMENT/\*WOOD  
MINS: / ACCIDENT PREVENTION/ ENERGY SOURCES/ SAFETY

BON10389# ISSUE 1 PAGE 54 CATEGORY 28 RPT#:  
HCP/C4101 CNT#: EG-77-C-01-4101 79/01/00 71 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Near term potential of wood as a fuel  
CORP: Mitre Corp., McLean, Va. AVAIL. NTIS SAP: HC  
A04/MF A01  
MAJS: /\*COMBUSTION EFFICIENCY/\*ENERGY POLICY/\*ENERGY SOURCES  
/\*WOOD  
MINS: / FUELS/ INDUSTRIAL ENERGY/ LIFE CYCLE COSTS/  
MANUFACTURING/ SYSTEMS ENGINEERING/ TECHNOLOGY  
UTILIZATION

ABA: DCE

ABS: The sources of wood as a fuel are cited. Technologies available to expand the near-term use of wood fuel include direct combustion, low-Btu gasification in the presence of air, pyrolysis to char, liquid fuel, and low-Btu gas in the absence of air, and densification. Life-cycle costs were evaluated for these technologies. Incentives to increase the use of wood fuel in the near term are identified. Systems manufacturers, architecture and engineering firms, and users are listed.

TILE STOVES--EFFICIENT AND ELEGANT WOODBURNERS,  
by Jason Schneider.  
Popular Science, vol. 214, no. 1, January 1979,  
p. 98-101.

The great stoves that warmed castles in the Old  
World are available here—but at a princely price

## CONTROL SYSTEM DESIGN FOR A WOOD BURNING INDUSTRIAL STEAM GENERATOR. H. E. Boehl.

Intech, vol 26, no 12, December 1979, p. 35-38.

*Controls have been implemented for a large industrial boiler which burns oil and wood waste — singly or in combination. The system is intended to maximize the use and combustion efficiency of available wood wastes. Development goals emphasized process as well as control criteria and included designing the facility to function as a system, using equipment of proven reliability whenever practical and adopting new technology only with high probability of success, capitalizing on plant operating and management experience, and meeting regional regulatory parameters. These goals evolved into a set of specific requirements, constraints, and opportunities — for optimized operation in spite of the difficulties imposed by the variable characteristics of the hogged fuel.*

S-588

## KEEP THE HOME FIRES BURNING.

Victoria Erin Towns.

House Beautiful, Jan. 1978, p. 96-97.

List of  
manufacturers  
included.  
(wood-burning  
stoves)

With heat at a premium this winter, many sage households are turning to wood-burning stoves as an attractive and efficient supplementary heat source.

American manufacturers are dusting off their old cast-iron dies and producing stoves much like the ones that warmed our grandparents. Heating with wood is more than just a nostalgic fashion, however—it's practical, cheerful, economical and gaining momentum across the country. Wood-burning-stove sales figures doubled in 1976-77 and, having already topped that record, are on the way to doubling again.

ORIGINAL PAGE IS  
OF POOR QUALITY

**Fuels, Alternative** 7607 (CONF-771175—, pp 1.4.1-1.4.21) Objectives and key-points of alcohol fuel research activities in the Federal Republic of Germany. Plassmann, E. (Technischer Überwachungs-Verein Rheinland e.V., Cologne). Jul 1978.

From Symposium on alcohol fuel technology; Wolfburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Throughout the entire transport and traffic scene in the Federal Republic of Germany it is the motor vehicle traffic that is playing the predominant part. Its efficiency is an essential prerequisite for satisfying the mobility demands and ensuring maintenance of our population. At the same time, the automobile industry is a vital economic factor in our country. Present forecasts indicate that the importance of motor vehicle traffic will increase even further during the next years so that to safeguard energy supply in this area will be a major concern in future, especially under the impression of an increasing shortage of mineral oil resources. These are the reasons why the Federal Ministry for Research and Technology established a research program specifically concentrated on "Alternate Fuels" within the "Motor Vehicles and Road Traffic" research scheme. This report covers the extent, status and future objectives of this research area.

GM RESEARCH LOOKS AT ALTERNATIVE FUELS, Based on "Automotive Fuels--Outlook for the Future," by Joseph B. Bidwell.

Automotive Engineering, vol. 86, no. 11, November 1978, p.50-54.

Investigators at General Motors Research Laboratories see alternative-sourced gasoline and diesel fuel as optimum responses to the dwindling supply of low-cost petroleum. Their studies indicate that this country's coal and oil shale can be exploited to maintain a mobile society—but energy supply leadtimes invoke a critical need for current action.

NASA TM-78895 Fuels, Alternative 1978

PROGRESS ON COAL-DERIVED FUELS FOR AVIATION SYSTEMS.  
Robert D. Witcofski, LaRC. May 1978. 24p.

CN-150,000, Audiotape & Videotape 1978  
NEW ENERGY TECHNOLOGY. Eric H. Willis. (Series title: Langley Colloquium Series). Aug.7,1978.

NASA,  
Langley Research Center

Lectures - Power sources Lectures - NASA, LaRC  
Power sources Fuels, Alternate  
Audiotapes - Power sources

Audiotape - LaRC 123 8147, 123 8154, 123 8162  
Videotape - LaRC 124 9102

TU Aspen Energy Forum, 4th, Aspen Institute for  
R10 Humanistic Studies, 1977.

.A79 Solar architecture : proceedings of the  
1977 Aspen Energy Forum 1977, May 27, 28, and  
29, 1977, Aspen, Colorado / editors, Gregory  
E. Franta, Kenneth R. Cl... ; graphics, T.  
Michael Manchester. — Ann Arbor, Mich. :  
Ann Arbor Science Publishers, c1978.  
ix, 331 p. : ill. ; 24 cm.

COMPOSTING TOILETS: A VIABLE ALTERNATIVE . . . . 271  
David Del Porto

Mech. Eng., v.99, no.11, Nov.1977.

29 ENERGY—FLUID FUELS FROM SOLIDS ..... Donald F. Othmer  
By the year 2000, our fluid fuels will be coming in some quantity from coal, shale, tar sands, and plant materials. But to meet future energy needs will require a massive expenditure of talent, time, and money.

**SYNTHETIC FUELS AND COMBUSTION**

J. P. LONGWELL

Corporate Research Laboratories, Exxon Research and Engineering Company,  
Linden, New Jersey 07036, USA

**Abstract**—As the supply of hydrocarbons for transportation fuels includes an increasing proportion of low hydrogen-to-carbon ratio sources, such as coal, the cost and waste of energy of converting these materials to the high hydrogen-to-carbon ratio fuels now required by land and air propulsion systems will increase. In the extreme, where coal is the major source of liquid fuel, elimination of restrictions on aromatics content (H/C ratio) could reduce refining energy cost by as much as 20% of the heat of combustion of the syncrude being processed. Refining costs are approximately proportional to refining energy consumption, and an energy saving of this magnitude would reduce the total cost of refined products by one-third. For a syncrude product cost of 30 \$/bbl, this would be a cost saving of 25 \$/gal. of product.

Such a large conservation and economic driving force provides a powerful incentive for choice of power plants capable of burning fuels of low hydrogen-to-carbon ratio in a clean and environmentally acceptable manner.

The main combustion problem is the increasing difficulty of avoiding the emission of soot, and the relative ability of power plants to completely burn out the soot formed in the early stages of combustion will be an important selection criterion.

In automotive systems, the combustion problems appear much more easily solved for the Stirling cycle and the gas turbine because of the steady flow conditions and the potentially longer time that can be provided for soot burnout. The liquid injection Diesel and stratified charge engines are at a disadvantage in this regard and may not be able to compete successfully with the Otto cycle engine, for which aromatics offer an improvement in efficiency because of their high octane number. Improvement in the ability of aircraft engine to burn highly aromatic, wide boiling range fuels offers the possibility of advances in economics and fuel conservation in air transportation.

Fortunately, there is every indication that combustion research and development can be expected to eliminate the need for high levels of hydrogenation and boiling range conversion in fuels manufacture. Much more research is needed in the chemistry of soot formation and burnout, and the mechanics of reactive flow involving high molecular weight liquids and vapors and soot, for the complex systems of practical interest. In development programs, highly aromatic fuels should be used even though the economic and conservation driving force for fuel specification changes might appear well into the future. While the examples and numbers used in this discussion are based on an extreme that is indeed well into the next century, the trend toward lower hydrogen-to-carbon ratio feed stocks is already underway, and it is timely to begin moving toward less energy intensive fuels manufacture in addition to working on more thermodynamically efficient propulsion machinery.

GN-150.493

1977

**ALTERNATIVES TO A PETROLEUM BASED ENERGY ECONOMY.**

Thomas E. Pinellii, LaRC. (A Research Paper).

1977. 67p.

NASA,

Langley Research Center

Fuels, Alternative  
Energy consumption  
Energy conservation

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2896  
.155  
1977

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**Intersociety Energy Conversion Engineering Conference, 12th, Washington, 1977.**

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810  
.A79  
1977

**Aspen Energy Forum, 4th, Aspen Institute for Humanistic Studies, 1977.**

Solar architecture : proceedings of the Aspen Energy Forum 1977, May 27, 28, and 29, 1977, Aspen, Colorado / editors, Gregory E. Franta, Kenneth R. Olson ; graphics, T. Michael Manchester. — Ann Arbor, Mich. : Ann Arbor Science Publishers, c1978. ix, 331 p. : ill. ; 24 cm. Includes index.

WOOD FOR ENERGY ..... 241  
Jø. Densmore

TP  
343  
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1976

**Symposium on Future Automotive  
Fuels--Prospects, Performance, and  
Perspective ...1977. (Card 2)**

October 6-7, 1976] / edited by Joseph  
M. Colucci and Nicholas E.  
Gallopoulos. New York : Plenum  
Press, 1977 .

ix, 380 p. : ill. ; 26 cm.  
Includes bibliographical references  
and index.

Attention is given to the future demand for automotive fuels,  
the U.S. energy outlook through 1990, aspects of energy conserva-  
tion and fuel-vehicle optimization, and opportunity for maximizing  
transportation energy conservation, the matching of future auto-  
motive fuels and engines for optimum energy efficiency, coal as a  
source of automotive fuels, motor fuels from oil shale, and the  
influence of nuclear energy on transportation fuels. The automotive  
utilization of intermediate-term future fuels is discussed, taking into  
account the characteristics of conventional fuels from nonpetroleum  
sources, the application of a new combustion analysis method in the  
study of alternate fuel combustion and emission characteristics,  
engine performance and exhaust emission characteristics of a  
methanol-fueled automobile, the combustion of methanol in an  
automotive gas turbine, and alternative fuels for automotive diesel  
engines. Hydrogen as a reciprocating engine fuel is considered in  
connection with an evaluation of long-term future fuels. The use of  
hydronitrogens, such as hydrazine and ammonia, as future auto-  
motive fuels is also discussed.

card 3)

G.R.

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507  
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v. 62

**Project Squid Workshop on Alternative Hydro-  
carbon Fuels for Engines: Combustion and  
Chemical Kinetics, Columbia Md., 1977.**

Alternative hydrocarbon fuels ...1978.  
(Card 2)

xvi, 463 p. — (Progress in astronautics  
and aeronautics ; v. 62)

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and the Air Force Office of Scientific  
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Includes bibliographies and  
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## FUELS, ALTERNATE

1979, v. 25

CRUDE YET UNCONVENTIONAL. Janet Raloff

Science News, v. 116, no.3, July 21 1979, p.42-44

There is a fossil fuel that could cut those long  
waits at the gas pump and perhaps even stabilize  
climbing gasoline prices.

Design, Construction, and Performance of Stick-Wood Fired Furnace for Residential and Small Commercial Application. by R.C. Hill

Dept. of Energy Report, COO-4559-1, October 1979  
Contract no. EC-77-S-02-4559

With funding from ERDA and DOE an experimental program was conducted at the University of Maine at Orono to develop a combustion system for residential furnaces that solves the traditional problem of wood burning: inefficiency, air pollution and fire hazard.

**FIRE SAFETY TIPS FOR WOOD BURNING APPLIANCES.**  
S. Lieberman.

Dimensions, vol 63, no 11, November 1979, p. 18-24.

Proper installation, operation and maintenance.

**WOODBURNER EFFICIENCY--HOW TO MEASURE WOOD-STOVE AND FIREPLACE PERFORMANCE,** by James Trefil.  
Popular Science, vol. 214, no. 1, January 1979, p. 102-104.

**Inexpensive gear and a few formulas tell you if you're getting your wood's worth**

Improving the Efficiency, Safety, and Utility of Woodburning Units. by T.T. Maxwell, et. al.

U.S. Dept. of Energy Report ORO-5552-T7, March 15, 1979

**HOW TO CONTROL CREOSOTE FOR SAFER WOOD BURNING.**  
Evan Powell.

Popular Science, vol 215, no 4, October 1979.  
p. 107-110.

New scientific research shows that much of what we "knew" was wrong-and even dangerous.

**WOOD AS AN ENERGY SOURCE.**

Energy Engineering, vol. 75, no. 5, Aug./Sept. 1978, p.17-20.

**SHARP COST INCREASES** for the conventional petroleum fuels — and their potential unavailability — have made wood an attractive and cost-competitive energy source.

Journal filed under title: Building Systems Design  
it is the Technical Journal of the Association of Energy Engineers

**AICHE Symposium Series, v.74, no.177. 1978**

**ENERGY AND ENVIRONMENTAL CONCERNS IN THE FOREST PRODUCTS INDUSTRY.** William T. McKeen, ed.  
(Papers presented at Forest Products Div. sessions of the 69th Annual Meeting of AICHE in Chicago, Ill., Nov.1976).

**American Institute of Chemical Engineers**

79A50884 ISSUE 22 PAGE 4189 CATEGORY 44  
78/00/00 19 PAGES UNCLASSIFIED DOCUMENT

UTTL: Environmental aspects of wood fuel  
AUTH: A/CARABEDIAN, H. T.; B/SANBORN, C. R. PAA:  
B/(Vermont Agency of Environmental Conservation,  
Montpelier, Vt.)  
In: Conference on Environmental Aspects of  
Non-Conventional Energy Resources - II, Denver, Colo.,  
September 25-29, 1978. Proceedings. (A79-50876 22-45)  
La Grange Park, Ill., American Nuclear Society, 1978,  
p. 19-3 to 19-21.

ABA: V.T.

ABS: An analysis of whole tree harvesting for wood fuel and  
the conversion of existing electric generating  
stations to consume wood fuel is presented.  
Consideration is given to planning an experimental  
harvest, preharvesting inventory, wood operation,  
environmental impacts of the harvesting operation, and  
the economics of wood fuel. It is noted that whole  
tree removal resulted in 3 - 4.5 times the yield  
expected by traditional inventory methods. Wood fuel  
is low in heating value, high in moisture, and has  
undesirable handling characteristics; however, the  
contents of sulfur and nitrogen are low. Emission  
testing has determined that the particulate emission  
rate from a mix of 45% oil/55% coal increased  
threefold as compared with 80% wood/20% oil.

79A22923 ISSUE 8 PAGE 1355 CATEGORY 25  
78/06/00 9 PAGES UNCLASSIFIED DOCUMENT DCAF  
A003293

UTTL: A theoretical study of wood gasification processes  
AUTH: A/COUSINS, W. J. PAA: A/(Department of Scientific  
and Industrial Research, Physics and Engineering  
Laboratory, Lower Hutt, New Zealand)  
New Zealand Journal of Science, vol. 21, June 1978, p.  
175-183.

MAJS: /\*COAL GASIFICATION/\*ENERGY SOURCES/\*FLUIDIZED BED  
PROCESSORS/\*PYROLYSIS/\*WOOD

MINS: / CHEMICAL EQUILIBRIUM/ COAL UTILIZATION/ ENERGY  
TECHNOLOGY/ REACTION KINETICS/ THERMODYNAMICS

ABA: (Author)

ABS: A thermodynamic theory that has been used successfully  
for many years to describe the gasification of coal is  
applied to the gasification of wood. Some modification  
of the theory is necessary to allow for the very high  
production of volatiles during the pyrolysis of wood.  
The use of the modified theory is illustrated by  
application to countercurrent and cocurrent  
gasification of wood with air/steam and oxygen/steam  
blasts.

79A15919 ISSUE 4 PAGE 648 CATEGORY 44 78/00/00  
12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Advanced processes for more efficient use of forest  
products residual material  
AUTH: A/RAYMOND, D. R. PAA: A/(Weyerhaeuser Co., Gig  
Harbor, Wash.)  
In: Energy technology V: Challenges to technology:  
Proceedings of the Fifth Conference, Washington, D.C.,  
February 27-March 1, 1978. (A79-15879 04-44)  
Washington, D.C., Government Institutes, Inc., 1978,  
p. 907-918.

ABA: V.P.

ABS: The generation of energy in the pulp, paper, and  
forest products industry is accomplished by a number  
of technologies. These include self-generation of  
hydro and hydroelectric power, the burning of bark,  
the burning (and chemical recovery) of spent pulping  
liquors, and the burning of hog (shredded) wood  
wastes. In the present paper, the status of these  
technologies is reviewed, and the need for further  
research and development work in this field, including  
new forest management systems, harvesting and  
transportation systems, and energy conversion systems  
is pointed out.

79A14689# ISSUE 3 PAGE 420 CATEGORY 44  
78/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Forest residues as an alternate energy source  
AUTH: A/RILEY, J. G.; B/SMITH, N. PAA: B/(Maine,  
University, Orono, Me.)

In: Annual Conference on Energy, 4th, Rolla, Mo.,  
October 11-13, 1977. Proceedings. (A79-14676 03-44)  
Rolla, Mo., University of Missouri-Rolla, 1978, p.  
211-220.

MAJS: /\*ENERGY POLICY/\*ENERGY SOURCES/\*FOREST MANAGEMENT/\*  
FUELS/\*WASTE UTILIZATION/\*WOOD

MINS: / ECOLOGY/ ENERGY CONSUMPTION/ ENERGY TECHNOLOGY/ SOIL  
EROSION

ABA: (Author)

ABS: Forest residues, in combination with more intensified  
timber production systems have potential as a  
substantial source of fuel wood. The extent and  
availability of this resource is discussed, with  
particular reference to the energetics and economics  
of existing and proposed harvesting systems.  
Utilization of residue wood fuels is considered and  
recent developments in small scale automatic wood chip  
burning heating systems for residential and commercial  
use are described.

UTTL: Wood energy-commercial applications  
AUTH: A/KENNEL, R. P.  
CORP: Ultrasytems, Inc., Washington, D. C. AVAIL NTIS  
SAP: HC A07/MF A01  
In NASA, Langley Res. Center Emerging Energy  
Alternatives for the Southeastern States p 27-38 (SEE  
N78-28615 19-44)  
MAJS: /\*COMMERCIAL ENERGY/\*ENERGY POLICY/\*ENERGY SOURCES/\*  
WOOD  
MINS: / ECONOMIC ANALYSIS/ EVALUATION/ HANDLING EQUIPMENT/  
LOW COST/ STORAGE

ABA: Author  
ABS: Wood energy is being widely investigated in many areas  
of the country because of the many obvious benefits of  
wood fuel such as the low price per million Btus  
relative to coal, oil, and gas; the wide availability  
of noncommercial wood and the proven ability to  
harvest it; established technology which is reliable  
and free of pollution; renewable resources; better  
conservation for harvested land, and the potential for  
jobs creation. The Southeastern United States has a  
specific leadership role in wood energy based on its  
established forest products industry experience and  
the potential application of wood energy to other  
industries and institutions. Significant questions  
about the widespread usage of wood energy are being  
answered in demonstrations around the country as well  
as the Southeast in areas of wood storage and bulk  
handling; high capitalization costs for harvesting and  
combustion equipment; long term supply and demand  
contracts; and the economic feasibility of wood energy  
outside the forest products industry.

WOOD: NATURE'S CELLULAR POLYMERIC COMPOSITE, by  
J. M. Dinwoodie.  
Physics in Technology, vol. 9, September 1978,  
p. 185-191.

**Wood, with its high strength-to-weight  
ratio, exceptional toughness across the  
grain, ease of working and attractive  
appearance, continues to compete  
successfully in many applications with  
man's synthetic polymers and  
composites**

## Alternative Sources of Energy, 35, 1978. features/special wood heat edition

- 3 Wood heat: An introduction/Don Marier
- 9 Burning wood safely/Bill Eckert
- 13 Heat output of woodburning stoves/Bill Wortman
- 19 Safety standards: do we need them?/Jack Sanders
- 24 Keep your wood dry/John McGeorge
- 28 Asia has a new miracle tree/Mario P. Chanco

TP  
324  
.T54

**Tillman, David A.**  
**Wood as an energy resource / David  
A. Tillman. -- New York : Academic  
Press, 1978.**  
xiv, 252 p. : ill. ; 24 cm.  
Includes bibliographical references  
and index.  
ISBN 0-12-691260-2

1. Wood as fuel. I. Title.  
TP324.T54 333.7'5 78-8252

A79-50884 Environmental aspects of wood fuel. H. T.  
Garabedian and C. R. Sanborn (Vermont Agency of Environmental  
Conservation, Montpelier, Vt.). In: Conference on Environmental  
Aspects of Non-Conventional Energy Resources - II, Denver, Colo.,  
September 26-29, 1978, Proceedings. (A79-50876 22-45) La Grange  
Park, Ill., American Nuclear Society, 1978, p. 19-3 to 19-21. 9 refs.  
An analysis of whole tree harvesting for wood fuel and the  
conversion of existing electric generating stations to consume wood  
fuel is presented. Consideration is given to planning an experimental  
harvest, preharvesting inventory, wood operation, environmental  
impacts of the harvesting operation, and the economics of wood fuel.  
It is noted that whole tree removal resulted in 3-4.5 times the yield  
expected by traditional inventory methods. Wood fuel is low in  
heating value, high in moisture, and has undesirable handling  
characteristics; however, the contents of sulfur and nitrogen are low.  
Emission testing has determined that the particulate emission rate  
from a mix of 45% oil/55% coal increased threefold as compared  
with 80% wood/20% oil. V.T.

LOOK WHO'S SETTING THE WORLD ON FIRE

Forbes, vol. 122, no. 10, November 1978, p. 97-103

**The energy crisis brought the wood stove business back from the dead. Now there are more wood stove makers than even the present booming market can support.**

HOW TO USE WOOD STOVES (AND USE THEM SAFELY!)  
Ole Wik  
The Mother Earth News, No. 48, November/  
December 1977, p. 49-54 & 57.

78A27810 ISSUE 10 PAGE 1791 CATEGORY 44  
77/00/00 19 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fuels from wood waste  
AUTH: A/SHAFIZADEH, F. PAA: A/(Montana, University,  
Missoula, Mont.)  
In: Fuels from waste. (A78-27801 10-44) New York,  
Academic Press, Inc., 1977, p. 141-159.

ABA: J.M.B.  
ABS: Thermal degradation of cellulose and hemicellulose to flammable volatile products and chars is discussed, with attention given to tar fractions, dehydration of sugar units, fission of sugar units and production of highly reactive carbonaceous residues. In particular, the pyrolysis products yielded by cellulose at 300 C under nitrogen, by cellulose and treated cellulose at 550 C, and by xylan and treated xylan at 500 C are tabulated. Heat contents of such fuels as Douglas fir lignin, larch, ponderosa pine, aspen, and Douglas fir bark are also analyzed. It is suggested that destructive distillation methods of wood residue treatment could be profitably replaced by fixed-bed pyrolysis or fluid-bed gasification to yield various types of fuel that are in demand.

TH Behaviour of wood products in fire : proceedings of a seminar organised by the  
1073 Timber Committee of the United Nations  
.B44 Economic Commission for Europe, Oxford,  
1977 22-25 March, 1977. — 1st ed. — Oxford ;  
New York : Published by Pergamon Press for  
the United Nations, c1977.  
x, 204 p. : ill. ; 25 cm.  
Some articles in French.  
Includes bibliographical references.

#### Environmental Action Reprint Series

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by Ole Wik

In the rush to wood stoves, many people will pick the wrong stove for their needs or else not know how to get the most out of their stoves. Hopefully, this book will suggest solutions to both problems.  
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TH 7438.W55

##### THE WOODBURNERS ENCYCLOPEDIA, by Shelton and Shapiro

This is the most comprehensive and informative book on the subject of wood as energy that we have seen. The clear and detailed text is designed to answer questions about the feasibility of wood heating, safety, costs, installation and operation. This book contains:

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- An alphabetical listing of over 160 manufacturers with sketches of their products
- Specification charts covering more than 400 woodburning products

The book reflects the practical experiences of both authors in heating with wood.  
156 pages, paperbound (1976) ..... \$6.95

ORIGINAL PAGE IS  
OF POOR QUALITY

TP  
324  
.G68  
1977

**Governor William G. Milliken's  
Conference on Wood Energy, University  
of Michigan, 1977.**

Wood energy : proceedings of  
Governor William G. Milliken's  
conference, November 29, 1977, Ann  
Arbor, Michigan / edited by Michel L.  
Hiser ; sponsored by the Michigan  
Public Service Commission in  
cooperation with the University of  
Michigan's Industrial Development and

FROM OIL AND GAS TO ALTERNATE FUELS: THE  
TRANSITION IN CONVERSION EQUIPMENT.  
John A. Belding & William M. Burnett  
Energy Conversion, Vol. 17, No. 2/3, 1977,  
p. 57-65.

**Abstract**—This Nation is facing a critical shortage of oil and natural gas resources. The Energy Research and Development Administration (ERDA)\* is responding to this problem with a broad strategy to open new energy choices. A major element of the strategy is a transition from oil and natural gas to alternate fuels. The subject of this paper is an approach to accomplishing this transition in energy conversion machinery.

The paper looks at the transition in each of four major market sectors: electric utilities, industry, transportation and commercial/residential. The processes/devices which presently convert oil and gas into useful products are examined in each market for ease of conversion to or replacement by coal or other alternate energy sources. Alternate energy sources discussed include coal, coal derived synthetic fuels, fuels from waste, solar energy, nuclear energy and waste thermal energy.

Based on this examination, a long range transition strategy is proposed which identifies transition approaches for each market sector dependent on the ease of conversion to alternate fuels in each sector. The strategy emphasizes near term transition in electric utilities to save petroleum resources for the more difficult to convert transportation sector. The roles of both improved efficiency and multi-fuel capability in the transition of conversion machinery are discussed.

**N78-22073\*** National Aeronautics and Space Administration,  
Washington, D. C.

**ALTERNATE-FUELED TRANSPORT AIRCRAFT POSSIBILITIES**

W. S. Aiken France Assoc. Aeronautique et Astronautique de  
France 1977 37 p refs Presented at The 13th Congr.  
Intern. Aeron. Paris, 2-3 Jun. 1977

(NASA-TM-78333) Note-77-30: ISBN-2-7170-0455-6) Avail:  
NTIS HC A03/MF A01 CSCL 01C

The paper is organized to describe: (1) NASA's cryogenically  
fueled aircraft program; (2) LH2 subsonic and supersonic transport  
design possibilities (3) the fuel system and ground side problems  
associated with LH2 distribution; (4) a comparison of LCH4  
with LH2; (5) the design possibilities for LCH4 fueled aircraft;  
and (6) a summary of where NASA's cryogenically fueled programs  
are headed. Author

**N78-11074\*** National Aeronautics and Space Administration,  
Lewis Research Center, Cleveland, Ohio

**ALTERNATIVE FUELS**

CP-2021  
Jack S. Grobman, Helmut F. Butze, Robert Friedman, Albert C.  
Antoine, and Thaine W. Reynolds *In its Aircraft Eng Emissions*  
Oct. 1977 p 277-308 refs (For availability see N78-11063  
02-07)

Avail: NTIS HC A20/MF A01 CSCL 21E

Potential problems related to the use of alternative aviation  
turbine fuels are discussed and both ongoing and required research  
into these fuels is described. This discussion is limited to aviation  
turbine fuels composed of liquid hydrocarbons. The advantages  
and disadvantages of the various solutions to the problems are  
summarized. The first solution is to continue to develop the  
necessary technology at the refinery to produce specification jet  
fuels regardless of the crude source. The second solution is to  
minimize energy consumption at the refinery and keep fuel costs  
down by relaxing specifications. Author

OK-142,681  
SYNTHETIC FUELS: OIL SHALE, COAL, OIL SANDS.  
(Quarterly Rept.). Mar. 1977.

Cameron Engineers, Inc.,  
Denver, Colo.  
Synthetic Fuels, v.14, no.1.

Mar.  
1977

Oil, Shale  
Sands, Tar  
Coal - Gasification

**FUTURE FUELS AND MIXTURE PREPARATION METHODS FOR  
SPARK IGNITION AUTOMOBILE ENGINES.**

W. Bernhardt.

Prog. Energy & Combustion Sci., v.3, no.3, 1977,  
p.139-50.

**Abstract** Research in the automobile industry focuses on studies of spark ignition automobile engines especially of stratified charge engines, lean combustion concepts, engines fueled by alcohol gasoline blends, alcohol engines, and engines with on-board gas generators fueled by a variety of liquid fuels. The goal of this work is the development of low-emission, high fuel-economy and high performance power systems for the early 1990s. The implementation of this objective makes it necessary for more information on future fuel characteristics. In addition proper mixture preparation methods must be applied to find solutions to specific problems such as NO<sub>x</sub> formation and aldehyde emission, while maintaining good fuel economy and high engine efficiency. The goal of this paper is to discuss the most attractive approaches for improved preparation and distribution of the fuel-air mixture with respect to future fuels such as alcohol gasoline blends and other alcohol fuels.

**Production Economics for Hydrogen, Ammonia, and Methanol During the 1980--2000 Period.**

H. G. Corneil, F. J. Heinzlmann, and E. W. S. Nicholson.  
Exxon Research and Engineering Co., Linden, N.J.  
Government Research Labs. Apr 77, 178p  
BNL-50663 Price code: PC A09/MF A01

Refinery hydrogen, ammonia, and methanol, the principal industrial hydrogen products, are now manufactured mainly by catalytic steam reforming of natural gas or some alternative light-hydrocarbon feed stock. Anticipated increases in the prices of hydrocarbons are expected to exceed those for coal, thus gradually increasing the incentive to use coal gasification as a source of industrial hydrogen during the 1980 to 2000 period. Although the investment in industrial hydrogen plants will exceed those for reforming by a factor of 2 or more, coal gasification will provide lower production costs (including 20%/y before tax return) for methanol manufacture in the early 1980's and for ammonia 5 years or so later. However, high costs for transporting coal to major refining centers will make it difficult to justify coal gasification for refinery hydrogen production during the 1980 to 2000 period. By the year 2000, 40 to 50% of the U.S. industrial hydrogen requirements will be provided by coal gasification thus conserving natural gas and light hydrocarbon feed stocks equivalent to about 600,000 B/D of crude oil. Electrolytic hydrogen production costs will be reduced by improved electrolysis technology such as the solid-polymer-electrolyte process. These improved processes will reduce electrolysis plant investments by a factor of 2 or more and reduce electricity requirements by about 20%. Although the production cost, including return for electrolytic hydrogen, will continue to exceed those for reforming and coal gasification, the use of electrolytic hydrogen will be attractive for many small users when the new technology is available in the early 1980's. Electrolytic hydrogen now about 0.7% of total U.S. industrial hydrogen requirements will probably increase to about 1.2% of the total by the year 2000. (ERA citation 03:024256)

**ALTERNATIVE HYDROCARBON FUELS FOR AVIATION.**  
W.G. Dukek and J.P. Longwell.  
EXXON Air World, v.29, no.4, 1977, p.92-96.

Analysis of the types of alternative fuels which aircraft may have to use towards the end of the century and beyond has been carried out by Exxon Research and Engineering Company. Wide-cut fuels that include blends of heavier diesel and burner fuel fractions with kerosene would represent a less energy intensive course to follow than hydrocracking heavy gas oils to make specification jet fuel. These alternative fuels would contain higher aromatics and exhibit higher freezing points than Jet A or Jet A-1 and would give refiners more flexibility in meeting aviation fuel volume requirements. At some time in the future, these alternative fuels could contain synthetic products from non-petroleum sources. Shale liquids would require minimum processing for jet fuel while coal liquid conversion to jet fuel would represent a very energy-intensive step. The combustion of high aromatic and wide boiling range fuels will require new engines and modified aircraft. Exxon has recommended to the U.S. Senate Sub-Committee on Aerospace Technology and National Needs that NASA work with the aviation and fuel industries in developing new aircraft for these future alternative fuels. In view of the long lead time required to develop such aircraft, this work should begin as soon as possible.

**OH-150,334**  
**INITIAL EVALUATION OF COAL DERIVED LIQUID FUELS**  
**IN A LOW EMISSION AND CONVENTIONAL TURBINE**  
**COMBUSTOR. R.J. Stettler and M.C. Hardin. Apr.**  
**1976. 12p. & illus.**

General Motors Technical Center, EP-6544  
Warren, Mich.

Fuels, Alternate  
Coal - Liquefaction  
Fuels - Combustion  
Fuels - Properties  
Engine emissions

CN-142,698

1975

ALTERNATE FUELS FOR AVIATION. G.J. Schott, Boeing  
Commercial Airplane Co. (Presented at 29th Annual  
Conference, Calif. Assn. of Airport Executives,  
July 16, 1975). 1975. 7p.

California Association of Airport  
Executives, Riverside

Fuels, Alternative  
Hydrogen  
Methane

Fuels, Jet - Synthesis  
Kerosene  
Methanol

HYDROGEN

79A53453# ISSUE 24 PAGE 4553 CATEGORY 44 RPT#:  
IAF PAPER 79-IISL-02 79/09/60 14 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Institutional issues in international solar energy utilization

AUTH: A/VON KRIES, W. PAA: A/(Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne, West Germany)

International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, 14 p.

MAJS: /\*HYDROGEN-BASED ENERGY/\*INTERNATIONAL COOPERATION/\* SOLAR ENERGY CONVERSION/\*SOLAR GENERATORS

MINS: / ENERGY TECHNOLOGY

ABA: A.T.

ABS: The paper examines large-scale international utilization of solar energy for production of electric power or fuel. The international features of the Solar Power Satellite Plants (SPS) and the Solar Thermal Electric Conversion Plants (STEC) are compared, noting that an SPS plant would be more international because of its installations in outer space, use of the internationally regulated frequency, and its high costs could require contributions from several countries. Reasons for internationalizing SPS and STEC plants including geographical, environmental, as well as the effect of microwave beams on organisms and the ionosphere, economic, and strategic are discussed, comparing the effects of SPS and STEC plants on these factors. The SIS space and ground framework, and a European STEC partnership organization are described, noting that STEC strengths are a proven organizational pattern, industrial/geographical decentralization, and cartel exclusion, while SPS has weaknesses of organizational gigantism, geographical/industrial centralization, and supplier oligarchy, concluding that STEC will probably materialize, rather than SPS.

79A37072 ISSUE 15 PAGE 2787 CATEGORY 44  
79/05/24 3 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen production from coal, water and electrons

AUTH: A/COUGHLIN, R. W.; B/FAROOQUE, M. PAA:  
B/(Connecticut, University, Storrs, Conn.)  
Nature, vol. 279, May 24, 1979, p. 301-303. Research supported by the University of Connecticut and U.S. Department of Energy.

MAJS: /\*COAL GASIFICATION/\*ELECTROCHEMICAL OXIDATION/\* HYDROGEN PRODUCTION/\*WATER

MINS: / EFFICIENCY/ ENERGY TECHNOLOGY/ FOSSIL FUELS

ABA: P.T.H.

ABS: The paper reports on a newly developed electrochemical process which converts coal and water into two separate gaseous products: one comprising essentially gaseous oxides of carbon and the other essentially pure hydrogen. The process chemistry takes place at mild temperatures and the gaseous products are essentially free of impurities such as tar, ash and sulfur compounds. This electrochemical gasification process involves the anodic oxidation of coal at an electrode.

AICHE Symposium Series, v.75, 1979  
no.189.

HEAT TRANSFER - SAN DIEGO 1979. Robert W. Lyczkowski, ed. (Comprised of papers presented at AIChE 18th National Heat Transfer Conf. held San Diego, Calif., Aug.5-8,1979).

A STUDY ON UTILIZING SOLAR ENERGY FOR HYDROGEN PRODUCTION

M. C. Chuang 273

Two types of solar concentrators were studied to investigate the potential to utilize solar energy for hydrogen production by using the Westinghouse Sulfur Water Decomposition system. From thermal analysis, it shows that the concentrator of paraboloid of revolution with evacuated receiver tube has great potential than that of the cylindrical parabolic concentrator to collect adequately the solar energy for hydrogen production.

THE TURNOVER TIMES AND POOL SIZES OF PHOTOSYNTHETIC HYDROGEN PRODUCTION BY GREEN ALGAE.  
E. Greenbaum.

Solar Energy, vol 23, no 4, 1979, p. 315-320.

**Abstract**—An investigation of the turnover times of photobiological production of hydrogen gas by green algae indicate that the photoreactions associated with molecular hydrogen production have promising properties for solar energy conversion and storage. Our results indicate that (a) the intrinsic kinetic rate capability of the hydrogen photoapparatus in green algae can keep pace with the incidence rate of light quanta, even in full sunlight; (b) the photogenerated electrons for hydrogen production probably lie in the mainstream of the electron transport chain of photosynthesis.

These results have been obtained by performing the first measurements on the turnover times and pool sizes of photosynthetic hydrogen production. For the three species of green algae studied, the turnover times range from 0.1 to 3 ms. The turnover time for photosynthetic hydrogen production is, therefore, comparable to that for oxygen production.

Rapid multiple flash experiments have been performed which indicate that the immediate source of reductant for photosynthetic hydrogen production is derived from a pool of 5-20 equivalents, depending on the alga. This pool is probably the plastoquinone pool linking the two photosystems of photosynthesis.

HYDROGEN PRODUCTION FROM COAL, WATER AND ELECTRONS.  
Robert W. Coughlin and M. Farooque.

Nature, vol 279, no 5711, 24 May 1979, p. 301-305.

*Coals and other forms of solid carbonaceous fossil fuel are oxidised to oxides of carbon at the anode of an electrochemical cell and hydrogen is produced at the cathode, these gases being produced in relatively pure states. The reaction proceeds at very mild temperatures and at operating electrical potentials significantly lower than the thermodynamic potential of water electrolysis. Although the reaction is readily observable at room temperature, the observed activation energies and the expected decomposition temperatures of the presumed intermediates suggest that much more rapid and steadier oxidation rates might be achieved at higher temperatures in the range 200-600 °C.*

THERMOCHEMICAL DECOMPOSITION OF WATER.  
Chemtech, vol 9, no 4, April 1979, p. 208-217.

A79-36049 High-temperature nuclear heat source for hydrogen production. R. N. Quade (General Atomic Co., San Diego, Calif.) and L. Meyer (General Atomic Europe, Zurich, Switzerland). *International Journal of Hydrogen Energy*, vol. 4, no. 2, 1979, p. 101-110. 6 refs.

The combination of nuclear breeder reactors and thermal converters can efficiently utilize uranium and thorium reserves and is a worldwide energy source which is potentially 20 times greater than coal. The very high temperature reactor (VHTR), a thermal converter, can be coupled to open and closed cycle processes to produce hydrogen in large quantities. Current work in the U.S. is focused on the design of a VHTR of about 850 MW(t). The thermal rating and the design are similar to those of the steam cycle Fort St. Vrain (FSV) reactor built in Colorado, U.S., but an intermediate helium circuit and a core outlet temperature of 925-950 °C are used. Hydrogen production using this reactor would be approximately 10 kg/sec with a carbon-based process or 3 kg/sec with a closed-loop thermochemical process. (Author)

A79-33756 The cost of hydrogen from coal. E. T. Kim, H. R. Moore, and R. I. Kermode (Kentucky, University, Lexington, Ky.). *International Journal of Energy Research*, vol. 3, Apr.-June 1979, p. 143-155. 17 refs. NSF Grant No. AER-73-0359-A02.

Isolation of the hydrogen and oxygen plants from the rest of the liquefaction complex, combined with appropriate transfer costs for all utilities and raw materials has been used to estimate the value of hydrogen. For the five alternatives, minimum cost hydrogen is produced by gasification of coal at 1000 psia. 500 psia gasification of coal yielded slightly more expensive hydrogen; however, on an equivalent mole basis of hydrogen, they were virtually the same. As would be expected, the cost of coal, discount cash flow rate and method of costing supplemental fuel needs were the primary variables affecting the cost of hydrogen. Hydrogen cost ranged from \$0.847/1000 standard cubic feet to \$2.986/1000 standard cubic feet. (Author)

PRESENT STATE AND FUTURE PROSPECTS OF THERMOCHEMICAL HYDROGEN PRODUCTION. G. E. Beghi.

*International Journal of Hydrogen Energy*, vol 4, no 6, 1979, p. 499-512.

**Abstract**—Thermochemical decomposition of water as a method of producing hydrogen is a relatively recent subject of research. First studies are mentioned, giving definitions and indicating methodology for analysis. Chemical reactions of "pure" and "hybrid" thermochemical cycles for the main processes under study are mentioned. For the experimental activities in progress, the recent demonstration of the technical feasibility on the laboratory scale is reported, based on some complete circuits in operation or under construction. For the technico-economic evaluations the different calculations are given and the uncertainty existing is emphasized, a figure of about 8.5-91 for hydrogen production cost seems to meet good consensus. Further experimental data, particularly in some research areas, are necessary to give evidence of the competitiveness of thermochemical processes; the next few years will be critical in contributing to give an answer as to the prospects of this new method for hydrogen production.

79A40747# ISSUE 17 PAGE 3236 CATEGORY 44  
 79/00/00 21 PAGES UNCLASSIFIED DOCUMENT  
 UTTL: Photoelectrolysis of aqueous solutions to hydrogen -  
 An approach to solar energy storage  
 AUTH: A/SMITH, F. R. PAA: A/(Newfoundland, Memorial  
 University, St. John's, Canada)  
 In: Chemistry for energy; Proceedings of the  
 Symposium, Winnipeg, Manitoba, Canada, June 5-7, 1978.  
 (A79-40736 17-44) Washington, D.C.: American Chemical  
 Society, 1979, p. 221-241.

MAJS: /\*ELECTRODES/\*ELECTROLYSIS/\*ENERGY STORAGE/\*HYDROGEN  
 PRODUCTION/\*N-TYPE SEMICONDUCTORS/\*  
 PHOTOELECTROCHEMICAL DEVICES/\*SOLAR ENERGY CONVERSION  
 MINS: / ELECTROLYTES/ ENERGY GAPS (SOLID STATE)/ ENERGY  
 TECHNOLOGY/ GRAPHS (CHARTS)/ IRON OXIDES/  
 SEMICONDUCTOR DEVICES/ TANTALUM COMPOUNDS/ TITANATES/  
 TITANIUM OXIDES/ TUNGSTEN OXIDES/ ULTRAVIOLET  
 RADIATION

ABA: S.D.  
 ABS: The paper shows how the advantages of hydrogen storage  
 combined with generation of electricity by solar  
 radiation make the concept of photoelectrolysis of  
 water quite attractive. Photoeffects are observed both  
 at oxygen-evolving anodes and at hydrogen-evolving  
 cathodes, both being useful in practical  
 photoelectrolysis when the incident radiation is  
 ultraviolet. Semiconductor anodes or cathodes are  
 required which do not decompose in the electrolyte and  
 which are electrocatalysts for oxygen or hydrogen  
 production from water. The band gaps of the  
 semiconductors should be reasonably matched to the  
 solar spectrum for high efficiency, and a suitable  
 degree of bending for the bands at the surface is  
 desirable. Materials used as anodes include TiO<sub>2</sub>,  
 various titanates and tantalates, WO<sub>3</sub> and Fe<sub>2</sub>O<sub>3</sub>. GaP  
 stands essentially alone as a cathode material. Future  
 prospects for an economic process are discussed.

OPEN-LOOP THERMOCHEMICAL CYCLES FOR THE PRODUCTION  
 OF HYDROGEN. W. L. Gonger.

International Journal of Hydrogen Energy, vol 4,  
 no 6, 1979, p. 517-522.

Abstract—The concept of open-loop thermochemical cycles (cycles which have additional or other feedstocks  
 than water and produce materials in addition to hydrogen and oxygen) is introduced. Preliminary analysis of  
 possible feedstocks available indicates substantial quantities of hydrogen could possibly be produced through  
 open-cycles. The advantages of open-cycles include the conversion of unwanted waste products to useful products  
 while producing hydrogen. A compilation of open processes which would have SO<sub>2</sub> in addition to water as feed  
 stock and which would produce sulfuric acid in addition to hydrogen and oxygen is given.

ENGINEERING IMPACT ON THE VALIDITY OF THE MARK-  
 16 THERMOCHEMICAL CYCLE. W. R. A. Goossens.

International Journal of Hydrogen Energy, vol 4,  
 no 6, 1979, p. 523-534.

Abstract—Mass and energy balances are presented for the whole Mark-16 thermochemical cycle using thermo-  
 dynamical information. The practical restrictions to the resulting good prospects are indicated. The impact on  
 technical constraints is assessed taking the HI step as an example. Adding the energy consumption of the product  
 separation units related to the HI-decomposition step to the energy consumption under equilibrium conditions  
 for the chemical reaction steps shows a thermal efficiency of 0.31 for the Mark-16 cycle.

79A49231 ISSUE 22 PAGE 4180 CATEGORY 44  
 79/00/00 2 PAGES UNCLASSIFIED DOCUMENT

UTTL: The impracticability of large-scale generation of  
 hydrogen from water photolysis by utilization of solar  
 radiation

AUTH: A/MELVIN, A. PAA: A/(British Gas Corp., London,  
 England)  
 International Journal of Hydrogen Energy, vol. 4, no.  
 3, 1979, p. 223, 224.

MAJS: /\*HYDROGEN PRODUCTION/\*PHOTOLYSIS/\*SOLAR RADIATION/\*  
 WATER  
 MINS: / ATMOSPHERIC PRESSURE/ COAL GASIFICATION/ ECONOMIC  
 FACTORS/ SOLAR ENERGY

ABA: (Author)  
 ABS: The possibility of using solar radiation for the  
 generation of hydrogen by the photolysis of water is  
 discussed in relation to requirements of large-scale  
 generation which would be needed in a hydrogen economy  
 or in coal gasification. Although the point is  
 conceded that solar energy is, for all practical  
 purposes, an infinite source, the conclusion is that  
 solar radiation is not available on the surface of the  
 plant in energy densities which would allow  
 large-scale hydrogen generation without overwhelming  
 technical and economic difficulties. The particular  
 restriction lies in the large ground areas required  
 for generation of reasonably large quantities of  
 hydrogen, since the volume of hydrogen at atmospheric  
 pressure which can be generated per square metre of  
 surface is only of the order of 0.2-0.4 cu m/day.

79A45579 ISSUE 20 PAGE 3774 CATEGORY 44  
79/00/00 17 PAGES UNCLASSIFIED DOCUMENT

UTTL: International developments in hydrogen technologies  
--- research cooperation for new hydrogen production  
methods

AUTH: A/BEGHI, G. E. PAA: A/(EURATOM and Comitato  
Nazionale per l'Energia Nucleare, Centro Comune di  
Ricerche, Ispra, Italy)  
In: Hydrogen for energy distribution; Proceedings of  
the Symposium, Chicago, Ill., July 24-28, 1978.  
(A79-45576 20-44) Chicago, Institute of Gas  
Technology, 1979, p. 41-57.

MAJS: /\*HYDROGEN PRODUCTION/\*HYDROGEN-BASED ENERGY/\*  
INTERNATIONAL COOPERATION/\*RESEARCH AND DEVELOPMENT/\*  
RESEARCH MANAGEMENT

MINS: / ENERGY TECHNOLOGY/ EUROPE/ INDUSTRIAL MANAGEMENT

ABA: A.T.

ABS: International cooperation in the research for new  
hydrogen production methods is reported. Research  
areas in hydrogen production and utilization and the  
International Energy Agency programs on hydrogen  
production from thermal decomposition of sulfuric  
acid, thermal decomposition of metal sulfate,  
hydrolysis of FeCl<sub>2</sub>, liquid separation of H<sub>2</sub>SO<sub>4</sub>/HI  
from solution, decomposition of HI, decomposition of  
FeCl<sub>3</sub>, and production of hydrogen from water are  
discussed. Other joint programs include thermochemical  
and electrolytic production, and transportation and  
storage of hydrogen. It is expected that as a result  
of cooperative actions, it will be possible to conduct  
integrated experimental activities, exchange of  
researchers, and joint participation in pilot scale  
and demonstration projects.

BON13296# ISSUE 4 PAGE 453 CATEGORY 28 RPT#:  
LA-UR-79-1115 CONF-790803-9 CNT#: W-7405-ENG-36  
79/00/00 6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Synfuel (hydrogen) production from fusion power  
AUTH: A/KRAKOWSKI, R. A.; B/COX, K. E.; C/PENDERGRASS, J.  
H.; D/POOTH, L. A.

CORP: Los Alamos Scientific Lab., N. Mex. AVAIL:NTIS  
SAP: HC A02/MF A01  
Presented at the 14th Intersoc. Energy Conversion  
Conf., Boston, 5 Aug. 1979

MAJS: /\*ENERGY CONVERSION/\*FUSION REACTORS/\*HYDROGEN  
PRODUCTION/\*SYNTHETIC FUELS

MINS: / BISMUTH/ ECONOMIC ANALYSIS/ SULFATES/ TECHNOLOGY  
ASSESSMENT/ THERMOCHEMISTRY

ABA: DOE

ABS: A potential use of fusion energy for the production of  
synthetic fuel (hydrogen) is described. The  
hybrid-thermochemical bismuth-sulfate cycle was as a  
vehicle to assess the technological and economic  
merits of this potential nonelectric application of  
fusion power.

79A45592\* ISSUE 20 PAGE 3774 CATEGORY 44  
79/00/00 21 PAGES UNCLASSIFIED DOCUMENT

UTTL: Dedicated nuclear facilities for electrolytic hydrogen  
production

AUTH: A/FOH, S. E.; B/ESCHER, W. J. D.; C/DONAKOWSKI, T.  
D. PAA: C/(Institute of Gas Technology, Chicago,  
Ill.)

CORP: Institute of Gas Technology, Chicago, Ill.  
In: Hydrogen for energy distribution; Proceedings of  
the Symposium, Chicago, Ill., July 24-28, 1978.  
(A79-45576 20-44) Chicago, Institute of Gas  
Technology, 1979, p. 339-359. NASA-supported  
research.

MAJS: /\*ECONOMIC FACTORS/\*ELECTROLYSIS/\*HYDROGEN PRODUCTION  
/\*NUCLEAR ELECTRIC POWER GENERATION/\*PERFORMANCE  
PREDICTION/\*THERMOCHEMISTRY

MINS: / COST ESTIMATES/ ENERGY TECHNOLOGY/ TABLES (DATA)/  
WATER TREATMENT

ABA: A.T.

ABS: An advanced technology, fully dedicated  
nuclear-electrolytic hydrogen production facility is  
presented. This plant will produce hydrogen and oxygen  
only and no electrical power will be generated for  
off-plant use. The conceptual design was based on  
hydrogen production to fill a pipeline at 1000 psi and  
a 3000 MW nuclear base, and the base-line facility  
nuclear-to-shaftpower and shaftpower-to-electricity  
subsystems, the water treatment subsystem,  
electricity-to-hydrogen subsystem, hydrogen  
compression, efficiency, and hydrogen production cost  
are discussed. The final conceptual design integrates  
a 3000 MWh high-temperature gas-cooled reactor  
operating at 980 C helium reactor-out temperature,  
direct dc electricity generation via acyclic  
generators, and high-current density, high-pressure  
electrolyzers based on the solid polymer electrolyte  
approach. All subsystems are close-coupled and  
optimally interfaced and pipeline hydrogen is produced  
at 1000 psi. Hydrogen costs were about half of the  
conventional nuclear electrolysis process.

## Hydrogen

TP  
359  
,H8  
H9  
v,5  
Hydrogen : its technology and implications,  
v.5 : implications of hydrogen energy /  
editors, Kenneth E. Cox, K. D. Williamson,  
Jr. -- Boca Raton, Fla. : CPC Press, c1979.  
129 p.  
Includes bibliographical references and

79A45593\* ISSUE 20 PAGE 3775 CATEGORY 44  
79/00/00 32 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Concepts for solar production of hydrogen  
AUTH: A/HANSON, J. A. PAA: A/(California Institute of  
Technology, Jet Propulsion Laboratory, Pasadena,  
Calif.)  
CORP: Jet Propulsion Lab., California Inst. of Tech.,  
Pasadena.  
In: Hydrogen for energy distribution: Proceedings of  
the Symposium, Chicago, Ill., July 27-28, 1978.  
(A79-45576 20-44) Chicago, Institute of Gas  
Technology, 1979, p. 361-392.  
MAJS: /\*ENERGY SOURCES/\*HYDROGEN PRODUCTION/\*SOLAR ENERGY  
CONVERSION/\*SYSTEMS ENGINEERING  
MINS: / CLEAN ENERGY/ COAL UTILIZATION/ ENERGY TECHNOLOGY/  
ENVIRONMENT EFFECTS/ OCEAN THERMAL ENERGY CONVERSION/  
THERMOCHEMISTRY/ WINDPOWER UTILIZATION  
ABA: M.E.P.  
ABS: Some basic technical approaches to producing hydrogen  
from solar energy are surveyed. Solar energy forms are  
divided into: (1) direct solar radiation and (2)  
indirect forms such as wind and ocean thermal  
gradient. Technical approaches are separated into: (1)  
direct hydrogen production from the action of sunlight  
on some substrate, (2) hydrogen production from  
sunlight via an intermediate form of energy such as  
heat and electricity, and (3) hydrogen production from  
indirect solar energy via an intermediate energy form.  
It is concluded that while hydrogen from solar energy  
will be expensive by present standards, the depletion  
of fossil fuels will cause solar hydrogen to emerge as  
one of the few alternatives to a nuclear-electric or  
nuclear-electric-hydrogen energy system.

80N10401# ISSUE 1 PAGE 55 CATEGORY 26 RPT#:  
NTIS/PS-79/0773/6 79/08/00 45 PAGES UNCLASSIFIED  
DOCUMENT  
UTTL: Hydrogen production. Citations from the international  
aerospace abstracts data base TLSP: Report, 1977 -  
Jul, 1979  
AUTH: A/ZOLLARS, G. F.  
CORP: New Mexico Univ., Albuquerque. CSS: (Technology  
Application Center.) AVAIL:NTIS SAP: HC \$28.00/MF  
\$28.00  
Springfield, Va. NTIS Sponsored by NTIS  
MAJS: /\*BIBLIOGRAPHIES/\*ELECTROLYSIS/\*HYDROGEN PRODUCTION/\*  
LIQUID HYDROGEN/\*PHOTOLYSIS/\*THERMOCHEMISTRY  
MINS: / ABSTRACTS/ COAL GASIFICATION/ MANUFACTURING/ SOLAR  
ENERGY CONVERSION/ THERMAL DISSOCIATION/ WATER  
ABA: GRA  
ABS: This bibliography cites 169 articles from the  
international literature concerning hydrogen  
production. Techniques examined include solar energy  
conversion, coal gasification, thermal dissociation,  
and water electrolysis.

79A51852\* ISSUE 23 PAGE 4378 CATEGORY 44  
79/00/00 3 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Hydrogen as the solar energy translator --- in  
photochemical and photovoltaic processes  
AUTH: A/KELLEY, J. H. PAA: A/(California Institute of  
Technology, Jet Propulsion Laboratory, Pasadena,  
Calif.)  
CORP: Jet Propulsion Lab., California Inst. of Tech.,  
Pasadena.  
In: Intersociety Energy Conversion Engineering  
Conference, 14th, Boston, Mass., August 5-10, 1979.  
Proceedings, Volume 1. (A79-51726 23-44) Washington,  
D.C., American Chemical Society, 1979, p. 800-802.  
Research sponsored by the U.S. Department of Energy.  
MAJS: /\*ELECTROLYSIS/\*HYDROGEN-BASED ENERGY/\*PHOTOCHEMICAL  
REACTIONS/\*PHOTOLYSIS/\*SOLAR ENERGY CONVERSION/\*  
THERMOCHEMISTRY  
MINS: / ENERGY TECHNOLOGY/ HYDROGEN PRODUCTION/ INDUSTRIAL  
MANAGEMENT/ TECHNOLOGY ASSESSMENT/ WATER  
ABA: (Author)  
ABS: Many concepts are being investigated to convert  
sunlight to workable energy forms with emphasis on  
electricity and thermal energy. The electrical  
alternatives include direct conversion of photons to  
electricity via photovoltaic solar cells and  
solar/thermal production of electricity via  
heat energy cycles. Solar cells, when commercialized,  
are expected to have efficiencies of about 12 to 14  
percent. The cells would be active about eight hours  
per day. However, solar-operated water-splitting  
process research, initiated through JPL, shows promise  
for direct production of hydrogen from sunlight with  
efficiencies of up to 35 to 40 percent. The hydrogen,  
a valuable commodity in itself, can also serve as a  
storable energy form, easily and efficiently converted  
to electricity by fuel cells and other  
advanced-technology devices on a 24-hour basis or on  
demand with an overall efficiency of 25 to 30 percent.  
Thus, hydrogen serves as the fundamental translator of  
energy from its solar form to electrical form more  
effectively, and possibly more efficiently, than  
direct conversion. Hydrogen also can produce other  
chemical energy forms using solar energy.

TK  
2896  
ISS  
1979

79N31422# ISSUE 22 PAGE 2936 CATEGORY 28 RPT#:  
SERI/TR-33-122 CNT#: EG-77-C-01-4042 79/01/00 109  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Photobiological production of hydrogen: A solar energy conversion option --- hydrogen metabolism in photosynthetic bacteria and algae

AUTH: A/WEAVER, P.: B/LIEN, S.: C/SEIBERT, M.

CORP: Midwest Research Inst., Golden, Colo. AVAIL.NTIS  
SAP: HC A06/MF A01

MAJS: /\*ALGAE/\*BACTERIA/\*HYDROGEN PRODUCTION/\*METABOLISM/\*  
PHOTOSYNTHESIS/\*SOLAR ENERGY CONVERSION

MINS: / CELLS (BIOLOGY)/ ELECTRON MOBILITY/ ENERGY  
TECHNOLOGY/ ENZYMES/ PHOTOTROPISM

ABA: DOE

ABS: The history of photobiological hydrogen production from its discovery in relatively pure cultures during the early 1930s to the present is reviewed with emphasis on hydrogen production by phototrophic organisms (and their components) which occurs at the expense of light energy and electron-donating substrates. Among the topics included is an overview of hydrogen metabolism in photosynthetic bacteria, eucaryotic algae, and cyanobacteria (blue-green algae). The primary enzyme systems, including hydrogenase and nitrogenase, are discussed along with the manner in which they are coupled to electron transport and the primary photochemistry of photosynthesis. A number of in vivo and in vitro photobiological hydrogen evolving schemes including photosynthetic bacterial, green algal, cyanobacterial, two-stage, and cell-free systems are examined. Specific technical problem areas that currently limit the yield and duration of many of the systems and research that might lead to progress in these specific areas are discussed.

### A COMPRESSORLESS AMMONIA PROCESS

Aldo V. da Rosa

Chemtech

Vol. 8, no. 1, January 1978,  
p. 28-29.

da Rosa shows how to do it: make feed hydrogen at high pressure.

BON12605# ISSUE 3 PAGE 360 CATEGORY 44 RPT#:  
LA-UR-79-1256 CONF-790803-25 CNT#: W-7405-ENG-36  
79/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Process design of the LASL bismuth sulfate thermochemical hydrogen cycle

AUTH: A/COX, K. E.: B/PENDERGRASS, J. H.: C/JONES, W. M.  
CORP: Los Alamos Scientific Lab., N. Mex. AVAIL.NTIS  
SAP: HC A02/MF A01

Presented at Intersoc. Energy Conversion Conf.,  
Boston, 5 Aug. 1979

MAJS: /\*BISMUTH COMPOUNDS/\*ENERGY POLICY/\*HYDROGEN  
PRODUCTION/\*SULFATES/\*THERMOCHEMISTRY

MINS: / ENERGY TECHNOLOGY/ HEAT SOURCES/ NUCLEAR FUSION/  
PROCESS CONTROL (INDUSTRY)/ THERMODYNAMIC EFFICIENCY/  
WATER

ABA: DOE

ABS: A process engineering flowsheet for a design of the LASL bismuth sulfate thermochemical cycle is presented. The design is based on laboratory data that indicate a lowered endothermic heat load for a partial decomposition of the solid bismuth sulfate. The results of the flowsheeting analysis yield a thermal efficiency of 50% for the cycle when coupled to a conceptual fusion energy heat source at 1500 K. A parametric analysis shows a slight drop in efficiency as the temperature of the heat source is decreased. The LASL bismuth sulfate thermochemical cycle appears to have potential as a means of producing hydrogen from high temperature heat sources such as fusion, fission, and solar energy; it also appears to be competitive with alternative thermochemical cycles as well as with water electrolysis for hydrogen production.

79A20360 ISSUE 6 PAGE 1031 CATEGORY 44  
78/00/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Thermal calculations for the reactor of a solar-power unit to produce hydrogen by thermolysis of water

AUTH: A/SHAKHBAZOV, SH. D.: B/RZAEV, P. F. PAA:  
B/(Azerbaidzhanskii Politekhnikheskii Institut, Baku,  
Azerbaidzhan SSR)

(Gelliotekhnika, no. 2, 1978, p. 69-73.) Applied Solar  
Energy, vol. 14, no. 2, 1978, p. 49-53. Translation.

MAJS: /\*CONDUCTIVE HEAT TRANSFER/\*HYDROGEN PRODUCTION/\*  
PYROLYSIS/\*SOLAR ENERGY CONVERSION/\*THERMAL REACTORS

MINS: / CONSTRUCTION MATERIALS/ GRAPHITE/ TEMPERATURE  
DISTRIBUTION/ THERMAL CONDUCTIVITY

ORIGINAL PAGE IS  
OF POOR QUALITY

78A43771 ISSUE 19 PAGE 3506 CATEGORY 44  
78/00/00 8 PAGES UNCLASSIFIED DOCUMENT  
UTTL: On photo fuel --- solar conversion of water into  
hydrogen and oxygen gas  
AUTH: A/BOCKRIS, J. O'M.: B/HANDLEY, L. PAA: B/(Flinders  
University, Adelaide, South Australia, Australia)  
Energy Conversion, vol. 18, no. 1, 1978, p. 1-8.  
MAJS: /\*ELECTROLYSIS/\*HYDROGEN OXYGEN FUEL CELLS/\*HYDROGEN  
PRODUCTION/\*PHOTOELECTRIC GENERATORS/ SOLAR ENERGY  
CONVERSION  
MINS: / ANODES/ COST ESTIMATES/ ELECTROCHEMISTRY/ ENERGY  
CONVERSION EFFICIENCY/ ENERGY TECHNOLOGY/ PHOTOVOLTAIC  
CONVERSION/ PIPELINES/ SEMICONDUCTORS (MATERIALS)/  
WATER

ABA: M.L.

ABS: The process of direct solar conversion of water into  
hydrogen and oxygen gas is discussed. The most  
important research goal is the attainment of a stable  
photoanode with a small energy gap (0.75-1.5 eV).  
Recent advances in cladding, stable photocathodes, and  
a stable working photodriven cell are characterized.  
Examined topics related to the optimization of  
photoelectrolysis include thermodynamic requirements,  
band bending, the reduction potential value, surface  
states, and doping of semiconductors. Photocorrosion  
and its possible prevention is considered. Present  
hydrogen generation efficiencies are only 0.1% with at  
least 5-10% needed for commercial utility.

78N30270# ISSUE 21 PAGE 2780 CATEGORY 28 RPT#:  
NTIS/PS-78/0546/B NTIS/PS-77/0495 NTIS/PS-76/0460  
78/06/00 118 PAGES UNCLASSIFIED DOCUMENT  
Supersedes NTIS/PS-77/0495; NTIS/PS-76/0460

UTTL: Hydrogen storage. Part 1: Storage as a gas or  
liquid. A bibliography with abstracts TLSP: Final  
Report, 1974 - May 1978

AUTH: A/CAVAGNARO, D. M.

CORP: National Technical Information Service, Springfield,  
Va. AVAIL.NTIS SAP: HC \$28.00/MF \$28.00

MAJS: /\*BIBLIOGRAPHIES/\*ENERGY STORAGE/\*FUEL TANKS/\*HYDROGEN  
FUELS/\*LIQUID HYDROGEN/\*STORAGE TANKS

MINS: / AUTOMOBILE FUELS/ ECONOMIC FACTORS/ ELECTROCHEMISTRY  
/ STORAGE STABILITY/ SYNTHETIC FUELS

ABA: GRA

ABS: This bibliography contains aspects of storing  
hydrogen as a liquid or a gas. Citations cover fuel  
storage, energy storage, and the construction of tanks  
used to store the material.

79A38633 ISSUE 16 PAGE 3027 CATEGORY 44  
78/00/00 9 PAGES In FRENCH UNCLASSIFIED DOCUMENT  
UTTL: Electrolytic hydrogen production by means of solar and  
wind energy

AUTH: A/DA CAMARA TORRES, C.: B/GOLDFARB, J. PAA:  
B/(Paraliba, Universidade Federal, Joao Pessoa, Brazil)  
In: International Solar Forum, 2nd, Hamburg, West  
Germany, July 12-14, 1978, Reports, Volume 2,  
(479-38576 16-44) Munich, Deutsche Gesellschaft fuer  
Sonnenenergie, 1978, p. 291-299. In French.

MAJS: /\*ELECTROLYSIS/\*HYDROGEN PRODUCTION/\*SOLAR ENERGY  
CONVERSION/\*WINDPOWER UTILIZATION

MINS: / COST ANALYSIS/ ENERGY TECHNOLOGY/ WINDPOWERED  
GENERATORS

ABA: (Author)

ABS: The authors propose the production of electrolytic  
hydrogen through a wind-solar power station,  
consisting of 5 Darrieus wind generators of 20 kw, a  
solar tower of 100 kwth, with hydroelectric  
complementation. During most of the day the  
electrolysis will be in the vapour phase and during  
the rest of the time in liquid phase. Studies made to  
establish the conditions for economic viability of the  
process arrived at a period of 11 years for recovery  
of the invested capital.

BON12197# ISSUE 3 PAGE 306 CATEGORY 28 RPT#:  
LA-UR-78-2895 CONF-781142-4 CNT#: W-7405-ENG-36  
78/10/31 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: LASL thermochemical hydrogen program status on October  
31, 1978 --- fusion-synfuel

AUTH: A/COX, K. E.: B/BOWMAN, M. G.

CORP: Los Alamos Scientific Lab., N. Mex. AVAIL.NTIS  
SAP: HC A02/MF A01

Presented at Chem. Hydrogen Energy Systems Contracts  
Rev., Washington, D.C., 28 Nov. 1978

MAJS: /\*BLANKETS (FUSION REACTORS)/\*HYDROGEN PRODUCTION/\*  
SYNTHETIC FUELS/\*THERMOCHEMISTRY

MINS: / BISMUTH COMPOUNDS/ ELECTROLYSIS/ REACTION KINETICS/  
SULFATES/ SULFUR OXIDES/ WATER

ABA: DOE

ABS: Progress is reported in developing an efficient and  
economical thermochemical cycle for the production of  
hydrogen from water utilizing thermal energy sources  
that become available. Topics covered include: (1)  
continuing experiments in sulfate decomposition,  
sulfate formation, and hydrogen iodide electrolysis;  
(2) fusion-synfuel study (hydrogen); and (3)  
evaluation of thermochemical cycles.

79A27651 ISSUE 10 PAGE 1836 CATEGORY 44  
78/00/00 408 PAGES UNCLASSIFIED DOCUMENT

UTTL: Applications of cryogenic technology. Volume 7 -  
Proceedings of the Conference on Cryogenic Energy  
Systems, Oak Brook, Ill., May 16-18, 1978  
AUTH: A/MISSIG, J. R.; B/VANCE, R. W. PAA: A/(Liquid  
Carbonic Corp., Chicago, Ill.); B/(Cryogenic Society  
of America, West Rancho Palos Verdes, Calif.) PAT:  
A/(ED.) SAP: \$29.50  
Conference sponsored by the Cryogenic Society of  
America Flushing, N.Y., Scholium International, Inc.,  
1978. 408 p (For individual items see A79-27652 to  
A79-27669)  
MAJS: /\*CONFERENCES/\*CONTROLLED FUSION/\*CRYOGENICS/\*ENERGY  
TECHNOLOGY/\*HYDROGEN PRODUCTION/\*MAGNETOHYDRODYNAMIC  
GENERATORS/\*SUPERCONDUCTIVITY  
MINS: / HYDROGEN-BASED ENERGY/ SUPERCONDUCTING MAGNETS/  
TECHNOLOGY ASSESSMENT/ TOKAMAK DEVICES  
ABA: B.J.  
ABS: Papers are presented on the implications of cryogenics

for hydrogen energy, MHD power generation, and the  
application of superconducting technology to the  
energy field. Consideration is also given to military  
applications of superconductivity and to the  
application of cryogenic technology to controlled  
fusion.

80N10361\*W ISSUE 1 PAGE 50 CATEGORY 27 RPT#:  
NASA-CASE-NPO-14315-1 US-PATENT-APPL-SN-900659  
78/04/27 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Molten salt pyrolysis of latex --- for hydrocarbon  
fuel production TLSP: Patent Application  
AUTH: A/BAUMAN, A. J. PAA: A/(JPL) PAT: A/inventor (to  
NASA)  
CORP: National Aeronautics and Space Administration,  
Pasadena Office, Calif.; Jet Propulsion Lab.,  
California Inst. of Tech., Pasadena. AVAIL:NTIS  
SAP: HC A02/MF A01  
Sponsored by NASA  
MAJS: /\*HYDROCARBON FUEL PRODUCTION/\*HYDROCARBON FUELS/\*  
LATEX/\*MOLTEN SALTS/\*PYROLYSIS/\*SYNTHETIC FUELS  
MINS: / INORGANIC COMPOUNDS/ PATENT APPLICATIONS/  
PHOTOSYNTHESIS/ PLANTS (BOTANY)/ TEMPERATURE EFFECTS/  
THERMAL DECOMPOSITION  
ABA: A.W.H.  
ABS: The production of synthetic hydrocarbon liquid fuel  
from latex rich plants is reported. The pyrolysis of  
high isoprene latex plants such as Guayule, or  
extracts thereof, in a molten inorganic salt at  
temperatures above 300 C is described. The pyrolysis  
process is examined using a number of inorganic salts  
and a reactor is described for the hydrogen fuel  
production.

79A34021 ISSUE 13 PAGE 2415 CATEGORY 44  
78/00/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Solar energy conversion in marine biological systems  
AUTH: A/MITSUI, A. PAA: A/(Miami, University, Coral  
Gables, Fla.)  
In: Alternative energy sources: Proceedings of the  
Miami International Conference, Miami Beach, Fla.,  
December 5-7, 1977. Volume 2. (A79-34002 13-44)  
Washington, D.C., Hemisphere Publishing Corp., 1978.  
p. 1013-1017.  
MAJS: /\*AQUICULTURE/\*BLUE GREEN ALGAE/\*FERTILIZERS/\*HYDROGEN  
PRODUCTION/\*MARINE RESOURCES/\*OFFSHORE ENERGY SOURCES  
/\*SOLAR ENERGY CONVERSION  
MINS: / ARGON/ BIOCHEMISTRY/ ENERGY TECHNOLOGY/ HYDROCARBON  
FUEL PRODUCTION/ MARINE BIOLOGY/ METHANE/ NITROGEN/  
NUTRITIONAL REQUIREMENTS/ PHOTOPRODUCTION  
ABA: J.M.B.  
ABS: The use of tropical marine microorganisms for fuel,  
food and fertilizer production is discussed, with  
emphasis on hydrogen photoproduction and nitrogen  
fixation. A blue-green algal strain has shown a  
hydrogen production rate of one cc per ml algal  
suspension per day in a nitrogen-free medium under an  
argon atmosphere; this high, stable production rate  
may make the algae an attractive source for hydrogen  
fuel. Many blue-green algae fix nitrogen and may serve  
as fertilizers. In addition, the soft cell walls of  
blue-green algae may make them suitable for processing  
as nutrients. Methane production aided by algal  
species also receives attention.

A78-51342\* Hydrogen from the solar photolysis of water.  
P. R. Ryason (California Institute of Technology, Jet Propulsion  
Laboratory, Pasadena, Calif.). *Energy Sources*, vol. 4, no. 1, 1978, p.  
1-22. 56 refs. Contract No. NAS7-100.

Developments related to the study of photosynthesis are  
examined and aspects of photosensitization by solids are considered.  
It is pointed out that solids photosensitization for solar photochemi-  
cal fuel formation is now an extremely active research area as a  
consequence of the promising results obtained with semiconductor  
photoelectrodes. The investigation of water decomposition schemes  
involving heterogeneous reactions is likely to be a productive area. As  
is the case for photosynthesis, the known examples of water  
decomposition by solids photosensitization involve charge separation  
processes immediately following light absorption. Homogeneous  
photoredox reactions are also discussed, taking into account thermo-  
chemical and photochemical cycles leading to the formation of a  
photooxidized ion, hydrogen quantum yields in the photo-oxidation  
aqueous ions, and thermochemical and photochemical cycles leading  
to the formation of a photoreduced ion. G.R.

SYSTEM EFFICIENCY OF A WATER - SPLITTING SYSTEM  
SYNTHESIZED BY PHOTOCHEMICAL AND THERMOELECTRIC  
CONVERSION OF SOLAR ENERGY.

T. Ohta, N. Kamiya, M. Yamaguchi, N. Gotoh,  
T. Otagawa, & S. Asakura  
International Journal of Hydrogen Energy,  
Vol. 3, No. 2, 1978, p. 203-208.

**Abstract** Valuable hybrid systems for hydrogen production by solar energy have been developed and the system efficiency has been estimated and discussed from various points of view. In order to decompose water into hydrogen and oxygen without the consumption of additional reactants, a steady stream of the reacting materials must be maintained in consecutive reaction processes and if the system has a rate determining step extra energy should be supplied to promote the reaction. In the Yokohama Mark 5 Process, the efficiency of the thermoelectric device is as low as 5%, however, the overall efficiency of hydrogen production can be raised to 20% by addition of extra electric power.

79A34026 ISSUE 13 PAGE 2415 CATEGORY 44  
78/00/00 19 PAGES UNCLASSIFIED DOCUMENT

UTTL: Direct Solar Energy Conversion at Sea /DSECAS/ -  
Characteristics of a baseline concept  
AUTH: A/ESCHER, W. J. D.; B/FOSTER, R. W.; C/VEZIROGLU, T.  
N. PAA: B/(Escher Technology Associates, St. Johns,  
Mich.); C/(Miami University, Coral Gables, Fla.)  
In: Alternative energy sources; Proceedings of the  
Miami International Conference, Miami Beach, Fla.,  
December 5-7, 1977. Volume 3. (A79-34022 13-44)  
Washington, D.C., Hemisphere Publishing Corp., 1978,  
p. 1115-1133.  
MAJS: /\*HYDROGEN-BASED ENERGY/\*OCEANS/\*SOLAR ENERGY  
CONVERSION  
MINS: / COST ANALYSIS/ ENERGY TECHNOLOGY/ OFFSHORE ENERGY  
SOURCES/ SOLAR GENERATORS  
ABA: (Author)  
ABS: The subject of the project is a direct solar energy  
conversion system sited in an equatorial ocean  
location. It is noted that this combination of a  
direct solar energy conversion system in this setting  
represents a heretofore unstudied family of systems.  
The possibility of using a number of alternative  
direct conversion methods such as photovoltaic,  
thermal heat engines, photochemical systems, etc. is  
noted and the advantages and disadvantages of ocean  
siting of such systems is discussed. The mariculture  
opportunity is particularly noted. A 'baseline' system  
comprised of high concentration ratio parabolic trough  
collectors, heat engines and electrolyzers/liqueriers  
of hydrogen and oxygen is presented to provide a basis  
for sizing and energy costs estimates. Comments on  
weather and sea motion as related to this class of  
system are presented.

THE PHOTOELECTROLYSIS OF WATER USING IRON TITANATE  
ANODES\*.

D. S. Ginley and M. A. Butler

Journal of Applied Physics, vol. 48, no. 5,  
May 1977, page 2019-

79A34113 ISSUE 13 PAGE 2423 CATEGORY 44  
78/00/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen fuel production by wind energy conversion  
AUTH: A/BEN-DOV, E.; B/NAOT, Y.; C/RUDMAN, P. S. PAA:  
A/(Israel Electric Corp., Ltd., Haifa, Israel);  
C/(Technion - Israel Institute of Technology, Haifa,  
Israel)  
In: Alternative energy sources; Proceedings of the  
Miami International Conference, Miami Beach, Fla.,  
December 5-7, 1977. Volume 8. (A79-34106 13-44)  
Washington, D.C., Hemisphere Publishing Corp., 1978, p.  
3563-3576.  
MAJS: /\*ECONOMIC ANALYSIS/\*ELECTROLYSIS/\*ENERGY CONVERSION/\*  
HYDROGEN FUELS/\*WATER/\*WINDPOWER UTILIZATION  
MINS: / ELECTRIC GENERATORS/ GASOLINE/ ROTOR SPEED/ WIND  
VELOCITY  
ABA: A.L.W.  
ABS: The economic feasibility of using wind energy  
conversion to produce hydrogen fuel by the  
electrolysis of water is considered. Wind energy  
production of hydrogen to replace gasoline can be  
achieved by feeding wind-generated electricity through  
a utility grid to an electrolysis facility or by means  
of an electrolysis unit at the wind turbine site and  
subsequent transmission of the hydrogen produced to  
points of use. On-site hydrogen production leads to a  
cost savings of 25% over that of utility-produced  
hydrogen, due to the use of a fixed pitch rotor in  
place of the variable pitch rotor necessary for stable  
frequency and voltage supply to a utility. It is  
concluded that hydrogen can be produced by on-site  
electrolysis at a cost less than the current price of  
gasoline in Europe at wind energy conversion sites  
with mean wind speeds exceeding only 4 m/sec.

BON12196# ISSUE 3 PAGE 305 CATEGORY 28 RPT#:  
LA-UR-78-2996 CONF-781178-1 CNT#: W-7405-ENG-36  
78/00/00 56 PAGES UNCLASSIFIED DOCUMENT

UTTL: Thermochemical production of hydrogen from water, a critical review

AUTH: A/COX, K. E.

CORP: Los Alamos Scientific Lab., N. Mex. AVAIL.NTIS

SAP: HC A04/MF A01

Presented at USA/USSR Workshop on Alternative Uses of Fusion Energy, Moscow, 20 Nov. 1978

MAJS: /\*HYDROGEN PRODUCTION/\*TECHNOLOGY ASSESSMENT/\*  
THERMOCHEMISTRY/\*WATER

MINS: / COSTS/ ELECTROLYSIS/ HYDROBROMIDES/ SULFUR OXIDES/  
SULFURIC ACID

ABA: DOE

ABS: The current status of thermochemical hydrogen technology as regards process chemistry, preliminary chemical engineering design, and techno-economics for a number of cycles undergoing active research and development efforts throughout the world at this time is assessed. Three cycles are receiving the bulk of the total effort and most of the funding: the hybrid sulfuric acid cycle; the sulfuric acid-hydrogen iodide cycle; and the hybrid sulfuric acid-hydrogen bromide cycle (Mark 13). All three cycles are at the stage where a laboratory scale continuous plant can be or is in operation. Improvements are being made in estimating the cost and efficiency of hydrogen produced from water and a thermal energy source either by thermochemical cycle technology or by water electrolysis. These include the heat penalty analysis and the OPTIMO computer code. Costs of thermochemical hydrogen have been found to fall in the \$7 to \$10/10 to the 16th power Btu range with efficiencies in the 35% to 45% bracket.

#### APPLICATION OF LASER FUSION TO THE RADIOLYTIC PRODUCTION OF HYDROGEN.

N. Vagelatos, N. A. Lurie, D. A. Vroom,  
D. H. Houston, R. D. Baird, & V. C. Rogers  
International Journal of Hydrogen Energy,  
Vol. 3, No. 2, 1978, p. 177-201.

Abstract—A preliminary conceptual design of a plant to produce hydrogen by laser-fusion-induced steam radiolysis has been developed. It consists of a suppressed ablation lithium wetted wall cavity surrounded by pure and borated steam regions in which fusion neutrons deposit a substantial fraction of their energy, causing nuclear heating in the steam and structural materials, as well as radiolysis of water molecules.

79A34118 ISSUE 13 PAGE 2424 CATEGORY 44  
78/00/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: A self-consistent process of producing hydrogen from sea water

AUTH: A/LODHI, M. A. K. PAA: A/(Texas Tech University, Lubbock, Tex.)

In: Alternative energy sources; Proceedings of the Miami International Conference, Miami Beach, Fla., December 5-7, 1977. Volume 8. (A79-34106 13-44) Washington, D.C., Hemisphere Publishing Corp., 1978. p. 3669-3673.

MAJS: /\*HYDROGEN PRODUCTION/\*OFFSHORE ENERGY SOURCES/\*SEA WATER

MINS: / ENERGY TECHNOLOGY/ GULF OF MEXICO/ HYDROELECTRIC POWER STATIONS

ABA: J.M.B.

ABS: The production of hydrogen from seawater and hydroelectric power from an artificially created head is proposed as an energy extraction scheme for the Gulf of Mexico. The head would be created in an open reservoir as a result of natural evaporation and removal of sea water for hydrogen production. The artificial head could yield about 5 times 10 to the 10th BTU per year, while energy from hydrogen burning would amount to about 10 to the 16th Btu per year.

#### GENERATING HYDROGEN IN MAGMA DEPOSITS Science News Vol. 113, no. 1, JAN. 7, 1978, p. 5

A group of physicists and geochemists at the Sandia Laboratories in Albuquerque, C. J. M. Northrup Jr., J. K. Galt, T. M. Gerlach and P. J. Modreski, has developed a method of producing hydrogen that uses water as a source. Because of the earth's huge resources of water, the method has a long-range potential that is virtually endless. Furthermore, it will also produce quantities of carbon monoxide, methane and steam. SAND-77-0509

79N32373# ISSUE 23 PAGE 3068 CATEGORY 28 RPT#:  
SAND-78-0191 CONF-780737-1 CNT#: EY-76-C-04-0769  
78/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fuels from magma: A potential energy source ...  
producing hydrogen, carbon monoxide, and methane

AUTH: A/GERLACH, T. M.  
CORP: Sandia Labs., Albuquerque, N. Mex. AVAIL NTIS  
SAP: HC A02/MF A01  
Presented at the 2d Circum-Pacific Energy and Mineral  
Resources Conf., Honolulu, 30 Jul. 1978

MAJS: /\*CARBON MONOXIDE/\*ENERGY TECHNOLOGY/\*GEOTHERMAL  
RESOURCES/\*HYDROGEN PRODUCTION/\*MAGMA/\*METHANE

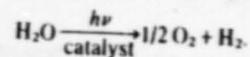
MINS: / BASALT/ BIOMASS ENERGY PRODUCTION/ IRON OXIDES/  
OXIDATION-REDUCTION REACTIONS/ WATER INJECTION

ABA: DOE  
ABS: The chemical and thermodynamic basis, the confirmatory  
laboratory experiments, and the geological data that  
point to the potential of magma as a resource that  
could produce large amounts of hydrogen as well as  
carbon monoxide and methane are discussed. The method  
of fuel production proposed depends on the reducing  
action of basalt on injected water; this chemical  
interaction causes the oxidation of ferrous components  
in the basalt and the production of hydrogen. The  
amount of hydrogen produced by a given body of basalt  
can be enhanced by introducing natural organic matter  
(biomass) into the injected water. This also would  
permit the method to be used to produce appreciable  
quantities of carbon monoxide and methane, and allows  
the exploitation of less FeO-rich magmas and hot  
rocks. Calculations show that the thermal energy of  
the magma may be used to gasify the biomass with  
resultant gas species resembling those from more  
conventional coal gasification processes.

#### PHOTOCATALYTIC DECOMPOSITION OF WATER AT SEMICONDUCTOR ELECTRODES.

H. Paul Maruska & Amal K. Ghosh  
Solar Energy, Vol. 20, No. 6, 1978, p. 443-  
458.

The current energy crisis has created a tremendous  
interest in discovering new sources of fuel to increase  
our dwindling resources. In the following article, we shall  
review one aspect of this search, concentrating on the  
specific chemical reaction which involves the sensitized  
photodecomposition of water to form oxygen and  
hydrogen, an extremely important fuel:



79A16463# ISSUE 4 PAGE 653 CATEGORY 44  
78/00/00 22 PAGES UNCLASSIFIED DOCUMENT

UTTL: Solar-hydrogen energy system and solar-hydrogen  
production methods

AUTH: A/VEZIROGLU, T. N.; B/KAKAC, S. PAA: B/(Miami,  
University, Coral Gables, Fla.)  
In: International Symposium-Workshop on Solar Energy,  
Cairo, Egypt, June 16-22, 1978. Symposium Lectures,  
(A79-16451 04-44) Coral Gables, Fla., University of  
Miami, 1978, p. 275-296.

MAJS: /\*CLEAN ENERGY/\*ENERGY TECHNOLOGY/\*HYDROGEN PRODUCTION  
/\*SOLAR ENERGY

MINS: / CHEMICAL REACTIONS/ ELECTROLYSIS/ PHOTOLYSIS/  
THERMOCHEMISTRY/ WATER

ABA: S J.  
ABS: Various methods of producing hydrogen using solar  
energy are discussed, including direct thermal,  
thermochemical, electrolytical, and photosynthetical  
methods. The methods are compared and the advantages  
of each are described. In addition, attention is given  
to the advantages of using hydrogen as solar energy.  
Indirect forms of solar energy, such as ocean  
thermal, ocean current, wind, and hydraulic, are also  
considered as primary energy sources for producing  
hydrogen

79A16464# ISSUE 4 PAGE 653 CATEGORY 44  
78/00/00 6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Solar hydrogen production at high temperatures

AUTH: A/BILGEN, E. PAA: A/(Ecole Polytechnique, Montreal,  
Canada)  
TJ  
310  
I73  
1978  
In: International Symposium-Workshop on Solar Energy,  
Cairo, Egypt, June 16-22, 1978. Symposium Lectures,  
(A79-16451 04-44) Coral Gables, Fla., University of  
Miami, 1978, p. 297-302.

MAJS: /\*HYDROGEN PRODUCTION/\*PHOTOLYSIS/\*SOLAR ENERGY/\*  
THERMOCHEMISTRY

MINS: / CLEAN ENERGY/ DECOMPOSITION/ ENERGY TECHNOLOGY/  
THERMODYNAMIC EFFICIENCY/ WATER

ABA: B. J.  
ABS: Solar energy thermal processes at temperatures  
exceeding approximately 1500 K are reviewed, and  
attention is given to the thermodynamics of water  
decomposition to produce hydrogen. Hydrogen production  
at such high temperatures is found to offer three  
major advantages over other methods: (1) high thermal  
efficiency with minimum thermal energy requirements,  
(2) minimum pollution and ecological impact, and (3)  
the possibility of reducing the number of chemical  
cycles to a minimum. One-step, two-step, or maximum  
three-step chemical cycles are possible at high  
temperatures, making possible the reduction of capital  
and operating costs, since the amount of chemicals  
used is reduced.

79N17354# ISSUE 8 PAGE 1006 CATEGORY 44 RPT#:  
PB-28750B/6 NSF/RA-780272 CNT#: NSF AER-77-11545  
78/06/15 71 PAGES UNCLASSIFIED DOCUMENT

UTTL: Photoproduction of hydrogen by marine blue-green algae  
TLSP: Annual Progress Report, 15 Dec. 1977 - 15 Jun.  
1978

AUTH: A/MITSUI, A.

CORP: Rosenstiel School of Marine and Atmospheric Sciences,  
Miami, Fla. CSS: (Div. of Biology and Living  
Resources.) AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /\*ALGAE/\*HYDROGEN PRODUCTION/\*PHOTOPRODUCTION

MINS: / CHEMICAL REACTIONS/ ENVIRONMENT EFFECTS/ HYDROGEN  
FUELS/ PH/ SOLAR ENERGY CONVERSION

ABA: GRA

ABS: The biological and biochemical photoproduction of  
hydrogen was studied for use as an alternate fuel.  
Earlier investigations found an organism which  
exhibits exceptionally high hydrogen producing  
capabilities in the form of a blue-green algal strain,  
Miami BG7.F were performed to reveal the mechanisms of

hydrogen production in this strain and to determine  
whether the efficiency of hydrogen production can  
attain levels required for applied projects. Emphasis  
in research shifted from the study of metabolic  
inhibitors of hydrogen production to a study of the  
enzyme systems which catalyze hydrogen production. It  
was discovered that hydrogen evolution by Miami BG7  
involves the participation of both hydrogenase and  
nitrogenase, with the latter appearing as the major  
contributor of the hydrogen production. However, Miami  
BG7 does not appear to exhibit hydrogenase activity.  
The effects of light intensity, temperature, and pH  
were tested and optimum conditions for hydrogen  
photoproduction were determined. It was found that the  
regulation of specific environmental parameters could  
lead to marked changes in the quantum efficiency of  
hydrogen production. A brief background review and  
discussion of hydrogen photoproduction is given with  
an approach to hydrogen production research.

#### THE HYDROGEN ECONOMY AND THE CHEMIST.

C. Marchetti.

Chemistry in Britain, v.13, no.6, June 1977,  
p.219-22.

What role has chemistry played in the evolution of  
energy systems. How will this change as the hydrogen  
economy becomes a reality?

78A39123 ISSUE 16 PAGE 2946 . CATEGORY 44  
78/06/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Solar energy conversion through biology - Could it be  
a practical energy source

AUTH: A/HALL, D. O. PAA: A/(King's College, London,  
England)

Fuel, vol. 57, June 1978, p. 322-333.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*HYDROGEN PRODUCTION/\*  
PHOTOSYNTHESIS/\*PLANTS (BOTANY)/\*SOLAR ENERGY  
CONVERSION

MINS: / BIBLIOGRAPHIES/ CARBON DIOXIDE/ CROPS/ ENERGY  
CONVERSION EFFICIENCY/ ENERGY TECHNOLOGY/ NITROGEN

ABA: S.C.S.

ADS: The article reviews the ways in which solar energy may  
be converted through biological systems both in terms  
of short-term and long-term goals. The efficiency of  
photosynthesis is discussed with reference to various  
high short-term dry weight yields of crops and their  
short-term photosynthetic efficiencies. Means for  
complete crop utilization for food, fuel, and  
fertilizer are proposed along with the development of  
energy farms and the feasibility studies which have  
been undertaken in the U.S., Brazil, Australia, and  
Europe. Consideration is also given to using cellulose  
as an energy source, the use of algal systems for  
food, fuel, and waste disposal, and the optimization  
of photosynthetic yield via selective plant breeding.  
The wide-scale use of controlled environments is  
described as are processes associated with nitrogen  
fixation and biocatalytic hydrogen-producing systems.

#### ON PHOTO FUEL.

J. O'M. Bockris and L. Handley.

Energy conversion, v.18, 1978, p.1-8.

Abstract - The direct solar conversion of water into hydrogen and oxygen gas is presented as a major  
energy alternative. Present efficiencies are only 0.1%, with at least 5-10% needed for commercial utility.  
The most important research goal is the attainment of a stable photoanode with a small energy gap  
(0.75-1.5eV). Photocorrosion and its possible prevention is discussed.

HYDROGEN EVOLUTION REACTION ON NIOBIUM IN CONCENTRATED  
KOH SOLUTION, by M. Okuyama, C. Belanger and D. L.  
Piron

International Journal of Hydrogen Energy, vol. 3,  
no. 3, 1978, p. 297-302

78N31265# ISSUE 22 PAGE 2921 CATEGORY 28 RPT#:  
LA-TR-77-52 CNT#: W-7405-ENG-36 77/00/00 18 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Production method for hydrogen by thermomechanical decomposition of water

AUTH: A/TAKASHI, H.

CORP: Kanner (Leo) Associates, Redwood City, Calif.  
AVAIL.NTIS SAP: HC A02/MF A01  
Transl. into ENGLISH from Japanese Patent Disclosure,  
no. 51-9093

MAJS: /\*HYDROGEN PRODUCTION/\*PYROLYSIS/\*WATER

MINS: / ALKALIES/ AMMONIA/ CARBONATES/ HALIDES/ HALOGENS/  
HYDROXIDES/ IRON OXIDES/ NITRATES

ABA: ERA

ABS: Triliron tetroxide and hydrogen are generated by thermal decomposition of ferrous hydroxide or from the reaction of water and ferrous oxide. The generated triliron tetroxide is caused to react with hydrogen halide or ammonium halide to obtain ferrous halide and halogen gas as well as ammonia gas. In cases when ferric halide is generated as a by-product, it is thermally decomposed to become ferrous halide and halogen gas. The ferrous halide is caused to react with alkali to obtain ferrous hydroxide or ferrous oxide as well as halide of alkali or the substance decomposed from this. The halogen gas is caused to react with either metallic oxide, with carbonate or with nitrate to generate oxygen. Alkali is regenerated from the reaction by-products by well known methods.

ORIGINAL PAGE 1  
OF POOR QUALITY

#### EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THERMOCHEMICAL HYDROGEN PRODUCTION.

K. F. Knoche, H. Cremer, D. Breywisch, S. Hegels, G. Steinborn, & G. Wuster  
International Journal of Hydrogen Energy,  
Vol. 3, No. 2, 1978, p. 209-216.

Abstract - Hydrolysis, chlorination and the reverse Deacon reaction as steps of thermochemical water splitting cycles have been investigated in a laboratory scale with respect to feasibility and chemical engineering aspects. The results are discussed. Some general theoretical considerations concerning the efficiency of thermochemical water splitting cycles are presented. Using general criteria, some chemical reactions of proposed schemes of water splitting processes are selected and compared.

#### NUCLEAR PROCESS HEAT FOR COAL GASIFICATION AND HYDROGEN PRODUCTION.

K. F. Knoche

Progress in Energy and Combustion Science, Vol.  
4, No. 2, 1978, p. 63-72.

This article deals with research and development programs for nuclear coal gasification, nuclear latent heat transport and hydrogen production using nuclear process heat. Nuclear coal gasification and nuclear latent heat transport is operated on a pilot plant basis by different research organisations and companies in West Germany. Hydrogen production by means of nuclear process heat has been investigated so far both experimentally and theoretically on a more fundamental basis by companies and research organisations in the US, Italy, Japan, West Germany and other countries.

TL  
507  
.P75  
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RR

NASA Conference on Radiation Energy Conversion, 3d, Ames Research Center, 1978.

Radiation energy conversion in space :  
technical papers prepared for the third  
NASA Conference on Radiation Energy Conversion

Photoelectrolysis of Water at High Current Density:  
Use of Laser Light Excitation of Semiconductor-  
Based Photoelectrochemical Cells  
MARK S. WRIGHTON, ANDREW B. BOCARSLEY,  
AND JEFFREY M. BOLTS

613

Proposed Photoenhanced Electrolysis by  
Evanescent Excitation  
RICHARD B. MILES, JACK J. GELFAND,  
AND BARRIE S.H. ROYCE

658

#### RECENT DEVELOPMENT OF LARGE ELECTROLYTIC HYDROGEN GENERATORS, by J. B. Laskin and R. D. Feldwick

International Journal of Hydrogen Energy, vol. 3,  
no. 3, 1978, p. 311-320

TP Hydrogen manufacture by electrolysis,  
 359 thermal decomposition and unusual  
 .HR techniques / edited by M. S. Casper.  
 H74 — Park Ridge, N.J. : Noyes Data Corp.,  
 1978.

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ANALYSIS FRAMEWORK FOR PHOTODECOMPOSITION IN  
 WATER, by John L. Mancini  
 Environmental Science & Technology, vol. 12, no. 12,  
 November 1978, p. 1274-1276

■ A framework is presented for analysis of first order photo-  
 decomposition in aqueous solutions. The framework is  
 tested using published experimental data on picloram photo-  
 decomposition and adequately represents experimental  
 results. The framework may be employed to alter, minimize,  
 and evaluate experimental work.

FEASIBILITY OF HYDROGEN PRODUCTION BY DIRECT WATER  
 SPLITTING AT HIGH TEMPERATURE, by S. Ihara

International Journal of Hydrogen Energy, vol. 3,  
 no. 3, 1978, p. 287-296

TP Hydrogen manufacture by electrolysis,  
 359 thermal decomposition and unusual  
 .HR techniques / edited by M. S. Casper.  
 H74 — Park Ridge, N.J. : Noyes Data Corp.,  
 1978.

x, 362 p. : ill. ; 24 cm.

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78V33697 1978 ISS: 00 TP245.H9C37 0-815506-91-0 665.81  
 LC-77-15222  
 AUTH: A/Casper, M. S.  
 JTTL: Hydrogen manufacture by electrolysis, thermal  
 decomposition, and unusual techniques / edited by M.  
 S. Casper.  
 Noyes Data Corp., Park Ridge, N.J. : x, 362 p. : ill.  
 : 25 cm.  
 Chemical technology review : no. 102 Energy technology  
 review : no. 21 \$39.00 Includes index. Bibliography:  
 p. 359-361.  
 LC: Hydrogen -- Patents.  
 NASA: / DECOMPOSITION/ ELECTROLYSIS/ HYDROGEN/  
 HYDROGEN PRODUCTION/ PATENTS/ THERMAL DISSOCIATION  
 LA: / TP359.H8H74  
 MAIN-AUTH TRACE-SERS\*TITL\* CATLG BY-LC  
 / / AVAIL: / LANGLEY/ LEWIS

TP Applications of cryogenic technology, v. 7  
 480 ...c1078 (Card ?)  
 .A6 ISBN 0-87936-009-7  
 v.7 1. Low temperature engineering--Addresses,  
 essays, lectures. I. Missig, James P.  
 II. Vance, Robert W. III. Cryogenic  
 Society of America. IV. CPY0-78, Oak  
 Brook, Ill., 1978.

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78A28170 ISSUE 10 PAGE 1796 CATEGORY 44 CNT#:  
 DSS-1505-0111 78/00/00 3 PAGES UNCLASSIFIED  
 DOCUMENT

UTTL: Photochemical storage of solar energy  
 AUTH: A/BOLTON, J. R. PAA: A/(Western Ontario, University,  
 London, Canada)  
 Solar Energy, vol. 20, no. 2, 1978, p. 181-183.  
 Department of Supply and Services  
 MAJS: /\*ENERGY STORAGE/\*HYDROGEN PRODUCTION/\*PHOTOCHEMICAL  
 REACTIONS/\*SOLAR ENERGY CONVERSION  
 MINS: / ABSORPTIVITY/ ENERGY TECHNOLOGY/ OXYGEN PRODUCTION/  
 PHOTODECOMPOSITION/ PHOTOSYNTHESIS/ TRANSMISSIVITY  
 ABA: D.M.W.  
 ABS: Artificial systems are considered the only feasible  
 method for the photochemical storage of solar energy.  
 This paper suggests that the design of such systems be  
 based on our knowledge of the mechanism of  
 photosynthesis. Basic principles of photochemical  
 storage are outlined, using daylight as a light

source. Attention is given to transmission and  
 absorption coefficients, and to the calculation of  
 energy loss as certain threshold barriers in the  
 photosynthetic process are surmounted. A scheme is  
 proposed which could use the photochemical  
 decomposition of water into hydrogen and oxygen by  
 employing a photochemically reducing dye in a coupled  
 system. The hydrogen would then be stored, to be used  
 for efficient, pollution-free fuel as needed.

THE BILLINGS SPE ELECTROLYZER, by B. C. Campbell.  
 Hydrogen Progress, vol. 4, no. 1, Winter 1978/79,  
 p. 19-26.

UTTL: Research and development of rapid hydrogenation for coal conversion to synthetic motor fuels TLSP: Annual Report, 1 Apr. 1977 - 31 Mar. 1978  
AUTH: A/DUNCAN, D. A.; B/BEESON, J. L.; C/OBERLE, R. D.  
CORP: Institute of Gas Technology, Chicago, Ill.  
AVAIL.NTIS SAP: HC A06/MF A01  
MAJS: /\*COAL UTILIZATION/\*ENERGY POLICY/\*ENERGY TECHNOLOGY/\*HYDROGEN-BASED ENERGY  
MINS: / HYDROGENATION/ LIGNITE/ SYNTHETIC FUELS  
ABA: DOE  
ABS: Runs were made in the bench-scale unit using power plant grind of lignite and hydrogen. The main products obtained were methane, ethane, carbon oxides, and hydrocarbon liquids. The thermal treatment of the reactants for all runs was characterized by a kinetic severity function, which is a measure of the products of a first order decomposition rate constant and the time interval that the reactants are exposed to the reaction environment. Overall, correlation with kinetic severity function was found to be a reasonable predictor for carbon conversion and methane yields. Initial work with liquids composition data shows that liquids composition does not correlate as well with kinetic severity function, indicating that other factors, such as reactions in sequence, influence liquids composition.

THE THERMOCHEMICAL DECOMPOSITION OF WATER USING BROMINE AND IODINE, by S. Mizuta, W. Kondo, T. Kumagai and K. Fujii.  
International Journal of Hydrogen Energy, vol. 3, no. 4, 1978, p. 407-417.

Abstract—Thermochemical hydrogen production by the decomposition of water in a closed cycle that uses the combination of bromine or iodine with alkaline-earth metals was investigated. A thermodynamic analysis of the suitability of alkaline-earth metals to the bromine and iodine cycles is presented. These cycles consist of: the redox reaction of bromine (iodine), thermal decomposition of bromate (iodate), hydrolysis of bromide (iodide) and the thermal dissociation of hydrogen bromide (iodide). As a result of preliminary experiments, five new cycles (Mg-Ba-Br cycle, Mg-K-Br cycle, Mg-I cycle, Mg-Ca-I cycle and Mg-Ba-I cycle) are presented.

UTTL: Automotive hydrogen storage with magnesium hydride  
AUTH: A/ROHY, D. A.  
CORP: Solar Turbines International, San Diego, Calif.  
AVAIL.NTIS SAP: HC A20/MF A01  
In DOE Highway Vehicle Systems p 334-341 (SEE N78-30293 21-31)  
MAJS: /\*AUTOMOBILE FUELS/\*ENERGY STORAGE/\*HYDRIDES/\*HYDROGEN FUELS/\*MAGNESIUM COMPOUNDS  
MINS: / ENERGY TECHNOLOGY/ HEAT OF DISSOCIATION/ MAGNESIUM ALLOYS/ NICKEL ALLOYS  
ABA: L.S.  
ABS: From experimental data it can be seen that modified Mg-Ni alloys offer the greatest potential for reaching that goal. Dissociation temperature at one atmosphere hydrogen pressure is reduced to 204 C for an alloy of

Mg, Ni, Cu, Si, and Y from 302 C for Mg<sub>0.9</sub>Ni<sub>0.1</sub>Hx. Nickel content has been reduced to 24 percent from 55 percent in Mg<sub>2</sub>NiHx. Dissociation temperatures as low as 223 C were achieved with alloys containing 10 percent nickel. Dissociation pressure, hydrogen capacity, kinetics, and safety are other hydride characteristics considered. Practical considerations of the cost, size, weight, fueling, and storage period of a hydride system with energy equivalent of 20 gallons of gasoline are reviewed. Some of the key features of this system are reviewed in this presentation.

A79-45579 International developments in hydrogen technologies. G. E. Beghi (EURATOM and Comitato Nazionale per l'Energia Nucleare, Centro Comune di Ricerche, Ispra, Italy). In: Hydrogen for energy distribution; Proceedings of the Symposium, Chicago, Ill., July 24-28, 1978. (A79-45576 20-44) Chicago, Institute of Gas Technology, 1979, p. 41-57.

International cooperation in the research for new hydrogen production methods is reported. Research areas in hydrogen production and utilization and the International Energy Agency programs on hydrogen production from thermal decomposition of sulfuric acid, thermal decomposition of metal sulfate, hydrolysis of FeCl<sub>2</sub>, liquid separation of H<sub>2</sub>SO<sub>4</sub>/HI from solution, decomposition of HI, decomposition of FeCl<sub>3</sub>, and production of hydrogen from water are discussed. Other joint programs include thermochemical and electrolytic production, and transportation and storage of hydrogen. It is expected that as a result of cooperative actions, it will be possible to conduct integrated experimental activities, exchange of researchers, and joint participation in pilot scale and demonstration projects.

A.T.

78N32296\*# ISSUE 23 PAGE 3067 CATEGORY 31  
RPT#: NASA-CR-158920 CNT#: NAS1-14157 78/09/00  
117 PAGES UNCLASSIFIED DOCUMENT

UTTL: Study of thermal insulation for airborne liquid hydrogen fuel tanks TLSP: Final Report  
AUTH: A/RUCCIA, F. E.; B/LINDSTROM, R. S.; C/LUCAS, R. M.  
CORP: Little (Arthur D.), Inc., Cambridge, Mass.  
AVAIL: NTIS SAP: HC A06/MF A01  
MAJS: /\*FUEL TANKS/\*LIQUID HYDROGEN/\*THERMAL INSULATION  
MINS: / CRYOGENIC FLUID STORAGE/ CRYOGENICS/ POLYURETHANE FOAM/ SEALS (STOPPERS)/ STORAGE TANKS  
ABA: G.Y.  
ABS: A concept for a fail-safe thermal protection system was developed. From screening tests, approximately 30 foams, adhesives, and reinforcing fibers using 0.3-meter square liquid nitrogen cold plate, CPR 452 and Stafoam AA1602, both reinforced with 10 percent by weight of 1/16 inch milled OCF Style 701 Fiberglas, were selected for further tests. Cyclic tests with these materials in 2-inch thicknesses bonded on a 0.6-meter square cold plate with Crest 7410 adhesive systems, were successful. Zero permeability gas barriers were identified and found to be compatible with the insulating concept.

79A34117 ISSUE 13 PAGE 2424 CATEGORY 44  
78/00/00 32 PAGES UNCLASSIFIED DOCUMENT

UTTL: Liquid hydrogen from solar energy now  
AUTH: A/ZACHMANN, H. C. PAA: A/(Associated Enterprises, Ellicott City, Md.)  
In: Alternative energy sources; Proceedings of the Miami International Conference, Miami Beach, Fla., December 5-7, 1977. Volume 8. (A79-34106 13-44) Washington, D.C., Hemisphere Publishing Corp., 1978, p. 3637-3668.  
MAJS: /\*COST EFFECTIVENESS/\*HYDROGEN PRODUCTION/\*PISTON ENGINES/\*SOLAR COLLECTORS  
MINS: / CONDENSATION/ ELECTROCHEMICAL CELLS/ ENERGY TECHNOLOGY  
ABA: B.J.  
ABS: Cost-effective hydrogen production using solar energy is found to be feasible in areas of high insolation with sources of fresh or salt water. The system would consist of a modular solar converter with collector, free piston engine, and a condenser; a dc voltage is generated which is applied directly to electrochemical

cells for the production of hydrogen. Operational factors are discussed and production costs are examined.

**ND0-14286f Argonne National Lab., Ill.**  
**EXPERIMENTAL VERIFICATION OF THE MERCURY-IODINE THERMOCHEMICAL CYCLE FOR THE PRODUCTION OF HYDROGEN FROM WATER, ANL-4**

E. H. Appelman, F. Schreiner, and B. M. Abraham 1978 58 p  
refs Presented at the World Hydrogen Energy Conf., Zurich, 21 Aug. 1978

(Contract W-31-109-eng-38)

(CONF-780807-11) Avail: NTIS HC A04/MF A01

A flow diagram for the cycle described was constructed and an overall practical efficiency of 28% in terms of delta G/sub f (H2O)/total heat input) was estimated from the new data. A substantial portion of the total heat input is required for the isolation of the ammonium iodide. The cycle should be capable of producing hydrogen from water with reasonable efficiency and without requiring heat at an unduly high temperature. The cycle should therefore be suitable for a practical demonstration of the technical feasibility of thermochemical hydrogen generation.

DOE

**A79-45592\*** Dedicated nuclear facilities for electrolytic hydrogen production. S. E. Foh, W. J. D. Escher, and T. D. Donakowski (Institute of Gas Technology, Chicago, Ill.). In: Hydrogen for energy distribution; Proceedings of the Symposium, Chicago, Ill., July 24-28, 1978. (A79-45576 20-44) Chicago, Institute of Gas Technology, 1979, p. 339-359. 22 refs. NASA-supported research.

An advanced technology, fully dedicated nuclear-electrolytic hydrogen production facility is presented. This plant will produce hydrogen and oxygen only and no electrical power will be generated for off-plant use. The conceptual design was based on hydrogen production to fill a pipeline at 1000 psi and a 3000 MW nuclear base, and the base-line facility nuclear-to-shaftpower and shaftpower-to-electricity subsystems, the water treatment subsystem, electricity-to-hydrogen subsystem, hydrogen compression, efficiency, and hydrogen production cost are discussed. The final conceptual design integrates a 3000 MWth high-temperature gas-cooled reactor operating at 980 C helium reactor-out temperature, direct dc electricity generation via acyclic generators, and high-current density, high-pressure electrolyzers based on the solid polymer electrolyte approach. All subsystems are close-coupled and optimally interfaced and pipeline hydrogen is produced at 1000 psi. Hydrogen costs were about half of the conventional nuclear electrolysis process. A.T.

BIOCHEMICAL ENGINEERING: RENEWABLE SOURCES OF ENERGY AND CHEMICAL FEEDSTOCKS. John M. Hystrom and Stanley H. Barnett, eds. (Papers presented at Symposium on Biochemical Sources of Energy held at 2nd Pacific Chemical Engineering Congress, Denver, Colo., Aug. 1977 and Symposium on Biological Sources of Energy & Chemical Feedstocks held at

THE PRODUCTION OF HYDROGEN GAS BY *Citrobacter intermedius* . . . . . J. E. Zajic, A. Margaritis, and J.

American Institute of Chemical Engineers  
Symposium on Biochemical Sources of Energy Aug. 1977  
Symposium on Biological Sources of Energy & Chemical Feedstocks Feb. 1978

PROBLEMS AROUND Fe-CL CYCLES, by D. Van Velzen and H. Langenkamp.  
International Journal of Hydrogen Energy, vol. 3, no. 4, 1978, p. 419-429.

Abstract—Cycles for the thermochemical decomposition of water belonging to the Fe-Cl family have been considered potentially attractive. An analysis of the thermal efficiency, investments costs and development potential of this family is presented, where electrolysis of water serves as a reference process.  
It is concluded that the thermal efficiency of these cycles is probably considerably below the values obtained with direct electrolysis whereas investment costs are presumably higher by a factor of more than two.  
Main problem areas are situated in the hydrolysis of FeCl<sub>3</sub>, as well as in the thermal decomposition of FeCl<sub>3</sub>. Both problems have to be solved simultaneously; finding a solution to only one will not be sufficient to build an attractive process.  
A number of possible alternative solutions to these problems are discussed.

TP  
359  
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H74  
Hydrogen manufacture by electrolysis, thermal decomposition and unusual techniques / edited by M. S. Casper. — Park Ridge, N.J. : Noyes Data Corp., 1978.  
x, 362 p. : ill. ; 24 cm. — (Energy technology review ; no. 21) (Chemical technology review ; no. 102)  
Bibliography: p. 359-361. .  
Includes index.

A79-45593 \* Concepts for solar production of hydrogen. J. A. Hanson (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: Hydrogen for energy distribution; Proceedings of the Symposium, Chicago, Ill., July 24-28, 1978. (A79-45576 20-44) Chicago, Institute of Gas Technology, 1979, p. 361-392. 24 refs.

Some basic technical approaches to producing hydrogen from solar energy are surveyed. Solar energy forms are divided into: (1) direct solar radiation and (2) indirect forms such as wind and ocean thermal gradient. Technical approaches are separated into: (1) direct hydrogen production from the action of sunlight on some substrate, (2) hydrogen production from sunlight via an intermediate form of energy such as heat and electricity, and (3) hydrogen production from indirect solar energy via an intermediate energy form. It is concluded that while hydrogen from solar energy will be expensive by present standards, the depletion of fossil fuels will cause solar hydrogen to emerge as one of the few alternatives to a nuclear-electric or nuclear-electric-hydrogen energy system. M.E.P.

Q & A HYDROGEN FROM COAL?  
Hydrogen Progress, Fall 1978, p.3-5.

This issue's Question and Answer section deals with coal gasification, the near term means of economically mass producing hydrogen for commercial use. Leonard D. Hadden, director of Contracted Research, was interviewed by HYDROGEN PROGRESS concerning current state-of-the-art gasifiers.

TP  
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**Hydrogen manufacture by electrolysis,  
thermal decomposition and unusual  
techniques / edited by M. S. Casper.**  
— Park Ridge, N.J. : Noyes Data Corp.,  
1978.

x, 362 p. : ill. ; 24 cm.  
ISBN 0-8155-0691-0

1. Water—Electrolysis. 2. Synthesis  
gas. 3. Hydrogen as fuel. I. Casper,  
M. S.

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A78-53326      Solid state chemistry of energy conversion and  
storage; Proceedings of the Symposium, New York, N.Y., April 5-8,  
1976. Symposium sponsored by the American Chemical Society.  
Edited by J. B. Goodenough (Oxford University, Oxford, England)  
and M. S. Whittingham (Exxon Research and Engineering Co.,  
Linden, N.J.). Washington, D.C., American Chemical Society (Ad-  
vances in Chemistry Series, No. 163), 1977. 380 p. \$38.50. (For  
individual items see A78-53327 to A78-53344)

Hydrogen as an energy carrier is considered along with the  
catalytic synthesis of hydrocarbons from carbon monoxide and  
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conversion of visible light to electrical energy, solar energy con-  
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temperature electrolysis/fuel cells.

G.R.

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Hydrogen manufacture by electrolysis, thermal decomposition and unusual techniques / edited by M. S. Casper.  
— Park Ridge, N.J. : Noves Data Corp., 1978.  
x, 362 p. : ill. ; 24 cm.  
ISBN 0-8155-0691-0  
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A79-45586      Hydrogen production via the K-T gas gasification process - Current economic and technological aspects. H. J. Michaels (Koppers Co., Inc., Pittsburgh, Pa.). In: Hydrogen for energy distribution; Proceedings of the Symposium, Chicago, Ill., July 24-28, 1978. (A79-45576 20-44) Chicago, Institute of Gas Technology, 1979, p. 225-238.

Technological and economic aspects of hydrogen production by the K-T gas gasification process are presented. The process converts carbonaceous feedstock into a raw gas containing principally carbon monoxide and hydrogen by partial oxidation, and it entails the reaction of a carbon containing feedstock with oxygen and steam at high temperatures in an entrained bed type of gasification system. The syngas produced can be used as a fuel gas or can be upgraded to hydrogen or synthetic natural gas. The process can handle a variety of feedstocks, including coal, char, and coke, and it produces no tars, phenols, or condensable hydrocarbons. The cost of producing 100 million SCFD of 97.4% pure hydrogen with less than 10 ppm carbon oxide is \$4.50 to \$7.00 per million Btu. The sensitivity of hydrogen costs to feedstock costs, plant site, and financing methods is discussed.

A.T.

International J. Hydrogen, v.2, no.1, 1977.

- 7    The Westinghouse Sulfur Cycle for the thermochemical decomposition of water
- 17   Process sensitivity studies on the Westinghouse Sulfur Cycle for hydrogen generation
- 23   OPTIMO—A method for process evaluation applied to the thermochemical decomposition of water
- 31   Large scale hydrogen production utilizing carbon in renewable resources
- 41   The manufacture of hydrogen from coal
- 53   Prospects for hydrogen production by water electrolysis to be competitive with conventional methods
- 61   Thermolysis or electrolysis? Why we choose the latter

ORIGINAL PAGE IS OF POOR QUALITY

78N2855# ISSUE 19 PAGE 2548 CATEGORY 44  
77/00/00 7 PAGES UNCLASSIFIED DOCUMENT DCAF  
E014186

UTTL: Photochemical hydrogen production through solar radiation by means of the membrane principle

AUTH: A/BRODA, E.

CORP: Wien Univ. (Austria). AVAIL:NTIS SAP: HC A99/MF A01

In WMO Solar Energy p 631-637 (SEE N78-28501 19-42)

MAJS: /\*HYDROGEN PRODUCTION/\*PHOTOLYSIS/\*SOLAR ENERGY  
CONVERSION/\*SOLAR RADIATION

MINS: / PHOTOSYNTHESIS/ PRODUCTION ENGINEERING/ TECHNOLOGY  
UTILIZATION

ABA: Author (ESA)

ABS: Nuclear experts are considering a hydrogen economy where H<sub>2</sub> serves as a fuel to make electricity, as a chemical reactant, as a metallurgical reductant and as a source of food. Now H<sub>2</sub> could also be made by photolysis of water. Theoretically, a quantum of green light carries enough energy for the reaction H<sub>2</sub>O = H<sub>2</sub> + 1/2O<sub>2</sub>. With long-wave light, photolysis could be achieved by combination of 2 quanta. Yet attempts to photolyze water, in presence of sensitizers (photocatalysts), have failed. In the last analysis, this is due to re-combination of the primary, highly reactive, products of the photochemical reaction. A solution of the problem is to be found by the spatial separation of the primary products, i.e. by development of suitable membranes where these products, and therefore also the stable gases H<sub>2</sub> and O<sub>2</sub> come out on opposite sides. The feasibility of this membrane principle has been shown in Nature for 3 giga-years. Using membranes, all photosynthetic cells (photosynthetic bacteria and plants) succeed in the photo-production of a reductant (in many cases at least ferredoxin in the reduced form) with a redox potential equal to that of H<sub>2</sub> in neutral solution (-0.4 V). The reductant can, but need not, be used by the cells for CO<sub>2</sub> assimilation. In man-made technology, the reducing power would be diverted as H<sub>2</sub>. It is not suggested to use or copy living cells. Rather their operation is to be studied so that technically useful membranes for water photolysis can be constructed abiotically. The scientific and practical aspects of large-scale photolytic H<sub>2</sub> production are discussed.

77A23718\* ISSUE 9 PAGE 1441 CATEGORY 44  
77/01/20 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: The thermal efficiency and cost of producing hydrogen and other synthetic aircraft fuels from coal

AUTH: A/WITCOFSKI, R. D. PAA: A/(NASA, Langley Research Center, Hampton, Va.)

CORP: National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.  
(Energy Research and Development Administration, World Hydrogen Energy Conference, 1st, Miami Beach, Fla., Mar. 1-3, 1976.) International Journal of Hydrogen Energy, vol. 1, Jan. 20, 1977, p. 365-377.

MAJS: /\*AIRCRAFT FUELS/\*COAL GASIFICATION/\*COAL LIQUEFACTION  
/\*COST ANALYSIS/\*HYDROGEN FUELS/\*SYNTHETIC FUELS/\*  
THERMODYNAMIC EFFICIENCY

MINS: / COST EFFECTIVENESS/ KEROSENE/ LIQUID HYDROGEN/  
METHANE

ABA: (Author)

ABS: A comparison is made of the cost and thermal efficiency of producing liquid hydrogen, liquid methane and synthetic aviation kerosene from coal. These results are combined with estimates of the cost and energy losses associated with transporting, storing, and transferring the fuels to aircraft. The results of hydrogen-fueled and kerosene-fueled aircraft performance studies are utilized to compare the economic viability and efficiency of coal resource

utilization of synthetic aviation fuels.

#### HYDROGEN QUANTUM YIELDS IN THE 360nm PHOTOLYSIS OF EU<sup>2+</sup> SOLUTIONS AND THEIR RELATIONSHIP TO PHOTOCHEMICAL FUEL FORMATION

P. R. Ryason  
Solar Energy  
Vol. 19, no. 5, 1977,  
p. 445-448.

#### CONCEPTUAL DESIGN OF LARGE SCALE WATER ELECTROLYSIS PLANT USING SOLID POLYMER ELECTROLYTE TECHNOLOGY

L. J. Nuttall  
Hydrogen Energy  
Vol. 2 no. 4 1977  
p. 395-403

78A18850# ISSUE 6 PAGE 100R CATEGORY 44  
77/00/00 32 PAGES In FRENCH UNCLASSIFIED DOCUMENT

UTTL: Comparison of the costs of producing hydrogen by electrolysis and by nuclear-based thermochemistry  
AUTH: A/DERIVE, C.; B/ESTEVE, B. PAA: A/(Electricite de France, Paris, France); B/(Gaz de France, Paris, France)

In: International Workshop on Hydrogen and Its Perspectives, Liege, Belgium, November 15-18, 1976. Proceedings, Volume 2. (A78-18126 06-44) Liege. Association des Ingenieurs Electriciens sortis de l'Institut Electrotechnique Montefiore, 1977. 32 p. In French.

MAJS: /\*ECONOMIC ANALYSIS/\*ELECTROLYSIS/\*ENERGY TECHNOLOGY/\*HYDROGEN PRODUCTION/\*NUCLEAR HEAT/\*THERMOCHEMISTRY  
MINS: / COST ANALYSIS/ ENERGY REQUIREMENTS/ HYDROCARBONS/ INVESTMENTS/ NUCLEAR POWER PLANTS/ PERFORMANCE PREDICTION

ABA: M. L.

ABS: Procedures for manufacturing hydrogen are reviewed with attention to costs and state of technological development. It is concluded that, at present, the most economical way to produce hydrogen is to establish large-scale facilities for processing hydrocarbons (natural gas). Eventually, the off-peak production of electric energy at nuclear plants might make electrolysis a competitive method. Factors which will determine if thermochemical means will ultimately become more economical than electrolysis are considered. Requirements for the development of large hydrogen-producing facilities are examined.

## HYDROGEN PRODUCTION FROM COAL USING A NUCLEAR HEAT SOURCE

R. N. Quade

International Journal of Hydrogen Energy, vol. 2, no. 2, 1977, p. 91-99

A strong candidate for hydrogen production in the intermediate time frame of 1990 to 1995 is a coal-based process using a high-temperature gas-cooled reactor as a heat source.

79A13658 ISSUE 3 PAGE 413 CATEGORY 44 77/00/00  
33 PAGES In GERMAN UNCLASSIFIED DOCUMENT  
UTTL: Problems, status, and prospects of a solar hydrogen economy

AUTH: A/JUSTI, E. PAA: A/(Braunschweig, Technische Universitaet, Braunschweig, West Germany)  
In: German Solar Energy Forum, 1st. Hamburg, West Germany, September 26-28, 1977. Proceedings, Volume 2. (A79-13619 03-44) Munich. Deutsche Gesellschaft fuer Sonnenenergie, 1977. p. 517-549. In German.

MAJS: /\*GAS PIPES/\*HYDROGEN PRODUCTION/\*HYDROGEN-BASED ENERGY/\*PIPELINES/\*SAFETY FACTORS/\*SOLAR ENERGY CONVERSION

MINS: / ECONOMIC ANALYSIS/ ENERGY TECHNOLOGY/ GAS PRESSURE/ HEATING/ PHOTOLYSIS/ REDUCTION (CHEMISTRY)

ABA: (Author)

ABS: This introductory lecture explains the reasons for transition from high tension lines to high pressure pipe lines to connect cheaply very distant energy production and consumption sites. The properties of various gaseous energy carriers, e.g., CH<sub>4</sub> and H<sub>2</sub>, are discussed. H<sub>2</sub> is found to be superior as universal energy carrier and raw material. Subsequently different methods of making H<sub>2</sub> gas from various primary energies are given, including biotechnical processes. Thereafter special advantageous applications of H<sub>2</sub> for industrial and domestic purposes, and the present status of construction of high pressure H<sub>2</sub> pipelines and the satisfactory experiences in Germany are reported. In conclusion the safety risks are treated.

## USE OF SOLAR ENERGY FOR DIRECT AND TWO-STEP WATER DECOMPOSITION CYCLIST

E. Bilgen

International Journal of Hydrogen Energy  
Vol. 2 no. 3  
pp. 251-257.

78A11350 ISSUE 1 PAGE 78 CATEGORY 44 77/00/00  
5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen from sunlight: The biological answer -  
Development of a low-cost biological solar panel  
AUTH: A/FRIEDLAND, J.  
In: International Solar Energy Society, Annual  
Meeting, Orlando, Fla., June 6-10, 1977, Proceedings,  
Sections 14-25. (A78-11212 01-44) Cape Canaveral,  
Fla., International Solar Energy Society, 1977, p.  
25-1 to 25-5.  
MAJS: /\*BIOSYNTHESIS/\*BLUE GREEN ALGAE/\*HYDROGEN PRODUCTION  
/\*PHOTOSYNTHESIS/\*SOLAR ENERGY CONVERSION  
MINS: / BIOMASS ENERGY PRODUCTION/ FILTRATION/ SOLAR CELLS  
ABA: J.M.B.  
ABS: Development of a hydrogen-producing apparatus which  
relies on a blue-green marine algal species is  
discussed. The species studied is capable of yielding  
as much as one milliliter of hydrogen per milliliter  
of algae during a 24-hour period. In addition, several  
selectively permeable polymer membranes are reviewed  
for use in separating the hydrogen gas from the  
anaerobic atmosphere under which the algae are  
cultured. A thin film of poly(vinylidene chloride) is  
found to allow transmission of more than 90% of the  
available hydrogen, while permitting less than 1% of  
the argon or nitrogen to pass. The adaptation of the  
experimental hydrogen generating system to large-scale  
fuel production is also mentioned.

78N33264# ISSUE 24 PAGE 3198 CATEGORY 28 RPT#:  
PB-280995/2 NSF/RA-770482 CNT#: NSF AER-77-11545  
77/00/00 53 PAGES UNCLASSIFIED DOCUMENT

UTTL: Photoproduction of hydrogen by marine blue-green algae  
TLSP: Progress Report, 15 Jun. - 15 Dec. 1977  
AUTH: A/MITSUI, A.  
CORP: Rosenstiel School of Marine and Atmospheric Sciences,  
Miami, Fla. CSS: (Div. of Biology and Living  
Resources.) AVAILNTIS SAP: HC A04/MF A01  
MAJS: /\*BLUE GREEN ALGAE/\*HYDROGEN PRODUCTION/\*  
PHOTOSYNTHESIS  
MINS: / BIOMASS ENERGY PRODUCTION/ MARINE BIOLOGY/  
METABOLISM/ SYNTHETIC FUELS  
ABA: GRA  
ABS: A survey of tropical Atlantic marine photosynthetic  
organisms was conducted in order to find an organism  
exhibiting exceptionally high hydrogen producing  
capabilities. Such an organism was found in the form  
of a blue-green algal strain, Miami BG7. As part of an  
in-depth investigation of hydrogen production in this  
species, the mechanisms of this process and hydrogen  
photoproduction were studied. The use of various  
metabolic inhibitors to investigate the biochemical  
pathways of hydrogen production was investigated.  
Results indicate that the process is strongly  
photodependent.

79A13660 ISSUE 3 PAGE 413 CATEGORY 44 77/00/00  
13 PAGES UNCLASSIFIED DOCUMENT

UTTL: On the thermal and thermo-electrolytical generation of  
hydrogen by solar energy  
AUTH: A/GRETZ, J. PAA: A/(EURATOM and Comitato Nazionale  
per l'Energia Nucleare, Centro Comune di Ricerche,  
Ispra, Italy)  
In: German Solar Energy Forum, 1st. Hamburg, West  
Germany, September 26-28, 1977, Proceedings, Volume 2,  
(A79-13619 03-44) Munich, Deutsche Gesellschaft fuer  
Sonnenenergie, 1977, p. 567-579.  
MAJS: /\*COST EFFECTIVENESS/\*ELECTROLYSIS/\*HYDROGEN  
PRODUCTION/\*SOLAR ENERGY CONVERSION/\*SOLAR HEATING/\*  
THERMAL ENERGY  
MINS: / COOLING SYSTEMS/ ENERGY TECHNOLOGY/ HELIOSTATS/  
HYDROGEN-BASED ENERGY/ TEMPERATURE EFFECTS/  
THERMOCHEMICAL PROPERTIES/ WATER FLOW  
ABA: S.C.S.  
ABS: Procedures for the generation of hydrogen by solar  
energy are presented, noting that electrolysis is the  
easiest and most cost-effective means for industrial

hydrogen production. The characteristics of a 1-MW(e)  
heliocentric demonstration plant are discussed,  
including net power output, heliostat field  
characteristics, the steam cycle, tower dimensions,  
receiver capabilities, and the cooling water system.  
Consideration is given to the thermodynamics of water  
splitting including electrolysis, thermolysis, and  
thermochemical cycles. Various decomposition  
techniques are reported.

## COMMODITY HYDROGEN FROM OFF-PEAK ELECTRICITY K. Darrow, N. Biederman, and A. Konopka

International Journal of Hydrogen Energy, vol.  
2, no. 2, 1977, p. 175-187

## HYDROGEN VIA STEAM REFORMING OF NAPHTHA

J. Rostrup-Nielsen  
Chemical Engineering Progress  
Vol. 73, no. 9, September 1977,  
p. 87-92.

77A37251# ISSUE 17 PAGE 2905 CATEGORY 44 RPT#:  
AIAA PAPER 77-726 77/06/00 7 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Solar energy depot --- using liquid hydrogen as fuel  
and oxygen as oxidizer

AUTH: A/ZACHMANN, H. C. PAA: A/(Associated Enterprises,  
Ellicott City, Md.)  
American Institute of Aeronautics and Astronautics,  
Thermophysics Conference, 12th, Albuquerque, N. Mex.,  
June 27-29, 1977, 7 p.

MAJS: /\*COST EFFECTIVENESS/\*HYDROGEN-BASED ENERGY/\*LIQUID

HYDROGEN/\*OXIDIZERS/\*SOLAR ENERGY CONVERSION

MINS: / CLOSED CYCLES/ ECONOMIC ANALYSIS/ ELECTRIC POWER  
PLANTS/ FEASIBILITY ANALYSIS/ OXYGEN/ SOLAR COLLECTORS  
/ THERMODYNAMIC CYCLES

ABA: (Author)

ABS: A completely new energy system is described based on  
the use of liquid hydrogen as a fuel, along with  
liquid or gaseous oxygen as an oxidizer. The concept  
is made economically feasible by a solar concentrator  
in conjunction with a free piston engine, using  
developments of a similar engine by Exxon Corp. and  
General Electric Co. to generate electricity in a  
closed thermodynamic system, which in turn is  
separately converted to liquid hydrogen. The cost  
effectiveness and competitive analysis with other  
fuels, as well as the capital investment, and other  
important considerations, was based on Australia as a  
location. Over 20 years of weather data along with a  
geographical analysis was used in the various options  
of power generation, fuel liquefaction, and cryogenic  
power transmission.

TJ New options in energy technology / sponsored  
163.2 by the American Institute of Aeronautics and  
N47 Astronautics, Edison Electric Institute, IEEE  
Power Engineering Society, -- New York :  
American Institute of Aeronautics and Astro-  
nautics, c1977.  
149 p. : ill. ; 29 cm.  
Papers nos. 77-1004-771034  
Includes bibliographical references.

Hydrogen by Electrolysis to Supplement Pipeline Gas Supplied - Technical and  
Economic Aspects - C. R. GUERRA and W. S. KU..... p.133.....

Hydrogen-via-Electricity: A Candidate Transitional Transportation Energy  
System Concept - E. E. ECKLUND and W. J. D. ESCHER..... p.140.....

79A11796 ISSUE 2 PAGE 265 CATEGORY 44 77,00/00  
16 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen production in a solar-hydrogen economy  
AUTH: A/BOCKRIS, J. OM. PAA: A/(South Australia, Flinders  
University, Adelaide, Australia)  
In: Symposium on Electrode Materials and Processes for  
Energy Conversion and Storage, Philadelphia, Pa., May

9-12, 1977, Proceedings. (A79-11776 02-25) Princeton,  
N.J., Electrochemical Society, Inc., 1977, p. 338-353.

MAJS: /\*ELECTROLYSIS/\*HYDROGEN PRODUCTION/\*  
PHOTOELECTROCHEMICAL DEVICES/\*SOLAR ENERGY CONVERSION  
MINS: / COAL UTILIZATION/ COST ANALYSIS/ ELECTROCHEMISTRY/  
ELECTROLYTIC CELLS/ OPTIMIZATION/ PHOTOSYNTHESIS/  
PHOTOVOLTAIC CONVERSION/ THERMOCHEMISTRY

ABA: M.L.

ABS: The prospects and costs of different approaches to  
hydrogen production on a commercial scale are  
examined. Features of new electrochemical processes  
are examined, and application of the theory of  
photochemical hydrogen production to determine the  
relationships of electrical parameters is described.  
Characteristics and economics of four stable  
photoelectrolytic cells involving new cathodes or  
stable CdS in solution are reported. It is suggested  
that high costs preclude the use of chemical processes  
for large-scale hydrogen generation.

IP Dickson, Edward M.

J60 The hydrogen energy economy

.D5 ...1977.

(Card 2)

4	HYDROGEN PRODUCTION	35
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	Closed-Cycle Thermochemical Decomposition of Water	42
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78A53458 ISSUE 24 PAGE 4387 CATEGORY 44  
77/00/00 31 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen from solar energy

AUTH: A/COX, K. E. PAA: A/(New Mexico, University,  
Albuquerque, N. Mex.)

In: Hydrogen: Its technology and implications. Volume  
1. (A78-53453 24-23) Cleveland, Ohio, CRC Press, Inc.,  
1977, p. 145-175.

MAJS: /\*COST ANALYSIS/\*ELECTROLYSIS/\*ENERGY CONVERSION  
EFFICIENCY/\*HYDROGEN PRODUCTION/\*SOLAR ENERGY  
CONVERSION/\*TECHNOLOGY ASSESSMENT

MINS: / BIOMASS ENERGY PRODUCTION/ DECOMPOSITION/ ENERGY  
TECHNOLOGY/ OCEAN THERMAL ENERGY CONVERSION/  
PHOTOSYNTHESIS/ THERMOCHEMISTRY/ WATER/ WINDPOWER  
UTILIZATION

ABA: G.R.

ABS: Both coal and nuclear energy are considered the  
primary energy sources from which hydrogen will be  
produced in the near term. However, alternate energy  
sources must be sought and developed for the long  
term. The most obvious energy source possessing the  
required attributes is solar energy. Use of solar  
energy has not become widespread largely due to the  
costs of its collection, conversion, and storage. To  
use solar energy as a major source of energy, it is  
highly desirable to be able to store it in a  
concentrated form that can be easily transported. A  
candidate system that appears to offer high potential  
for solar energy conversion and storage is that of the  
decomposition of water into hydrogen and oxygen.  
Attention is given to the solar resource, proposed  
methods of solar energy conversion, ocean thermal  
energy conversion, power from wind, biomass,  
artificial solar collection schemes, methods of solar  
energy conversion to hydrogen, photosynthetic methods,  
and the economics of hydrogen production from solar  
energy

#### PHOTOELECTROLYSIS OF WATER AT HIGH CURRENT DENSITY: USE OF ULTRAVIOLET LASER EXCITATION.

A.B. Bocarsly, et al.

Appl. Phys. Letters, v.31, no.9, Nov.1,1977, p.568-70.

The behavior of  $TiO_2$  and  $SrTiO_3$  photoanodes in cells for the photoelectrolysis of  $H_2O$  has been investigated for high-intensity 351, 364-nm excitation from an Ar ion laser. Intensities up to  $380 W/cm^2$  have been used. For  $TiO_2$ , a small amount of surface decomposition is found after irradiation at high intensity, whereas  $SrTiO_3$  undergoes no detectable changes. Current-voltage properties for both electrodes are essentially independent of light intensity up to the level of  $380 W/cm^2$ , and there is little if a change in quantum efficiency for electron flow. Photocurrent densities have been shown to exceed  $A/cm^2$  for  $O_2$  evolution. Data show that the energy storage rate associated with the  $SrTiO_3$  photoelectrolysis can exceed  $30 W/cm^2$ ; this represents the highest demonstrated rate of sustained optic to chemical energy conversion.

78N27565# ISSUE 18 PAGE 2413 CATEGORY 44 RPT#:  
SAN/0034-77/1 CNT#: EY-76-5-03-0034-239 77/06/00  
44 PAGES UNCLASSIFIED DOCUMENT

UTTL: Solar energy conversion with hydrogen producing algae  
TLSP: Final Report, 1 Feb. 1976 - 31 Apr. 1977

AUTH: A/BENEMANN, J. R.; B/HALLENBECK, P. C.; C/WEISSMAN,  
J. C.; D/KOCHIAN, L. V.; E/KOSTEL, P. C.; F/OSWALD,  
W. J.

CORP: California Univ., Berkeley. CSS: (Sanitary  
Engineering Research Lab.) AVAIL:NTIS SAP: HC  
A03/MF A01

MAJS: /\*BLUE GREEN ALGAE/\*HYDROGEN PRODUCTION/\*SOLAR ENERGY  
CONVERSION

MINS: / BIOCHEMISTRY/ ECONOMIC ANALYSIS/ ENGINEERING  
MANAGEMENT/ OXYGEN PRODUCTION/ PHOTOLYSIS/  
PHYSIOLOGICAL FACTORS/ SYSTEMS ANALYSIS

ABA: ERA

ABS: Biophotolysis--the production of hydrogen and oxygen  
from water and sunlight by biological catalysts--was  
demonstrated, for the first time, using  
nitrogen-starved cultures of the blue-green alga  
*Anabaena cylindrica*. This system demonstrates all the  
requirements for development of a practical system of  
biophotolysis--high (23 microns mole/mg dry weight)  
and sustained (3 weeks or longer) hydrogen and oxygen  
production at a 2:1 ratio with no fundamental  
limitations in scale-up, stability, or longevity.  
Present limitations of this system may be classified  
as biochemical, physiological engineering. Advances  
were made in all areas. Operation of an outdoor  
biophotolysis system demonstrates the basic

feasibility of this method of energy conversion. An  
engineering and economic analysis reveals many aspects  
of this system which will require further research and  
development before practical applications will be  
possible.

#### THERMOCHEMICAL HYDROGEN PRODUCTION VIA A CYCLE" USING BARIUM AND SULFUR: REACTION BETWEEN BARIUM SULFIDE AND WATER.

K. Ota and W. L. Conger

International Journal of Hydrogen Energy, vol.  
2, no. 2, 1977, p. 101-106

78N26228# ISSUE 17 PAGE 2231 CATEGORY 28 RPT#:  
FE-2435-16 OR-4 CNT#: EX-76-C-01-2435  
EF-77-C-01-2435 PROJ. 9010 77/11/00 47 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Development of the steam-iron process for hydrogen production TLSP: Quarterly Report, 1 Apr. - 30 Jun. 1977

CORP: Institute of Gas Technology, Chicago, Ill.

AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /\*HYDROGEN PRODUCTION/\*IRON/\*PILOT PLANTS/\*STEAM

MINS: / CHARRING/ CHEMICAL REACTIONS/ COAL/ MINERALS/  
SINTERING

ABA: G.Y.

ABS: The purpose of this project is to initiate operational evaluation of the steam-iron pilot plant for the production of hydrogen and to carry out the necessary supporting research. The overall program plan is divided into seven tasks: (1) Reactor System Start-up; (2) Reactor System Variables Study; (3) Design of Static Blade Test Equipment; (4) Kinetic Studies; (5) Char Evaluation; (6) Attrition Studies; and (7) Lift-Line Studies. During the present quarter, one ore circulation and one char feed test were completed. In the char feed test, 47 tons of char were fed at rates up to 3/4 tons/hr and a char bed of 12 feet was maintained for 80 hours. Bed temperatures were increased to 1275 F to initiate char gasification. One was circulated at 5 tons/hr for a period of 30 hours under full automatic control. By replacing the internals of the life-line expansion joint with metal components, interruption in solid circulation, caused by chips of refractory and ceramics, were successfully eliminated. Modification of the upper solids control valve also improved circulation. Additional bed level measurement devices are being installed to further improve solids circulation and allow study of reactor operating variables.

## DEVELOPMENT STUDIES ON THERMOCHEMICAL CYCLES FOR HYDROGEN PRODUCTION

D. van Velzen and H. Langenkamp

International Journal of Hydrogen Energy, vol. 2, no. 2, 1977, p. 107-121

The experimental work in the field of the development of cycles of the Fe/Cl family is described.

78A16049 ISSUE 4 PAGE 628 CATEGORY 44 CNT#:  
NSF AER-72-03566-A02 77/10/27 9 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: High temperature, stable, spectrally selective solar absorbers for thermochemical hydrogen production

AUTH: A/GUREV, H. S.; B/HAHN, R. E.; C/MASTERSON, K. D.  
PAA: C/(Arizona, University, Tucson, Ariz.)

International Journal of Hydrogen Energy, vol. 2, Oct. 27, 1977, p. 259-267.

MAJS: /\*ENERGY ABSORPTION FILMS/\*HYDROGEN PRODUCTION/\*  
SILICON FILMS/\*SOLAR FURNACES/\*SPECTRAL SENSITIVITY/\*  
THERMAL DISSOCIATION

MINS: / EMITTANCE/ HIGH TEMPERATURE ENVIRONMENTS/ NEAR

INFRARED RADIATION/ REFLECTANCE/ REFRACTIVITY/ SILICON  
COMPOUNDS/ VAPOR DEPOSITION/ WATER TEMPERATURE

ABA: (Author)

ABS: The thermochemical reduction of water by reactions similar to the Mark I process requires a processing temperature of 730 C. The efficient utilization of solar photothermal energy conversion in distributed collector systems to attain this temperature will require the use of suitable spectrally selective surfaces which are stable at the operating temperature. A coating system with demonstrated high-temperature capability has been developed. A silicon thin-film absorber is deposited by chemical vapor deposition (CVD) on a silver thin-film reflector. This optical stack is fabricated at temperatures in excess of 800 C, and the CVD technology is amenable to large-scale production in a flow-through system. At 500 C the present Si-Ag system has typical solar absorptance and total normal emittance values of 0.75 and 0.06, respectively. Samples were fabricated which maintained their high spectral selectivity after 2000 thermal cycles between 150 C and 450 C, and after 100 h at 600 C. Further process studies now underway indicate that the solar absorptance can be improved to better than 0.85 by employing a Si-Ge multilayer absorber and that the operating range of the stacks can potentially be raised to the 800-900-C range by employing a refractory-metal thin-film reflector.

UTTL: Use of solar energy for direct and two-step water decomposition cycles

AUTH: A/BILGEN, E.; B/DUCARROIR, M.; C/FOEX, M.; D/SIBIEUDE, F.; E/TROMBE, F. PAA: A/(Ecole Polytechnique, Montreal, Canada); D/(CNRS, Laboratoire des Ultra-Refractaires, Odeillo, Pyrenees-Orientales, France); E/(CNRS, Laboratoire de l'Energie Solaire, Odeillo, Pyrenees-Orientales, France)

TP  
360  
W67  
1976  
(Energy Research and Development Administration and University of Miami, World Hydrogen Energy Conference, 1st, Miami Beach, Fla., Mar. 1-3, 1976.) *International Journal of Hydrogen Energy*, vol. 2, Oct. 27, 1977, p. 251-257. Research supported by the National Research Council of Canada.

MAJS: /\*HYDROGEN PRODUCTION/\*HYDROGENOLYSIS/\*REACTION KINETICS/\*SOLAR FURNACES/\*THERMAL DISSOCIATION

MINS: / FEASIBILITY ANALYSIS/ HELIOSTATS/ HYDROGEN FUELS/ THERMODYNAMIC EFFICIENCY/ TWO PHASE FLOW/ WATER TEMPERATURE/ ZINC OXIDES

ABA: (Author)

ABS: The feasibility of using concentrate solar energy at high temperatures to decompose water is experimentally demonstrated. Preliminary studies show that direct decomposition of water at 2000-2500 C is possible and that the main development should be directed toward reactor design and the separation of product gases. On the other hand, it is shown that two-step thermochemical cycles for hydrogen production are feasible when the reactions are carried out at appropriate high temperatures in a solar furnace. The thermal decomposition of zinc oxide, suitable for such a two-step cycle, is studied in detail.

**THEORETICAL TREATMENT OF THE PHOTOELECTRO-CHEMICAL PRODUCTION OF HYDROGEN**

J. O'M. Bockris and K. Uosaki

*International Journal of Hydrogen Energy*, vol. 2, no. 2, 1977, p. 123-138

The photocurrents or whole cells are calculated, and finally the hydrogen production rate under solar irradiation is evaluated for a typical cell.

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**Intersociety Energy Conversion Engineering Conference, 12th, Washington, 1977.**

- 779140 — Development of a Sulfur-Iodine Thermochemical Water-Splitting Cycle for Hydrogen Production, J. R. Schuster, J. L. Russell, Jr., K. H. McCorkle, K. J. Mysels, J. H. Norman, D. R. O'Keefe, S. A. Stowell, P. W. Trester, D. G. Williamson, *General Atomic Co.*, San Diego, Calif. .... 920
- 779141 — Development Progress on the Sulfur Cycle Water Decomposition System, G. H. Farbman, R. L. Ammon, C. C. Hardman, S. Spewock, *Westinghouse Electric Co.*, Pittsburgh, Pa. .... 928
- 779142 — Irreversibilities, Heat Penalties, and Economics for the Methanol/Sulfuric Acid Process, J. E. Funk, *University of Kentucky*, Lexington, Ky.; K. F. Knoche, *University of Aachen*, Aachen, West Germany ..... 933
- 779143 — Recent Engineering and Chemistry Development of the ZnSe Thermochemical Hydrogen Cycle, H. H. Otsuki, R. K. Pearson, O. H. Krikorian, *Lawrence Livermore Lab.*, Livermore, Calif. .... 939
- 779144 -- Irreversibilities in Thermochemical Cycles for Hydrogen Production by Water Decomposition, K. E. Cox, M. Natarajan, *University of Mexico* ..... 947
- 779150 — Supercorrodng Alloys for Generating Heat and Hydrogen Gas, S. A. Black, S. S. Sergev, *CEL/NCBC*, Port Hueneme, Ca. .... 973
- 779151 — Hydrogen Separation and Production from Coal-Derived Gases Using Fe<sub>2</sub>TiNi<sub>1.2</sub>, V. Cholera, D. Gidaspow, *Inst. of Gas Technology*, Chicago, Ill. .... 981

78N24383# ISSUE 15 PAGE 1978 CATEGORY 28 RPT#:  
SAND-77-0509 CNT#: EY-76-C-04-0789 77/06/00 33  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Potential fuel production from magma  
AUTH: A/NORTHRUP, C. J. M., JR.; B/GERLACH, T. M.;  
C/MODRESKI, P. J.; D/GALT, J. K.  
CORP: Sandia Labs., Albuquerque, N. Mex. AVAIL:NTIS  
SAP: HC A03/MF A01  
MAJS: /\*GEOTHERMAL RESOURCES/\*HYDROGEN PRODUCTION/\*MAGMA  
MINS: / CARBON MONOXIDE/ ENERGY SOURCES/ METHANE  
ABA: ERA  
ABS: Recent calculations and measurements indicate that  
basaltic magma is a new, extensive source for fuels  
(hydrogen, carbon monoxide, and methane). The fuel  
production processes are found to occur in nature as

well as the laboratory and as a result, the work  
indicates that current concepts of geothermal energy  
can be broadened beyond producing only steam and heat.  
When magma is considered as a geothermal resource, its  
use for the direct production of fuels should be  
included. It is possible to generate several mole  
percent hydrogen when water-rich fluid is equilibrated  
with the ferrous and ferric iron in magma. The basis  
of the fuel production processes, the fuel yields for  
injected water and water plus natural organic matter,  
and the increased geothermal resources that would be  
made available by these processes are described.

**A79-34113** Hydrogen fuel production by wind energy  
conversion. E. Ben-Dov (Israel Electric Corp., Ltd., Haifa, Israel), Y.  
Naot, and P. S. Rudman (Technion - Israel Institute of Technology,  
Haifa, Israel). In: Alternative energy sources; Proceedings of the  
Miami International Conference, Miami Beach, Fla., December 5-7,  
1977, Volume 8. (A79-34106 13-44) Washington, D.C., Hemisphere  
Publishing Corp. 1978, p. 3563-3576. 7 refs.

The economic feasibility of using wind energy conversion to  
produce hydrogen fuel by the electrolysis of water is considered.  
Wind energy production of hydrogen to replace gasoline can be  
achieved by feeding wind-generated electricity through a utility grid  
to an electrolysis facility or by means of an electrolysis unit at the  
wind turbine site and subsequent transmission of the hydrogen  
produced to points of use. On-site hydrogen production leads to a  
cost savings of 25% over that of utility-produced hydrogen, due to  
the use of a fixed pitch rotor in place of the variable pitch rotor  
necessary for stable frequency and voltage supply to a utility. It is  
concluded that hydrogen can be produced by on-site electrolysis at a  
cost less than the current price of gasoline in Europe at wind energy  
conversion sites with mean wind speeds exceeding only 4 m/sec.

A.L.W.

78N23252# ISSUE 14 PAGE 1828 CATEGORY 28 RPT#:  
FE-1518-46 CNT#: EY-76-C-01-1518 PROJ. 8920  
77/10/00 296 PAGES UNCLASSIFIED DOCUMENT

UTTL: Development of the steam-iron system for production of  
hydrogen for the HYGAS process TLSP: Final Status  
Report, 1 May 1973 - 30 Jun. 1976  
CORP: Institute of Gas Technology, Chicago, Ill.  
AVAIL:NTIS SAP: HC A13/MF A01  
MAJS: /\*FLUIDIZED BED PROCESSORS/\*HYDROGEN PRODUCTION/\*IRON  
/\*MECHANICAL ENGINEERING/\*STEAM  
MINS: / BEDS (PROCESS ENGINEERING)/ COMPUTERIZED SIMULATION/  
IRON ORES/ SLURRIES/ TES. FACILITIES  
ABA: Author (ERA)  
ABS: The status of the following eight major tasks is  
reported: reducing gas generation testing to establish

operating conditions for the design of the producer  
reactor; process design and construction; shakedown  
operation of the pilot facility; fluidized bed testing  
to obtain data for the design of the fluidized iron  
ore beds, lift lines, and seal legs in the steam iron  
reactor; slurry feed testing to obtain data for design  
of the char feed system; small scale kinetic testing  
to evaluate the use of other iron compounds in the  
steam iron process; char evaluation testing to  
determine preferred operating conditions for different  
chars to produce reducing gas for the steam-iron  
reactor; and computerized analysis evaluation of plant  
design and operating data.

Lambert, Jack L.

Photochemical generation of hydrogen from water : project  
completion report / by Jack L. Lambert and J. V. Paukstelis ; a  
research project conducted by the Kansas Water Resources Re-  
search Institute at Kansas State University. — Manhattan, Kan.  
: The Institute, 1977. N79-1024Z#

9 p. : ill. ; 28 cm. — (Contribution - Kansas Water Resources Research  
Institute ; no. 194)

Includes bibliographical references.

1. Hydrogen. 2. Photochemistry. I. Paukstelis, J. V., joint author. II.  
Kansas Water Resources Research Institute. III. Title. IV. Series: Kansas Wa-  
ter Resources Research Institute. Contribution ; no. 194.  
TP245.H9L35 665.8'1 79-622725  
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79N11239# ISSUE 2 PAGE 167 CATEGORY 28 RPT#:  
FE-2206-14 CNT#: EX-76-C-01-2206 77/10/00 154  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Catalytic conversion of coal energy to hydrogen  
TLSP: Project Final Report

AUTH: A/STARKOVICH, J. A.; B/PINKERTON, J. D.; C/MOTLEY,  
E.

CORP: TRW Defense and Space Systems Group, Redondo Beach,  
Calif. CSS: (Chemistry and Chemical Engineering Lab.  
) AVAIL.NTIS SAP: HC AOB/MF A01

MAJS: /\*CATALYTIC ACTIVITY/\*COAL GASIFICATION/\*ENERGY  
CONVERSION EFFICIENCY/\*HYDROGEN PRODUCTION

MINS: / ALKALIES/ CHARRING/ FLUIDIZED BED PROCESSORS/  
POTASSIUM COMPOUNDS/ TEMPERATURE DISTRIBUTION

ABA: DOE

ABS: The catalytic gasification of coal char with the use  
of alkali salt based catalyst systems for promoting  
the char-lime-steam, char-steam, and char-oxygen-steam  
gasification reactions was studied. The activity and  
recyclability performance of selected alkali catalyst  
systems were evaluated using both fixed and fluid bed  
reactors. It was established in both fixed and fluid  
bed reactor tests that all char gasification reactions  
could be made to rapidly occur at 650 C with steam  
using alkali catalysts such as sodium and potassium  
carbonate. The reaction temperature is approximately  
150 to 200 deg lower than the temperature at which  
rapid reaction can be effected for uncatalyzed char  
gasification reactions. It was shown in reactions  
carried out in fluidized bed reactors, that a 95  
percent pure hydrogen product is obtainable from  
catalyzed char-acceptor-steam reactions at 650 C and  
for 3 to 6 atmosphere reaction pressures.

### THE USE OF CHROMIUM BROMIDE HYDRATES IN THE SULFURIC ACID HYDROGEN BROMIDE CYCLE FOR THE PRODUCTION OF HYDROGEN THERMOCHEMICALLY. ESTIMATES OF CYCLE EFFICIENCY

C. F. V. Mason  
Hydrogen Energy  
Vol. 2 no. 4  
p. 423-429

1977

78A28357 ISSUE 10 PAGE 1797 CATEGORY 44 CNT#:  
NSF BMS-75-03415 NSF BMS-75-19643 NSF AER-75-16962  
77/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Mutational analysis of *Chlamydomonas reinhardtii* -  
Application to biological solar energy conversion

AUTH: A/MCBRIDE, A. C.; B/LIEN, S.; C/TOGASAKI, R. K.;  
D/SAN PIETRO, A. PAA: D/(Indiana University,  
Bloomington, Ind.)

PH  
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In: Biological solar energy conversion: Proceedings of  
the Conference, Miami, Fla., November 15-18, 1976.  
(A78-28351 10-44) New York, Academic Press, Inc.  
1977, p. 77-86.

MAJS: /\*ALGAE/\*HYDROGEN PRODUCTION/\*MUTATIONS/\*PHOTOLYSIS/\*  
SOLAR ENERGY CONVERSION

MINS: / BIOMASS ENERGY PRODUCTION/ ENERGY TECHNOLOGY/  
PHOTOSYNTHESIS

ABA: J.M.B.

ABS: Mutant strains of *Chlamydomonas reinhardtii* were  
employed in studying hydrogen photoevolution. An  
investigation involving anaerobically adapted  
wild-type cells and two photosynthetically incompetent  
strains gave evidence that water is the primary source  
for rapid initial photoevolution. In addition, a  
mutant strain with a more oxygen-resistant hydrogenase  
than wild-type cells was sought. Finally, a selection  
program was initiated to isolate mutant strains with  
greater resistance to the inhibitory effects of the  
herbicide DCMU.

A78-29331 \* # Status of the DOE /STOR/ sponsored national  
program on hydrogen production from water via thermochemical  
cycles. C. E. Baker (NASA, Lewis Research Center, Cleveland, Ohio).  
U.S. Department of Energy and University of Miami, Miami  
International Conference on Alternative Energy Sources, Miami  
Beach, Fla., Dec. 5-7, 1977, Paper. 15 p. 5 refs.

A pure thermochemical cycle is a system of linked regenerative  
chemical reactions which accepts only water and heat and produces  
hydrogen. Thermochemical cycles are potentially a more efficient  
and cheaper means of producing hydrogen from water than is the  
generation of electricity followed by electrolysis. The Energy Storage  
Systems Division of the Department of Energy is currently funding a  
national program on thermochemical hydrogen production. The  
National Aeronautics and Space Administration is responsible for the  
technical management of this program. The goal is to develop a cycle  
which can potentially operate with an efficiency greater than 40%  
using a heat source providing a maximum available temperature of  
1150 K. A closed bench-scale demonstration of such a cycle would  
follow. This cycle would be labeled a 'reference cycle' and would  
serve as a baseline against which future cycles would be compared.

✓ 78A27868 ISSUE 10 PAGE 1794 CATEGORY 44  
77/00/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Solar production of hydrogen

AUTH: A/VEZIROGLU, T. N.: B/KAKAC, S. PAA: A/(Miami, University, Coral Gables, Fla.): B/(Middle East Technical University, Ankara, Turkey)

TJ  
810  
5623  
In: Solar energy engineering. (A78-27852 10-44) New York, Academic Press, Inc., 1977. p. 385-395.

MAJS: /\*ELECTROLYSIS/\*ENERGY TRANSFER/\*HYDROGEN PRODUCTION/\*PHOTOSYNTHESIS/\*SOLAR ENERGY CONVERSION/\*THERMOCHEMISTRY

MINS: / ENERGY TECHNOLOGY/ HYDROGEN-BASED ENERGY/ PHOTOLYSIS / REACTION KINETICS/ THERMODYNAMIC EFFICIENCY

ABA: G.R.

ABS: For a large-scale utilization of solar energy it would be very convenient if the energy obtained could be stored for a use at times when solar energy is not sufficiently available. Possibilities to store solar energy as chemical energy in the form of hydrogen are discussed. This approach has also the advantage that the hydrogen as energy carrier could be transported to other locations where energy is needed. Thermochemical, electrolytical, thermal and photosynthetic methods are considered. The various methods are compared and the advantages of each are stated. Among the four basic methods for producing hydrogen from solar energy, the direct thermal method has the potential of highest thermal efficiency. It is expected that in the near future solar hydrogen could be produced using electrolysis, and later, thermochemical processes. In the years 2000s hydrogen could possibly be obtained by direct thermal water splitting.

#### THE CALCIUM-IODINE CYCLE FOR THE THERMOCHEMICAL DECOMPOSITION OF WATER

K. Funji, W. Kondo, W. Mizuta and T. Kumagai  
Hydrogen Energy  
Vol. 2 no. 4 1977  
p. 413-421

#### THE GREENLAND HYDROPOWER AS A SOURCE OF ELECTROLYTIC HYDROGEN

U. La Roche  
Hydrogen Energy  
Vol. 2 no. 4 1977  
p.405-411

✓ 77A50205 ISSUE 24 PAGE 4185 CATEGORY 44  
77/00/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen production from water utilizing solar heat at high temperatures

AUTH: A/NAKAMURA, T. PAA: A/(Ministry of International Trade and Industry, Electrotechnical Laboratory, Tanashi, Tokyo, Japan)

MAJS: /\*FEASIBILITY ANALYSIS/\*HYDROGEN PRODUCTION/\*SOLAR ENERGY CONVERSION/\*THERMAL DISSOCIATION/\*WATER VAPOR

MINS: / ENTHALPY/ HEAT OF DISSOCIATION/ HIGH TEMPERATURE NUCLEAR REACTORS/ IRON OXIDES/ OXYGEN PRODUCTION/ THERMODYNAMIC EFFICIENCY

ABA: (Author)

ABS: Possibilities of producing hydrogen and oxygen from water utilizing solar heat at high temperatures are investigated. The process of direct thermal decomposition of water is studied using a conceptual model. It is shown that the thermodynamic requirements for the direct thermal decomposer are difficult to realize from the structural viewpoint and that existing separation methods are not applicable for such a decomposition process if it is to attain sufficiently high thermal efficiencies. Feasibilities of realizing simple two-step thermochemical decomposition processes are investigated based on existing thermochemical data. It is predicted, as the results of thermochemical as well as thermodynamic analyses, that a two-step thermochemical decomposition process using iron oxide operates efficiently at relatively low temperatures attainable with solar heat and compatible with structural materials.

#### ENTROPY PRODUCTION, EFFICIENCY, AND ECONOMICS IN THE THERMOCHEMICAL GENERATION OF SYNTHETIC FUELS

I. THE HYBRID SULFURIC ACID PROCESS  
K. F. Knoche and J. E. Funk  
Hydrogen Energy  
Vol. 2 no. 4  
p. 377-385

#### ENTROPY PRODUCTION, EFFICIENCY, AND ECONOMICS IN THE THERMOCHEMICAL GENERATION OF SYNTHETIC FUELS

II. THE METHANOL WATER SPLITTING CYCLE  
K. F. Knoche and J. E. Funk  
Hydrogen Energy  
Vol. 2 no. 4 1977  
p.387-393

**HYDROGEN PRODUCTION FROM WATER UTILIZING SOLAR HEAT AT HIGH TEMPERATURES**

T. Nakamura

Solar Energy

Vol. 19, no. 5, 1977,

p. 467-475.

**Abstract**—Possibilities of producing hydrogen and oxygen from water utilizing solar heat at high temperatures are investigated. The process of direct thermal decomposition of water is studied using a conceptual model. It is shown that the thermodynamic requirements for the direct thermal decomposer are difficult to realize from the structural viewpoint and that existing separation methods are not applicable for such a decomposition process if it is to attain sufficiently high thermal efficiencies. Feasibilities of realizing simple two-step thermochemical decomposition processes are investigated based on existing thermochemical data. It is predicted, as the results of thermochemical as well as thermodynamic analyses, that a two-step thermochemical decomposition process using iron oxide operates efficiently at relatively low temperatures attainable with solar heat and compatible with structural materials.

77A30321\* ISSUE 13 PAGE 2203 CATEGORY 44 CNT#:  
NAS7-100 77/00/00 6 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Performance data for a terrestrial solar  
photovoltaic/water electrolysis experiment  
AUTH: A/COSTOGUE, E. N.; B/YASUI, R. K. PAA:  
A/(California Institute of Technology, Jet Propulsion  
Laboratory, Pasadena, Calif.); B/(TRW, Inc.,  
Cleveland, Ohio)  
CORP: Jet Propulsion Lab., California Inst. of Tech.,  
Pasadena.; TRW, Inc., Cleveland, Ohio.

(International Solar Energy Society, International  
Solar Energy Congress and Exposition, Los Angeles,  
Calif., July 28-Aug. 1, 1975.) Solar Energy, vol. 19,  
no. 2, 1977, p. 205-210.

MAJS: /\*ELECTROLYSIS/\*ENERGY TECHNOLOGY/\*HYDROGEN-BASED  
ENERGY/\*PHOTOVOLTAIC CONVERSION/\*SOLAR ARRAYS/\*SOLAR  
ENERGY CONVERSION

MINS: / GAS GENERATORS/ HYDROLYSIS/ MARINER 4 SPACE PROBE/  
OPTIMIZATION/ SOLAR CELLS/ SYSTEM EFFECTIVENESS

ABA: G.R.

ABS: A description is presented of the equipment used in  
the experiment, taking into account the surplus solar  
panel from the Mariner 4 spacecraft which was used as  
a solar array source and an electrolytic hydrogen  
generator. Attention is also given to operational  
considerations and performance data, system  
considerations and aspects of optimization, and  
large scale hydrogen production considerations.

**USE OF SOLAR ENERGY FOR DIRECT AND TWO-STEP WATER DECOMPOSITION CYCLES**

E. Gilgen

International Journal of Hydrogen Energy

Vol. 2, no. 3, 1977,

p. 251-257.

**HYDROGEN AND OXYGEN FROM WATER.**

E. A. Fletcher and R. L. Moen

Science, v. 197, no. 4308, September 9, 1977,

p. 1050-1056.

The use of solar energy in a one-step effusional  
process is considered.

**HIGH TEMPERATURE; STABLE, SPECTRALLY SELECTIVE SOLAR ABSORBERS FOR THERMOCHEMICAL HYDROGEN PRODUCTION**

H.S. Gurev, R.E. Hahn, and K.D. Masterson  
International Journal of Hydrogen Energy  
p. 259-267.

**HIGH TEMPERATURE; STABLE, SPECTRALLY SELECTIVE SOLAR ABSORBERS FOR THERMOCHEMICAL HYDROGEN PRODUCTION**

H. S. Gurev, R. E. Hahn and K. D. Masterson  
International Journal of Hydrogen Energy  
Vol. 2, no. 3  
pp. 259-267

**FEASIBILITY STUDIES OF CHEMICAL REACTIONS FOR THERMOCHEMICAL WATER SPLITTING CYCLES OF THE IRON-CHLORINE, IRON-SULFUR AND MANGANESE-SULFUR FAMILIES**

K. F. Knoche, H. Cremer, G. Steinborn and W. Schneider  
International Journal of Hydrogen Energy  
Vol. 2, no. 3  
pp.269-289.

**FEASIBILITY STUDIES OF CHEMICAL REACTIONS FOR THERMOCHEMICAL WATER SPLITTING CYCLES OF THE IRON-CHLORINE, IRON-SULFUR AND MANGANESE-SULFUR FAMILIES**

K.F. Knoche, H. Cremer, G. Steinborn and W. Schneider  
International Journal of Hydrogen Energy  
Vol. 2, no. 3, 1977,  
p. 269-289.

**PHOTOELECTROLYSIS OF WATER IN SUNLIGHT WITH SENSITIZED SEMICONDUCTOR ELECTRODES**

Amal K. Ghosh and H. Paul Maruska  
J. of the Electrochemical Society  
Vol. 124, no. 10, October 1977,  
p. 1516-1522.

In all previous studies of the photoelectrolysis of water, very little attention has been paid to the carrier generation and transport properties of the optically active semiconductor electrode. To gather such information the present work theoretically analyzes the spectral response of TiO<sub>2</sub> photoelectrolysis cells. Comparison with experimental results allows us to determine the diffusion length of minority carriers in TiO<sub>2</sub> for the first time. It is the hole transport that governs the spectral response curve, not the electron transport. The quantum efficiency of carrier generation in TiO<sub>2</sub> electrodes in the photoelectrolysis mode can be increased to 80% by doping the crystals with Al. The sunlight conversion efficiency has been raised to 1.3% from 0.4% reported earlier by others. The spectral response of the device has been extended into the visible portion of the spectrum through sensitization of the TiO<sub>2</sub> with Cr dopant impurities, allowing hydrogen generation with visible light. The photoelectrolytic processes associated with the impurity doped crystals are discussed.

79N70365# CATEGORY 28 RPT#: TID-27802 CNT#:  
W-7405-ENG-92-095 77/05/16 128 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Evaluation of the commercial feasibility of hydrogen production by the solar photoelectrolysis of water, task 1 TLSP: Interim Report  
AUTH: A/SCHWERZEL, R. E.; B/BROOMAN, E. W.; C/CRAIG, R. A.; D/WOOD, V. E.  
CORP: Battelle Columbus Labs., Ohio. AVAIL.NTIS  
MAJS: /\*ELECTROLYSIS/\*FEASIBILITY ANALYSIS/\*HYDROGEN PRODUCTION/\*PHOTOELECTRICITY/\*SOLAR ENERGY/\*WATER  
MINS: / OXIDATION-REDUCTION REACTIONS/ SEMICONDUCTORS (MATERIALS)

77N30294\*# ISSUE 21 PAGE 2782 CATEGORY 33  
77/05/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Space power technology applied to the energy problem  
AUTH: A/MILLER, J. L.; B/MORGAN, J. R.  
CORP: National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala. AVAIL.NTIS SAP: HC A12/MF A01  
In its Proc. of the ASPE/MSFC Symp. on Eng. and Productivity Gains from Space Technol. p 257-269 (SEE N77-30273 21-31)  
MAJS: /\*AEROSPACE ENGINEERING/\*ELECTROLYSIS/\*HYDROGEN PRODUCTION/\*WATER  
MINS: / ENERGY CONSUMPTION/ FOSSIL FUELS/ NUCLEAR FUELS/ PHOTOVOLTAIC CONVERSION/ SOLAR CELLS/ SOLAR ENERGY  
ABA: B.L.P.  
ABS: A solution to the energy problem is suggested through the technology of photovoltaic electrolysis of water to generate hydrogen. Efficient solar devices are discussed in relation to available solar energy, and photovoltaic energy cost. It is concluded that photovoltaic electrolytic generation of hydrogen will be economically feasible in 1985.

79V12407 1977 ISS: 13 TP359.H8H9 V.1 0-8493-5121-9  
635.B1 LC-77-7305

AUTH: A/Cox, Kenneth E.; B/Williamson, Kenneth D.  
UTTL: Hydrogen: its technology and implications. TLSP: v. 1. Hydrogen production technology / editors: Kenneth E. Cox, K. D. Williamson. -  
CRC Press, Cleveland : 193 p. : ill. : 23 cm.  
Includes bibliographical references and index.  
LC: Hydrogen as fuel.  
ADDED: Title: Hydrogen production technology.  
NASA: / ELECTROLYSIS/ HYDROGEN FUELS/ SOLAR ENERGY  
LA: / TP359.H8H9 V.1  
MAIN-TITL TRACE-AUTH\* CATLG BY-FACILITY  
78/01/03 COPYRIGHT AVAIL: / LANGLEY

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1977

Conference on the Electrochemistry and Physics  
of Semiconductor Liquid Interfaces under  
Illumination, Airlie, Va., 1977.

Semiconductor liquid - junction solar  
cells ... c1977. (Card 2)  
Electrochemical Society, c1977.

vi, 333 p. : ill. ; 23 cm. -- (Proceed-  
ings volume 77-3)

1. Solar batteries--Congresses. 2. Photo-  
voltaic power generation--Congresses. I.

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77-726                      Solar energy depot. H. C. Zachmann (Associat-  
ed Enterprises, Ellicott City, Md.). *American Institute of Aeronautics  
and Astronautics, Thermophysics Conference, 12th, Albuquerque, N.  
Mex., June 27-29, 1977, Paper 77-726.* 7 p.

A completely new energy system is described based on the use  
of liquid hydrogen as a fuel, along with liquid or gaseous oxygen as  
an oxidizer. The concept is made economically feasible by a solar  
concentrator in conjunction with a free piston engine, using  
developments of a similar engine by Exxon Corp. and General  
Electric Co. to generate electricity in a closed thermodynamic  
system, which in turn is separately converted to liquid hydrogen. The  
cost effectiveness and competitive analysis with other fuels, as well as  
the capital investment, and other important considerations, was  
based on Australia as a location. Over 20 years of weather data along  
with a geographical analysis was used in the various options of power  
generation, fuel liquefaction, and cryogenic power transmission.

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Hydrogen : its technology and implications.  
v. 1. Hydrogen production technology / edi-  
tors: Kenneth E. Cox, K. D. Williamson. --  
Cleveland : CRC Press, c1977.

193 p. : ill. ; 23 cm.

Includes bibliographical references and  
index.

Chapter 1

Water Electrolysis . . . . . p.3 . . . . . Kenneth E.  
A. P. Fickett and Fritz R. Kalhammer . . . . . title:

Chapter 2

Thermochemical Water Decomposition . . . . . p.45 . . . . .  
James E. Funk

Chapter 3

Hydrogen from Fossil Fuels . . . . . p.61 . . . . .  
R. I. Kermode

Chapter 4

Hydrogen from Nuclear Energy . . . . . p.179 . . . . .  
R. J. Jiaoletti

Chapter 5

Hydrogen from Solar Energy . . . . . p.145 . . . . .  
Kenneth E. Cox

77N21601#    ISSUE 12    PAGE 1613    CATEGORY 44  
76/03/00    3 VOLS    40 PAGES    UNCLASSIFIED DOCUMENT

UTTL: Microbial hydrogen production  
AUTH: A/ZAJIC, J. E.; B/BROSSEAU, J.  
CORP: University of Western Ontario, London.    AVAIL.NTIS  
SAP: HC A99/MF A01  
In Miami Univ. 1st World Hydrogen Energy Conf. Proc.,  
Vol. 2 40 p (SEE N77-21591 12-44)  
MAJS: /\*ENERGY CONVERSION/\*GAS GENERATORS/\*HYDROGEN-BASED  
ENERGY/\*MICROBIOLOGY  
MINS: / ENERGY TECHNOLOGY/ MICROANALYSIS/ MICROORGANISMS/  
MICROPARTICLES  
ABA: Author  
ABS: Microbial production is one of the four processes  
available for the production of hydrogen from  
nonfossil primary energy sources. Autotrophy and  
heterotrophy, biological oxidation, and respiration,  
as well as fermentation were studied in regard to the  
production of hydrogen gas by microorganisms.

78N26865\*# ISSUE 17 PAGE 2316 CATEGORY 44  
76/09/00 4 PAGES UNCLASSIFIED DOCUMENT

UTTL: Status of photoelectrochemical production of hydrogen and electrical energy  
AUTH: A/BYVIK, C. E.; B/WALKER, G. H.  
CORP: National Aeronautics and Space Administration, Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A13/MF A01  
In Princeton Univ. Partially Ionized Plasmas, Including the 3rd Symp. on Uranium Plasmas p 244-247 (SEE N78-26837 17-70)  
MAJS: /\*ELECTRIC POWER/\*HYDROGEN PRODUCTION/\*PHOTOELECTRICITY  
MINS: / CHEMICAL ENERGY/ ELECTROCHEMISTRY/ ELECTROLYSIS/ SINGLE CRYSTALS  
ABA: Author

ABS: The efficiency for conversion of electromagnetic energy to chemical and electrical energy utilizing semiconductor single crystals as photoanodes in electrochemical cells was investigated. Efficiencies as high as 20 percent were achieved for the conversion of 330 nm radiation to chemical energy in the form of hydrogen by the photoelectrolysis of water in a SrTiO<sub>3</sub> based cell. The SrTiO<sub>3</sub> photoanodes were shown to be stable in 9.5 M NaOH solutions for periods up to 48 hours. Efficiencies of 9 percent were measured for the conversion of broadband visible radiation to hydrogen using n-type GaAs crystals as photoanodes. Crystals of GaAs coated with 500 nm of gold, silver, or tin for surface passivation show no significant change in efficiency. By suppressing the production of hydrogen in a CdSe-based photogalvanic cell, an efficiency of 9 percent was obtained in conversion of 633 nm light to electrical energy. A CdS-based photogalvanic cell produced a conversion efficiency of 5 percent for 500 nm radiation.

AICHE Symposium Series, v.72, no.158

1976

BIOCHEMICAL ENGINEERING - ENERGY RENEWABLE RESOURCES AND NEW FOODS. S.M. Barnett, J.P. Clark and J.M. Nystrom, eds.

Photosynthesis as a model for photochemical hydrogen generation  
Biophotolysis of water to hydrogen and oxygen  
Conversion of natural products by biofuel cells

78N26869\*# ISSUE 17 PAGE 2317 CATEGORY 44  
CNT#: NSG-7039 76/09/00 6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Gas core reactors for coal gasification  
AUTH: A/WEINSTEIN, H.  
CORP: Illinois Inst. of Tech., Chicago. AVAIL.NTIS SAP: HC A13/MF A01  
In Princeton Univ. Partially Ionized Plasmas, Including the 3rd Symp. on Uranium Plasmas p 269-274 (SEE N78-26837 17-70)  
MAJS: /\*CHEMICAL REACTORS/\*COAL GASIFICATION/\*HYDROGEN PRODUCTION/\*REACTOR CORES  
MINS: / CARBON MONOXIDE/ COAL UTILIZATION/ GASEOUS FISSION REACTORS/ WATER  
ABA: Author

ABS: The concept of using a gas core reactor to produce hydrogen directly from coal and water is presented. It is shown that the chemical equilibrium of the process is strongly in favor of the production of H<sub>2</sub> and CO in the reactor cavity, indicating a 98% conversion of water and coal at only 1500 K. At lower temperatures in the moderator-reflector cooling channels the equilibrium strongly favors the conversion of CO and additional H<sub>2</sub>O to CO<sub>2</sub> and H<sub>2</sub>. Furthermore, it is shown the H<sub>2</sub> obtained per pound of carbon has 23% greater heating value than the carbon so that some nuclear energy is also fixed. Finally, a gas core reactor plant floating in the ocean is conceptualized which produces H<sub>2</sub>, fresh water and sea salts from coal.

TP  
360  
.W67  
1976  
V. 2

World Hydrogen Energy Conference, 1st, Miami Beach, 1976.

Conference proceedings: 1st World Hydrogen Energy Conference, 1-3 March 1976, Miami Beach, Florida; presented by International Association for Hydrogen Energy, Clean Energy Research Institute, University of Miami / sponsored by: Energy Research and Development Administration, the School of Continuing Studies, University of Miami edited by T. Nejat Veriroglu. —

77N28323# ISSUE 19 PAGE 2516 CATEGORY 29 RPI#  
UCRL-52177 CNT#: W-7405-ENG-48 76/11/15 41 PAGES

UNCLASSIFIED DOCUMENT

UTTL: Biosolar production of fuels from algae  
AUTH: A/JEFFRIES, T. W.; B/MOULTHROP, P. H.; C/TIMOURIAN, H.; D/WARD, R. L.; E/BERGER, B. J.  
CORP: California Univ., Livermore, Lawrence Livermore Lab.  
AVAIL.NTIS SAP: HC A03/MF A01  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*BLUE GREEN ALGAE/\*  
HYDROGEN-BASED ENERGY/\*METHANE/\*SOLAR ENERGY  
MINS: / AMMONIA/ ANAEROBES/ ENERGY CONVERSION/ HYDROGEN/  
PHOTOLYSIS  
ABA: Author (ERA)

ABS: A design concept is described for the production of methane, hydrogen, and ammonia using solar energy. Filamentous, nitrogen fixing blue-green algae are employed as a source of biomass for methane and ammonia generation by anaerobic digestion and as a biological catalyst for the photoproduction of hydrogen from water. The resources needed, biomass production and harvest, anaerobic digester, the process of biophotolysis, and product separation are discussed. The environmental and genetic modifications possible to increase biomass production are indicated. Preliminary cost estimates are made for methane and hydrogen production. It is concluded that biosynthetic methane is not economically competitive with that derived from coal gasification, but that hydrogen production offers a viable long range prospect.

TP World Hydrogen Energy Conference, 1st, Miami  
360 Beach, 1976.  
.W67 Conference proceedings: 1st World Hydro-  
1976 gen Energy Conference, 1-3 March 1976, Miami  
V.1 Beach, Florida; presented by International  
Association for Hydrogen Energy, Clean  
Energy Research Institute, University of  
Miami / sponsored by: Energy Research and  
Development Administration, the School of  
Continuing Studies, University of Miami  
edited by T. Nejat Veriroglu. —

77A33339\*# ISSUE 14 PAGE 2372 CATEGORY 44  
76/00/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen production from coal using a nuclear heat source

AUTH: A/QUADE, R. N. PAA: A/(General Atomic Co., San Diego, Calif.)

CORP: General Atomic Co., San Diego, Calif.  
In: World Hydrogen Energy Conference, 1st, Miami Beach, Fla., March 1-3, 1976, Proceedings, Volume 1, (A77-33326 14-44) Coral Gables, Fla., University of Miami: New York, Pergamon Press, 1976, p. 4A-55 to 4A-66. NASA-sponsored research.

MAJS: /\*COAL UTILIZATION/\*HEAT SOURCES/\*HIGH TEMPERATURE GAS COOLED REACTORS/\*HYDROGEN PRODUCTION/\*HYDROGEN-BASED ENERGY/\*REACTOR DESIGN

MINS: / COAL GASIFICATION/ COAL LIQUEFACTION/ COST EFFECTIVENESS/ ENERGY CONVERSION EFFICIENCY/ SYSTEM EFFECTIVENESS/ TEMPERATURE EFFECTS/ URANIUM

ABA: (Author)

ABS: A strong candidate for hydrogen production in the intermediate time frame of 1985 to 1995 is a coal-based process using a high-temperature gas-cooled reactor (HTGR) as a heat source. Expected process efficiencies in the range of 60 to 70% are considerably higher than all other hydrogen production processes except steam reforming of a natural gas. The process involves the preparation of a coal liquid, hydrogasification of that liquid, and steam reforming of the resulting gaseous or light liquid product. A study showing process efficiency and cost of hydrogen vs nuclear reactor core outlet temperature has been completed, and shows diminishing returns at process temperatures above about 1500 F. A possible scenario combining the relatively abundant and low-cost Western coal deposits with the Gulf Coast hydrogen users is presented which provides high-energy density transportation utilizing coal liquids and uranium.

QD Australian Conference on Electrochemistry,  
551 4th, Flinders University of South Australia,  
.A87 1976.  
1976 Trends in electrochemistry ... c1977.  
(Card 2)  
xi, 408 p. : ill. ; 26 cm.  
Organized by the Electrochemical Division

Competing Pathways towards Large Scale Hydrogen Production. . 79  
J.O'M. BOCKRIS

ORIGINAL PAGE IS  
OF POOR QUALITY

79N26240# ISSUE 17 PAGE 2248 CATEGORY 31 RPT#:  
P/51/76/14 76/12/00 79 PAGES In FRENCH  
UNCLASSIFIED DOCUMENT DCAF E090903

UTTL: Comparison of different techniques for producing hydrogen: Production costs analysis

AUTH: A/PORTAS, J. Y.

CORP: Electricite de France, Chatou. CSS: (Div. Etudes Generales and Methodes.) AVAIL.NTIS SAP: HC A05/MF A01

MAJS: /\*COST ANALYSIS/\*HYDROGEN PRODUCTION/\*HYDROGEN-BASED ENERGY/\*TECHNOLOGY ASSESSMENT

MINS: / COAL GASIFICATION/ ELECTROLYSIS/ PRODUCTION ENGINEERING/ THERMOCHEMISTRY

ABA: Author (ESA)

ABS: A multivariable economic analysis of different techniques available, or under study, for the production of hydrogen as an alternative energy source is given. Present and projected costs of hydrogen production by electrolysis are considered. Alternative techniques such as vapor reconstitution or partial oxidation of hydrocarbons, coal gasification, and thermochemistry are also evaluated. Finally, an in depth cost analysis of methods for obtaining hydrogen by electrolysis is made in order to provide a basis for comparison with other techniques.

77N21602# ISSUE 12 PAGE 1613 CATEGORY 44  
76/03/00 3 VOLS 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: The photosynthetic production of hydrogen

AUTH: A/NEIL, G.; B/NICHOLAS, D. J. D.; C/BOCKRIS, J. O.; D/MCCANN, J. F. PAA: A/(Flinders Univ., Adelaide, Australia); C/(Flinders Univ., Adelaide, Australia); D/(Flinders, Univ., Adelaide, Australia)

CORP: Adelaide Univ. (Australia). AVAIL.NTIS SAP: HC A99/MF A01

In Miami Univ., 1st World Hydrogen Energy Conf. Proc., Vol. 2 8 p (SEE N77-21591 12-44)

MAJS: /\*ENERGY TECHNOLOGY/\*HYDROGEN-BASED ENERGY/\*PHOTOSYNTHESIS

MINS: / ANABAENA/ HYDROGEN FUELS/ INERT ATMOSPHERE/ PHOTOCHEMICAL REACTIONS/ X RAY IRRADIATION

ABA: Author

ABS: The rate of hydrogen produced from Anabaena cylindrica under an inert atmosphere and light irradiation was examined. An approximate estimate of the area required to produce hydrogen in adequate quantities from Anabaena cylindrica to provide enough energy for the needs of a city of a population of 1 million people was calculated.

77A33381# ISSUE 14 PAGE 2327 CATEGORY 31  
76/00/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen vehicular fuel storage as a step in a water splitting cycle

AUTH: A/RUDMAN, P. S. PAA: A/(Technion - Israel Institute of Technology, Haifa, Israel)  
In: World Hydrogen Energy Conference, 1st, Miami Beach, Fla., March 1-3, 1976, Proceedings, Volume 2. (A77-33326 14-44) Coral Gables, Fla., University of Miami; New York, Pergamon Press, 1976, p. 3B-31 to 3B-39.

MAJS: /\*GAS EVOLUTION/\*HYDROGEN FUELS/\*HYDROGEN PRODUCTION/ PROPELLANT STORAGE/\*REFUELING/\*THERMOCHEMISTRY

MINS: / CHEMICAL REACTIONS/ HYDROGEN-BASED ENERGY/ METAL HYDRIDES/ WATER

ABA: S.D.

ABS: The paper shows that a unique refueling cycle is possible for hydrogen produced in a thermochemical water-splitting cycle, where fuel production for hydrogen vehicular refueling is an integral part of the refueling loop. Chemical reactions of hydrogen release for fuel storage are identified and discussed along with acceptance criteria for fuel storage systems. Merits and short-comings of such a hydrogen refueling system are pointed out.

77N21606# ISSUE 12 PAGE 1614 CATEGORY 44

76/03/00 3 VOLS 16 PAGES UNCLASSIFIED DOCUMENT

JTTL: Feasibility of hydrogen production by direct water splitting at high temperature

AUTH: A/IHARA, S.

CORP: Electrotechnical Lab., Tokyo (Japan). AVAIL.NTIS SAP: HC A99/MF A01

In Miami Univ., 1st World Hydrogen Energy Conf. Proc., Vol. 2 16 p (SEE N77-21591 12-44)

MAJS: /\*HEAT OF DISSOCIATION/\*HIGH TEMPERATURE RESEARCH/\*HYDROGEN-BASED ENERGY/\*WATER TREATMENT

MINS: / FEASIBILITY ANALYSIS/ SOLAR ENERGY/ THERMAL DISSOCIATION/ WATER VAPOR

ABA: Author

ABS: Conceptual study on the process of hydrogen production by direct dissociation of water using high temperature solar energy is described. Calculated result of equilibrium composition of water vapor, hydrogen, and oxygen suggests that temperatures above 3000 K are required for the dissociation of water. Considerations are made on a solar furnace for supplying such high temperature energy. Basic ideas on the method for separating hydrogen and oxygen from high temperature water vapor are suggested.

77A11335 ISSUE 1 PAGE 76 CATEGORY 44 76/02/00  
11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Primary energy sources for hydrogen production  
AUTH: A/MARCHETTI, C. PAA: A/(International Institute of Applied Systems Analysis, Laxenburg, Austria)  
Revue de l'Energie, vol. 27, Feb. 1976, p. 102-112.  
In English and French.  
MAJS: /\*ENERGY SOURCES/\*ENERGY TECHNOLOGY/\*HYDROGEN-BASED ENERGY  
MINS: / COAL UTILIZATION/ CONTROLLED FUSION/ ECOLOGY/ FOSSIL FUELS/ NUCLEAR FISSION/ SOLAR ENERGY CONVERSION/ THERMODYNAMIC EFFICIENCY/ WOOD  
ABA: R.D.V.  
ABS: Various blue-sky approaches to production of hydrogen by novel low-cost thermodynamically efficient processes with ecological compatibility are put forth. Tapping of hydrogen stored in trees by using genetically engineered microflora and suitable collectors, secondary recovery of coal, an energy-island concept of using nuclear fission reactors in hydrogen production at terawatt levels, hydrogen extraction from thermonuclear plasma, tapping solar energy by developing photothermal chemistry techniques and appropriate semiconductors and solid electrolytes, and tapping melting glacier ice and ocean thermal gradients are considered. The storability, transportability, flexibility, and ecological compatibility of hydrogen and the ecological safety of associated electrolytic processes are pointed out.

77A19072 ISSUE 6 PAGE 867 CATEGORY 44 76/00/00  
19 PAGES UNCLASSIFIED DOCUMENT

UTTL: Solar production of hydrogen as a means of storing solar energy  
AUTH: A/VEZIROGLU, T. N.; B/KAKAC, S. PAA: B/(Miami, University, Coral Gables, Fla.)  
In: Heliotechnique and development: Proceedings of the International Conference, Dhahran, Saudi Arabia, November 2-6, 1975. Volume 1. (A77-19043 06-44)  
Cambridge, Mass.: Development Analysis Associates, Inc., 1976, p. 399-417.  
MAJS: /\*ENERGY STORAGE/\*ENERGY TECHNOLOGY/\*HYDROGEN-BASED ENERGY/\*SOLAR ENERGY CONVERSION  
MINS: / ELECTROLYSIS/ PHOTOLYSIS/ THERMAL DISSOCIATION/ THERMOCHEMISTRY/ THERMODYNAMIC EFFICIENCY  
ABA: B.J.  
ABS: The hydrogen energy concept fits well with solar energy for storing, transmitting, and utilizing it. This paper discusses four basic methods for producing hydrogen from solar energy: direct thermal, thermochemical, electrolytic, and photolytic methods. The direct thermal method is found to have the potential of highest thermal efficiency

77A21316 ISSUE 8 PAGE 1244 CATEGORY 44  
76/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Conversion of solar energy by photosynthetic production of molecular hydrogen  
AUTH: A/BEREZIN, I. V.; B/VARFOLOMEEV, S. D. PAA: B/(Moskovskii Gosudarstvennyi Universitet, Moscow, USSR)  
(Gellotekhnika, vol. 12, no. 3, 1976, p. 60-73.)  
Applied Solar Energy, vol. 12, no. 3, 1976, p. 45-54.

Translation.

MAJS: /\*ENERGY TECHNOLOGY/\*HYDROGEN-BASED ENERGY/\*MOLECULAR GASES/\*PHOTOSYNTHESIS/\*SOLAR ENERGY CONVERSION/\*SYNTHETIC FUELS  
MINS: / CATALYSIS/ ECONOMIC ANALYSIS/ ELECTRON TRANSFER/ ENERGY POLICY/ HYDROGEN FUELS/ PHOTOLYSIS/ THERMODYNAMIC EFFICIENCY  
ABA: B.J.  
ABS: Molecular mechanisms of photosynthesis (including decomposition of water and electron transport under the action of light) are capable of providing conditions necessary for the production of hydrogen. Attention is given to solar-energy conversion efficiency in the photosynthetic production of hydrogen. Also considered are technical requirements for the development of systems for the biophotolysis of water, thermodynamic requirements for exogenous electron acceptors of the electron transport chain, the catalysis of molecular hydrogen formation, and the reliability of water biophotolysis systems.

77N33374# ISSUE 24 PAGE 3204 CATEGORY 28 RPT#:  
EPRI-AF-233 CNT#: EPRI PROJ. 714-1 76/12/00 71  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen production from coal liquefaction residues  
TLSP: Final Report  
AUTH: A/ROBIN, A. M.  
CORP: Texaco, Inc., Montebello, Calif. CSS: (Research Lab. ) AVAIL.NTIS SAP: HC A05/MF A01  
MAJS: /\*COAL LIQUEFACTION/\*HYDROGEN PRODUCTION/\*RESIDUES  
MINS: / CARBON MONOXIDE/ COAL GASIFICATION/ GAS GENERATORS  
ABA: ERA  
ABS: High ash H-coal residues from the liquefaction of coals were gasified in a synthesis gas generator. The synthesis gas produced consisted of over 92 percent volume carbon monoxide and hydrogen on a dry basis. Approximately 40 tons of each residue was gasified at 24 atmospheres pressure at residue feed rates up to 1/2 ton per hour. No major operating problems were experienced. Cold gas efficiencies averaged between 83 and 84 percent. Steam and oxygen requirements were comparable to those of heavy oil gasification. Enough data were obtained to verify existing computer correlations and establish information needed to provide a commercial plant design for these two, and other similar, coal liquefaction residues.

✓ 77A13540 ISSUE 3 PAGE 388 CATEGORY 44 76/10/20  
9 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Hydrogen production using solar radiation  
AUTH: A/OHTA, T.; B/VEZIROGLU, I. N. PAA: A/(Yokohama National University, Yokohama, Japan) R/(Miami University, Coral Gables, Fla.)  
International Journal of Hydrogen Energy, vol. 1, Oct. 20, 1976, p. 255-263.  
MAJS: /\*ELECTROLYSIS/\*GAS GENERATORS/\*HYDROGEN-BASED ENERGY  
/\*PYROLYSIS/\*SOLAR ENERGY CONVERSION/ WATER  
MINS: / CORROSION RESISTANCE/ ENERGY CONVERSION EFFICIENCY/  
ENERGY TECHNOLOGY/ HYDROGEN FUELS/ SYSTEMS ENGINEERING  
/ THERMOCHEMISTRY  
ABA: (Author)  
ABS: Various water-splitting methods using solar energy are reviewed and compared to each other. Direct thermal method has the highest efficiency, however it poses difficulties because of the need for heat-resisting materials. Thermochemical method becomes promising if corrosion-resisting materials are found. Electrolytic method is straightforward and conventional. However, a hybrid system combining electrolytic method with thermochemical and/or photochemical methods looks promising and is believed to result in optimum conversion efficiencies in the near future. Photolysis and biochemical methods are environmentally most acceptable, but are of low conversion efficiencies presently

✓ 77N21603# ISSUE 12 PAGE 1613 CATEGORY 44  
76/03/00 3 VOLS 23 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Bioconversion of solar energy in salt water:  
Photosynthetic hydrogen production systems  
AUTH: A/MITSUI, A.  
CORP: Miami Univ., Fla. CSS: (Rosenstiel School of Marine and Atmospheric Science.) AVAIL:NTIS SAP: HC  
A99/MF A01  
In its 1st World Hydrogen Energy Conf. Proc., Vol. 2  
23 p (SEE N77-21591 12-44) Sponsored in part by NSF  
ABA: Author  
ABS: Hydrogen photoproduction via marine photosynthetic systems is reviewed. Special emphasis is placed on the economic and logistical importance of using salt water as the hydrogen (proton) and electron donor in such a system. In addition, the advantages of using marine photosynthetic microorganisms are discussed from the standpoint of maintaining stable mass cultures with high solar conversion efficiencies. A program is outlined for the multiple utilization of hydrogen producing mass cultures, including harvesting cultures for food production, using cellular products for methane production, and isolating metabolically active cellular products for medical use.

77A12771 ISSUE 2 PAGE 242 CATEGORY 44 76/00/00  
7 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Hydrogen from solar energy via water electrolysis  
AUTH: A/COX, K. E. PAA: A/(New Mexico University, Albuquerque, N. Mex.)  
In: Intersociety Energy Conversion Engineering Conference, 11th, State Line, Nev., September 12-17, 1976. Proceedings, Volume 1. (A77-12662 02-44) New York, American Institute of Chemical Engineers, 1976, p. 926-932. Research supported by the University of New Mexico.  
MAJS: /\*ELECTROLYSIS/\*HYDROGEN-BASED ENERGY/\*SOLAR ENERGY/\*  
WATER  
MINS: / COST ANALYSIS/ ENERGY TECHNOLOGY/ PHOTOVOLTAIC CELLS  
/ SOLAR ARRAYS/ SYSTEM EFFECTIVENESS  
ABA: (Author)  
ABS: Hydrogen production from solar energy alleviates the two major problems associated with solar energy as a primary energy source, storage and the intermittency of solar radiation. An attractive and simple method to produce hydrogen is by the electrolysis of water. Power for the electrolysis cells is supplied by an array of silicon solar photovoltaic cells. Experiments have been conducted with a 12 watt (peak power) array wired directly to an electrolyzer. Initial results, though not optimum, have shown that hydrogen is produced at efficiencies of up to 10%. An average efficiency of 4.5% was obtained in daily tests.

✓ 77A19076 ISSUE 6 PAGE 867 CATEGORY 44 76/00/00  
10 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Solar energy utilization - The photochemical approach  
AUTH: A/BRODA, E. PAA: A/(Wien, Universitatzet, Vienna, Austria)  
In: Heliotechnique and development: Proceedings of the International Conference, Dhahran, Saudi Arabia, November 2-6, 1975. Volume 1. (A77-19043 06-44) Cambridge, Mass., Development Analysis Associates, Inc., 1976, p. 471-480.  
ABA: (Author)  
ABS: The essential feature of bacterial and plant photosynthesis is the light-powered transfer of an electron to a compound with a standard redox potential about equal to that of hydrogen in neutral solution. A hypothesis is put forward on how photolysis evolved in the history of organisms. Theoretically, it is possible to photolyse water into hydrogen and oxygen without participation of organisms, or even biogenic substances. This necessitates the application of the membrane principle where hydrogen and oxygen are set free in different loci. Hydrogen could be used as a basis for a technical hydrogen economy.

77A33336# ISSUE 14 PAGE 2372 CATEGORY 44 CNT#: 20  
EPA-IAG-0646 76/00/00 20 PAGES UNCLASSIFIED DOCUMENT

UTTL: Synthetic fuels from solid wastes and solar energy  
AUTH: A/ANTAL, M. J., JR.; B/FEBER, R. C.; C/TINKLE, M. C.  
PAA: A/(Princeton University, Princeton, N.J.);  
C/(California, University, Los Alamos, N. Mex.)  
In: World Hydrogen Energy Conference, 1st, Miami  
Beach, Fla., March 1-3, 1976, Proceedings, Volume 1.  
(A77-33326 14-44) Coral Gables, Fla., University of  
Miami; New York, Pergamon Press, 1976, p. 3A-69 to  
3A-88. U.S. Environmental Protection Agency  
MAJS: /\*HYDROGEN-BASED ENERGY/\*REACTION KINETICS/\*SOLAR  
ENERGY CONVERSION/\*SOLID WASTES/\*SYNTHETIC FUELS  
MINS: / CARBON DIOXIDE/ COST EFFECTIVENESS/ DOMESTIC ENERGY/  
ECONOMIC ANALYSIS/ HEAT SOURCES/ STEAM/ TOWERS  
ABA: P.T.H.  
ABS: The basic reaction by which organic solid wastes in  
the presence of steam yield hydrogen and carbon  
dioxide is noted, and the possibilities of developing  
processes based on it for the production of  
significant amounts of hydrogen are examined. In  
particular, the option using solar tower as the heat  
source is discussed. Heating requirements are  
analyzed, and possible hydrogen production efficiency  
for a given system is roughly estimated to be at least  
70%. An estimate of the overall economics of the  
system is provided.

74y16898 1969 ISS: 00 IL521.3.C6A3 NO. 1244 621.359  
LC-74-601262

AUTH: A/Klein, Martin G., A/1936-  
UTTL: Hydrogen-oxygen electrolytic regenerative fuel cells,  
by M. Klein and R. Astrin.  
National Aeronautics and Space Administration: for  
sale by the Clearinghouse for Federal Scientific and  
Technical Information, Springfield, Va. (Washington)  
xi, 345 p. illus. 27 cm.  
3.00 NASA contractor report, NASA CR-1244 \*Prepared  
under contract no. NAS 3-2781 by Electro-Optical  
Systems, Inc., Pasadena, Calif. for Lewis Research  
Center.\*  
LC: Fuel cells.  
ADDED: Astrin, Robert F., joint author.  
Electro-Optical Systems, Inc., Pasadena, Calif. United  
States, Lewis Research Center, Cleveland, United  
States, National Aeronautics and Space Administration,  
NASA contractor report NASA CR-1244  
MAIN-AUTH TRACE-SERS-CORP-TITL-AUTH- CATLG BY-LC  
/ /

77A33367# ISSUE 14 PAGE 2310 CATEGORY 23  
76/00/00 40 PAGES UNCLASSIFIED DOCUMENT

UTTL: Microbial hydrogen production  
AUTH: A/ZAJIC, J. E.; B/BROSSEAU, J.  
In: World Hydrogen Energy Conference, 1st, Miami  
Beach, Fla., March 1-3, 1976, Proceedings, Volume 2.  
(A77-33326 14-44) Coral Gables, Fla., University of  
Miami; New York, Pergamon Press, 1976, p. 4B-29 to  
4B-68.  
ABA: S.D.  
ABS: A comparison of fuel properties of nonfossil and other  
fuels reveals that hydrogen is an ideal fuel not only  
as an alternative primary energy source but also as a  
highly efficient energy carrier. The four basic  
processes available for hydrogen production from  
nonfossil primary energy sources are electrolytic,  
thermomechanical, radiolytic, and microbial. The paper  
is a brief review of microbial production of hydrogen.  
Primary environmental factors determining the outcome  
of enrichment procedures for some chemolithotrophic and  
chemoheterotrophic bacteria are identified. The  
biochemistry of hydrogen gas production by  
microorganisms is discussed for 'clostridial' and  
'coll-type' reactions. Also discussed are the  
nitrogenase relationship to hydrogen synthesis and the  
use of photosynthetic bacteria.

79N70225# CATEGORY 51 RPT#: PB-282358/1  
NNSF/RA/N-75-414 CNT#: NSF AER-75-11171 75/09/30  
50 PAGES UNCLASSIFIED DOCUMENT

UTTL: A survey of hydrogen producing photosynthetic  
organisms in tropical and subtropical marine  
environments TLSP: Semiannual Report, 15 Apr. - 30  
Sep. 1975  
AUTH: A/MITSUI, A.  
CORP: Rosenstiel School of Marine and Atmospheric Sciences,  
Miami, Fla. AVAIL NTIS  
MAJS: /\*ALGAE/\*HYDROGEN PRODUCTION/\*MARINE BIOLOGY/\*TROPICAL  
REGIONS  
MINS: / BIOMASS ENERGY PRODUCTION/ CELLS (BIOLOGY)/  
PHOTOSYNTHESIS

77A25824 ISSUE 10 PAGE 1669 CATEGORY 44  
76/00/00 302 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Hydrogen technology for energy --- Book  
AUTH: A/MATHIS, D. A. SAP: \$32  
Park Ridge, N.J., Noyes Data Corp. (Energy Technology  
Review, No. 9), 1976. 302 p.

ABA: G.R.

ABS: The production of hydrogen as an energy storage medium appears particularly attractive in connection with schemes for the utilization of primary energy sources for which a storage of the provided energy is vital because of the intermittent nature of operation on the remoteness of the power source location from the points at which the energy is to be used. Primary energy sources considered are related to solar energy, wind energy, fossil energy, and nuclear energy. The technical aspects of storage and transmission systems for a proposed 'hydrogen economy' are examined. Suggestions concerning the integration of the hydrogen economy into the energy system of the U.S. are presented. A description is provided of technological problems related to the handling of gaseous hydrogen, liquid hydrogen, and hydrogen in the form of metal hydrides. Attention is given to the usage of hydrogen for fuel and energy storage, nontechnical aspects of a hydrogen economy, and a listing of hydrogen technology experts.

77A19077 ISSUE 6 PAGE 868 CATEGORY 44 76/00/00  
7 PAGES UNCLASSIFIED DOCUMENT

UTTL: The photosynthetic production of hydrogen  
AUTH: A/NEIL, G.; B/NICHOLAS, D. J. D.; C/BOCKRIS, J. O'M.  
D/MCCANN, J. F. PAA: D/(South Australia, Flinders  
University, Bedford Park; Adelaide, University,  
Adelaide, Australia)

In: Heliotecchnique and development: Proceedings of the  
International Conference, Dhahran, Saudi Arabia,  
November 2-6, 1975. Volume 1. (A77-19043 06-44)  
Cambridge, Mass., Development Analysis Associates,  
Inc., 1976. p. 481-487.

ABA: (Author)

ABS: This paper examines the hydrogen producing capabilities of *Anabaena cylindrica*, a blue-green algae. The experimental set up is described and results showing hydrogen and ethylene evolution with time are presented for several solutions. It is estimated that to produce hydrogen from solar energy to power a city of one million people at a rate of 10 kW per person, an area of about 400 sq km would be needed. However, many problems still need to be solved before producing hydrogen on a large scale via biological systems becomes feasible.

TP  
360  
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Microbial energy conversion : the proceedings of a seminar / sponsored by the UN Institute for Training and Research (UNITAR) and the Ministry for Research and Technology of the Federal Republic of Germany, held in Göttingen, October 1976 ; edited by H. G. Schlegel and J. Farnes. — Oxford, Eng. ; New York : Pergamon Press, 1976.

644 p. : ill. ; 24 cm.

A supplement to Solar energy.

(Continued on card 2)

#### Hydrogen formation

R. THAUER

Limitation of microbial H<sub>2</sub>-formation via fermentation . . . . . p. 201 . . . . .

E. N. KONDRATIEVA

Phototrophic microorganisms as source of hydrogen and hydrogenase formation . . . . .

A. SAN PIETRO p. 205

Hydrogen formation from water by photosynthesis and artificial systems p. 217.

S. G. REEVES, K. K. RAO, L. ROSA and D. O. HALL

Biocatalytic production of hydrogen . . . . . p. 235 . . . . .

Th. SCHRECKENBACH

Light-energy conversion by the purple membrane from *Halobacterium halobium* . . . . .

E. L. FOO and C. G. HEDEN

Is a biocatalytic production of methanol a practical proposition? . . . . . p. 245 . . . . .

## HYDROGEN - PRODUCTION

79:45577- ISSUE 20 PAGE 3774 CATEGORY 44  
79/00/00 18 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen in the U.S. energy picture  
AUTH: A/KELLEY, J. H.; B/MANVI, R. PAA: B/(California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.)

CORP: Jet Propulsion Lab., California Inst. of Tech., Pasadena.

In: Hydrogen for energy distribution; Proceedings of the Symposium, Chicago, Ill., July 24-28, 1976. (A79-45576 20-44) Chicago, Institute of Gas Technology, 1979, p. 9-26.

MAJS: /\*DOMESTIC ENERGY/\*ENERGY TECHNOLOGY/\*HYDROGEN PRODUCTION/\*HYDROGEN-BASED ENERGY

MINS: / ALLOCATIONS/ BLOCK DIAGRAMS/ COMMERCIAL ENERGY/ DEMAND (ECONOMICS)/ DISTRIBUTING/ ECONOMIC FACTORS/ ENERGY CONSUMPTION/ FORECASTING/ NASA PROGRAMS/ RESEARCH AND DEVELOPMENT/ TRANSPORTATION ENERGY/ UNITED STATES OF AMERICA

ABA: A.T.

ABS: A study of hydrogen in the U.S. program performed by the Hydrogen Energy Systems Technology (HEST) investigation is reported. Historic production and use of hydrogen, hydrogen use projections, hydrogen supply, economics of hydrogen production and supply, and future research and development needs are discussed. The study found current U.S. hydrogen utilization to be dominated by chemical and petroleum industries, and to represent 3% of total energy consumption. Hydrogen uses are projected to grow by a factor of 5 to 20 during the remainder of this century, and new applications in synthetic fuel from coal manufacture and directly as energy storage or fuel are expected to develop. The study concluded that development of new methods of supplying hydrogen replacing natural gas and petroleum feedstocks with alternate sources such as coal and heavy oils, and electrolysis techniques is imperative.

79N29379# ISSUE 20 PAGE 2662 CATEGORY 28 RPT#:  
BNL-25760 CONF-790415-16 CNT#: EY-76-C-02-0016  
79/00/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen technology: An overview --- conferences

AUTH: A/SALZANO, F. J.; B/MEZZINA, A.; C/BELLER, M.; D/STRICKLAND, G.; E/SRINIVASAN, S.

CORP: Brookhaven National Lab., Upton, N. Y. AVAIL.NTIS  
SAP: HC A02/MF A01

Presented at the 177th ACS Natl. Meeting, Honolulu, Hawaii, 1 Apr. 1979

MAJS: /\*CONFERENCES/\*HYDROGEN-BASED ENERGY/\*MATERIALS RECOVERY/\*NATURAL GAS/\*TECHNOLOGY ASSESSMENT

MINS: / CRYOGENIC FLUID STORAGE/ EUROPE/ JAPAN/ PRODUCTION ENGINEERING/ RESEARCH AND DEVELOPMENT

ABA: DOE

ABS: The key technologies needed for hydrogen to make major inroads into the U.S. energy economy as a fuel derived from renewable or abundant nonfossil resources is presented. The unique relationship between hydrogen and the fuel cell is discussed. The state-of-the-art of hydrogen transmission and storage are presented, and a scenario shows how the commercialization of the fuel cell as an electric-generating device in urban areas could lead to the introduction and use of hydrogen in a wider variety of end uses. At the present time there is a great deal of international interest in hydrogen. A broad picture of the activities of a number of western European countries and Japan in the area of hydrogen and a summary of international interest in this area is presented.

79A45602 ISSUE 20 PAGE 3775 CATEGORY 44  
79/00/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fuel uses of hydrogen in the residential/commercial/industrial sectors  
AUTH: A/BAKER, N. R. PAA: A/(Institute of Gas Technology, Chicago, Ill.)

In: Hydrogen for energy distribution; Proceedings of the Symposium, Chicago, Ill., July 24-28, 1978. (A79-45576 20-44) Chicago, Institute of Gas Technology, 1979, p. 569-582.

MAJS: /\*FUEL COMBUSTION/\*HYDROGEN FUELS  
MINS: / BURNERS/ COMMERCIAL ENERGY/ DOMESTIC ENERGY/ ENERGY TECHNOLOGY/ FLAME STABILITY/ FLAMMABILITY/ INDUSTRIAL ENERGY/ METHANE

ABA: (Author)

ABS: In this paper, hydrogen as a fuel is discussed and its technical merits are examined. In anticipation of the time when natural gas can no longer satisfy the consumptive demand, hydrogen has been suggested as the obvious replacement. In order for hydrogen to play a major role as a residential, commercial, or industrial fuel, the effect of its substitution for natural gas in conventional combustion devices must be examined. This paper discusses several of hydrogen's combustion properties, principally in comparison with those of methane. The effect of converting existing burners to hydrogen use is discussed regarding energy input, operation, and emissions. Two differing hydrogen combustion techniques are reviewed, and their relative advantages discussed. In general, recent developments in hydrogen combustion devices have shown that such burners can be both cleaner and more efficient than their hydrocarbon counterparts.

**A80-11955** Hydrogen - A means of integrating competing technology into a unified energy system. R. T. Jaske. In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. (A80-11953 02-44) Washington, D.C., Government Institutes, Inc., 1979, p. 207-214, 12 refs.

The 1975 state of hydrogen energy technology is reviewed, and some criteria for a long range national energy delivery system are outlined. It is found that only a limited number of systems can meet all of the key properties of a nationally optimized, highly independent energy system. The most promising combination appears to be the utilization of breeder reactors or fusion machines to supply thermal energy for generation of electricity and for production of hydrogenous fuel (methane-methanol-hydrogen) for a common pool delivery system. Competitive forces would allocate the shares of electricity and stored fuel on the basis of efficiency and market conditions, guided by national objectives. B.J.

BON10397# ISSUE 1 PAGE 55 CATEGORY 28 RPT#:  
NTIS/PS-79/0771/0 79/08/00 24 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen as a fuel. Citations from the international aerospace abstracts data base TLSP: Progress Report, 1977 - Jul. 1979

AUTH: A/ZOLLARS, G. F.

CORP: New Mexico Univ., Albuquerque. CSS: (Technology Application Center.) AVAIL:NTIS SAP: HC \$28.00/MF \$28.00

Sponsored in part by NTIS

MAJS: /\*AIRCRAFT FUELS/\*AUTOMOBILE FUELS/\*BIBLIOGRAPHIES/\*HYDROGEN FUELS

MINS: / ENERGY CONVERSION EFFICIENCY/ FUEL COMBUSTION/ GAS MIXTURES/ STORAGE STABILITY

ABA: GRA

ABS: The 219 citations concern the use of hydrogen as a fuel for aircraft and automobiles. Topics covered include storage, fuel combustion studies, gas mixtures, and energy conversion efficiency.

low cost relative to all other options examined. Since a large volume of natural gas storage is presently in service, a pressing need to develop fixed site hydrogen storage technology (beyond the conversion of this underground storage to hydrogen) was not identified.

BON12189# ISSUE 3 PAGE 305 CATEGORY 28 RPT#:  
UTIAS-241 CN- ISSN-0082-5255 79/10/00 30 PAGES UNCLASSIFIED DOCUMENT

UTTL: The future role of hydrogen fuel in an electrical society

AUTH: A/PATTERSON, G. N.

CORP: Toronto Univ. (Ontario). CSS: (Inst. for Aerospace Studies.) AVAIL:NTIS SAP: HC A02/MF A01

MAJS: /\*ENERGY POLICY/\*HYDROGEN FUELS/\*MANAGEMENT PLANNING/\*TECHNOLOGY ASSESSMENT

MINS: / ELECTRIC POWER PLANTS/ ENGINES/ MANUFACTURING/ STORAGE TANKS

ABA: M.M.M.

ABS: The manufacture, storage, and use of hydrogen for peak-shaving purposes, vehicular power plants, and as a chemical raw material are discussed and programs for future development are indicated. It is concluded that plans for the future use of hydrogen on a large scale should be initiated now.

and users is discussed.

PRINT 28/2/1-29      TERMINAL=33

79V30600 1979 ISS: 00 TP359.H8H88 665.81 LC-79-106664

AUTH: A/Escher, William J. D.

UTTL: Hydrogen for energy distribution : TLSP: symposium papers, presented July 24-28, 1978 / symposium chairman, William J. D. Escher : symposium director, Wendell W. Waterman ; produced by Jack W. White, Susan M. Briles, and Wilma McGrew ; sponsored by Institute of Gas Technology.

The Institute, Chicago : viii, 676 p. : ill. : 23 cm.

\$60.00 Includes bibliographical references.

LC: Hydrogen as fuel -- Congresses.

ADDED: Chicago, Institute of Gas Technology.

NASA: / CONFERENCES/ ENERGY DISTRIBUTION/ FUEL CELLS/ HYDROGEN FUELS/ HYDROGEN-BASED ENERGY/ TECHNOLOGY ASSESSMENT

MA: / TP359.H8.H995 1979 C2X

MAIN-TITL TRACE-CORP\*AUTH\* CATLG BY-LC

/ / AVAIL: / LEWIS/ MARSHALL/ NASA HQ.

78V55104 1979 ISS: 00 TP359.H8H9 VOL. 5 0-849351-25-1  
665.8108 5: 665.81 LC-78-21140

AUTH: A/Cox, Kenneth E.; B/Williamson, Kenneth D.

UTTL: Implications of hydrogen energy / editors, Kenneth E. Cox, K. D. Williamson, Jr.

CRC Press, Cleveland : 129 p. : ill. : 26 cm.

Hydrogen, its technology and implications : v. 5

Includes bibliographical references and index.

LC: Hydrogen as fuel.

NASA: / ENERGY TECHNOLOGY/ HYDROGEN FUELS/ HYDROGEN PRODUCTION

MA: / TP359.H8.H995 1979 V5 C2

MAIN-TITL TRACE-SERS\*AUTH\* CATLG BY-LC

/ / AVAIL: / MARSHALL

HYDROGEN ENERGY BIBLIOGRAPHY. D. D. Kenney.

International Journal of Hydrogen Energy, vol 4, no 4, 1979, p. 339-341.

CN-150,854 *Hydrogen Utilization* 1979  
FORESIGHT - VOLUME I. SOCIETAL ASPECTS OF  
HYDROGEN ENERGY SYSTEMS. (Prepared for the  
Subcommittee on Advanced Energy Technologies  
& Energy Conservation Research, Development  
& Demonstration of the Committee on Science  
& Technology, U.S. House of Representatives,  
95th Congress, 2nd Session by NBS & Science  
Policy Research Div. of Library of Congress,  
Dec.1978). 1979. 161p. (Committee Print).

96th Congress, 2nd Session

96th Congress, 2nd Session

Serial YYY

Committee on Science and Technology

Hearings - Committee on Science & Technology  
Hydrogen

79V29923 1979 ISS: 00 TP359.H8G73 333.7 LC-79-101945

AUTH: A/Greenberg, Gail I.

UTTL: What about hydrogen as a fuel? / Gail Greenberg.

Business Communications Co., Stamford, Conn. : vii,  
116 leaves : ill. : 29 cm.

Business opportunity report ; E-002R Includes  
bibliographical references.

LC: Hydrogen as fuel.

MAIN-AUTH TRACE-SERS\*TITL\* CATLG BY-LC

/ /

ANALYSIS OF A DELPHI STUDY ON HYDROGEN.

P. Valette, L. Valette, M. Siebker, & J.

Leclercq

International Journal of Hydrogen Energy,

Vol. 3, No. 2, 1978, p. 251-259.

Abstract - Eighty-six experts of thirteen countries have participated in a Delphi study started in July terminated in March 1975. This study has found a consensus on many different technical and economic and on the consumption of hydrogen in 1985 and 2000. Most of these features have been investigatedprehensive forecasting effort on a world-wide basis. The study emphasized three specific areas: transportation and consumption.

**A79-45576** Hydrogen for energy distribution; Proceedings of the Symposium, Chicago, Ill., July 24-28, 1978. Symposium sponsored by the Institute of Gas Technology, Chicago, Institute of Gas Technology, 1979. 682 p. \$60. (For individual items see A79-45577 to A79-45606)

The symposium focused on hydrogen as an energy carrier analogous to electricity, covering its status today in the captive and merchant hydrogen industry to future uses, such as hydrogen-fueled transportation systems. Specifically, papers covered hydrogen in the U.S. energy picture, international developments in hydrogen technologies, demand and supply as a chemical feedstock in U.S., modern ammonia synthesis use of hydrogen, economics of small use hydrogen, developmental hydrogen via coal gasification processes, alkaline electrolysis, water electrolysis using polymer electrolytes, hydrogen via thermochemical and other advanced water-splitting technologies, transmission of gaseous hydrogen, and liquid hydrogen fueled commercial aircraft. A.T.

**78N32292#** ISSUE 23 PAGE 3066 CATEGORY 28 RPT#:  
NTIS/PS-78/0635/9 NTIS/PS-77/0522 NTIS/PS-76/0458  
78/06/00 167 PAGES UNCLASSIFIED DOCUMENT  
Supersedes NTIS/PS-77/0522; NTIS/PS-76/0458

**UTTL:** Hydrogen use as a fuel. A bibliography with abstracts  
**TLSP:** Progress Report, 1964 - May 1978

**AUTH:** A/HUNDEMANN, A. S.  
**CORP:** National Technical Information Service, Springfield, Va. AVAIL.NTIS SAP: HC \$29.00/MF \$28.00  
**MAJS:** /\*BIBLIOGRAPHIES/\*ENERGY POLICY/\*HYDROGEN FUELS/\*SYNTHETIC FUELS  
**MINS:** / ELECTRIC POWER SUPPLIES/ ENERGY CONSUMPTION/ ENERGY SOURCES/ ENERGY TECHNOLOGY/ HYDROGEN PRODUCTION  
**ABA:** GRA  
**ABS:** Federally-funded research studies pertaining to the technical feasibility of using hydrogen as a fuel for vehicular transportation, electric power generation, and both subsonic and supersonic aircraft are discussed. Excluded are studies on hydrogen production and storage. These topics are covered in other bibliographies. This updated bibliography contains 162 abstracts, 29 of which are new entries to the previous edition).

**78N31261#** ISSUE 22 PAGE 2920 CATEGORY 28 RPT#:  
AD-A055024 DST-18505-522-78 DST-18505-522-76  
78/06/00 103 PAGES UNCLASSIFIED DOCUMENT  
Supersedes DST-18505-522-76

**UTTL:** Hydrogen technology, foreign  
**AUTH:** A/BU51, J. D.  
**CORP:** Defense Intelligence Agency, Washington, D.C.  
AVAIL.NTIS SAP: HC A06/MF A01  
**MAJS:** /\*ECONOMICS/\*HYDROGEN FUELS/\*TECHNOLOGICAL FORECASTING  
/\*TECHNOLOGY ASSESSMENT  
**MINS:** / ENERGY TECHNOLOGY/ POLLUTION CONTROL/ RESOURCES  
MANAGEMENT/ SYNTHETIC FUELS  
**ABA:** GRA  
**ABS:** Molecular hydrogen has the long-range capability of being a fuel and an efficient 'energy carrier' (a medium for transporting chemical and/or electrical energy); however, hydrogen is not a primary energy source since it is dependent upon other energy sources for its actual production. In general these dependent energy sources are thermal energy, electrical energy, and radiant energy. Because of hydrogen's specific chemical and physical properties, its more immediate applications are for aviation fuels, industrial

chemical production, industrial and domestic heating, off-peak energy storage, electrical and thermal energy transmission, reduction of metal ores, and synthetic food production. Automotive applications employing hydrogen as a fuel are hindered by its poor volumetric energy storage density. The high cost of hydrogen (about \$2.14/GJ (1977 dollars US)) will prevent its use as standard fuel in the near future. Other synthetic fuels derived from advanced coal-gasification processes or fermentation of organic matter for the production of synthetic natural gas (SNG) or alcohols (Methanol and ethanol) presently appear more practical, and are receiving greater foreign and domestic funding. The greatest impact of hydrogen will be on the future international energy policy of the United States. By reducing a country's dependency on imported energy, hydrogen can greatly affect its military capability and socioeconomic stability. The pendulum is presently swinging towards hydrogen acceptance in industrialized countries dependent upon imported energy resources such as Japan, France, West Germany, and Italy. Significant hydrogen research programs presently exist in these Western countries.

78N29596# ISSUE 20 PAGE 2691 CATEGORY 44 RPT#:  
EPRI-EM-570 CNT#: EPRI PROJ. 919-1 77/10/00 157  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Assessment of fuel processing alternatives for fuel  
cell power generation TLSP: Final Report  
AUTH: A/CUSUMANO, J. A.; B/LEVY, R. B.  
CORP: Catalytica Associates, Inc., Palo Alto, Calif.  
AVAIL:NTIS SAP: HC AOB/MF A01  
MAJS: /ELECTRIC GENERATORS/ FUEL CELLS/ HYDROGEN FUELS  
MINS: / COMBUSTION PRODUCTS/ FEASIBILITY ANALYSIS/ METHANE  
ABA: ERA

ABS: The hydrogen fuel-cell power plant is expected to  
become a commercial reality in the near future. The  
fuel processor which converts hydrocarbon feedstocks  
to hydrogen is an integral part of this system.  
Fuel-cell power systems presently being developed are  
capable of utilizing methane through light naphthas  
for this purpose; however, a reasonable fuel-cell  
market will require the use of a number of fuels,  
ranging from synthesis gas to distillate oils. In this  
context, No. 2 fuel oil is of particular interest. The  
present study focuses on hydrogen production  
technologies for dispersed fuel-cell power stations,  
using a No. 2 fuel-oil feedstock. The primary  
objective is to provide a perspective for the  
feasibility of efficiently converting this feed to  
hydrogen in a fuel processor which is integrated with  
the dispersed power station. The approach involved a  
comprehensive review and analysis of existing,  
emerging, and conceptual hydrogen production  
technologies. Of the processes considered,  
high-temperature steam reforming (both fixed and  
fluidized catalytic beds) and autothermal reforming  
are the more promising fuel-processing alternatives.

78V13516 1977 ISS: 10 TP359.H8H9 V.2 0-8493-5122-7  
665.81

AUTH: A/Cox, Kenneth E.; B/Williamson, Kenneth D.  
UTTL: Hydrogen : TLSP: its technology and implications. v.  
2. Transmission and storage / editors: Kenneth E.  
Cox, K. D. Williamson, Jr. -  
CRC Press, Cleveland : 142 p. : ill. ; 26 cm.  
Includes bibliographical references and indexes.  
LC: Hydrogen as fuel.  
NASA: / CRYOGENIC FLUID STORAGE/ ENERGY SOURCES/  
ENERGY TECHNOLOGY/ FUELS/ HYDRIDES/ HYDROGEN  
PRODUCTION/ HYDROGEN-BASED ENERGY/ LIQUID HYDROGEN/  
METALS/ STORAGE TANKS  
HQ: / TP359.H8H9 V.2  
MAIN-TITL TRACE-AUTH\* CATLG BY-FACILITY  
77/12/12 COPYRIGHT AVAIL: / LANGLEY/ NASA HQ.

78N25938# ISSUE 16 PAGE 2188 CATEGORY 75 RPT#:  
EPRI-ER-581 CNT#: EPRI PROJ. 645 77/11/00 175  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Exploratory studies of high-efficiency advance fuel  
fusion reactors TLSP: Annual Report, Feb. 1977  
CORP: Illinois Univ., Urbana.; Brookhaven National Lab.,  
Upton, N. Y.; California Univ., Livermore, Lawrence  
Livermore Lab. CSS: (Fusion Studies Lab.)  
AVAIL:NTIS SAP: HC AOB/MF A01  
Prepared in cooperation with BNL and California Univ.,  
Lawrence Livermore Lab.  
MAJS: /DEUTERIUM/ FUSION REACTORS/ HYDROGEN FUELS  
MINS: / ENERGY CONVERSION/ NEUTRON FLUX DENSITY/ POWER  
PLANTS/ TOKAMAK DEVICES

ABA: ERA  
ABS: The potential advantages and feasibility of using  
deuterium and D-He-3 fusion fuels rather than D-T are  
examined. The present report describes the first part  
of the study which was concerned with the use of  
Tokamak reactors to burn such fuels on the expectation  
that, due to the emphasis on such systems in the  
national R and D program, they will form the basis for  
the first generation of fusion power plants.  
Parameters are presented for three classes of  
reactors: D-D plants designed for He-3 generations as  
well as electrical production; D-He-3 Tokamak that  
would serve as satellites to the generators by burning  
He-3 in smaller, relatively clean plants suitable for  
near-urban siting; and self-contained catalyzed-D  
Tokamaks that burn T and He-3 from D-D fusion in-situ  
The size scaling for these plants is, in descending

order, D-D generators, catalyzed-D plants, and D-He-3  
satellites. This flexibility in size and fuel allows a  
wide variation in characteristics that could well be  
vital to the full utilization of fusion power.

77V36172 1977 ISS: 00 TP359.H8G48 0-387814-53-1 665.81  
LC-77-14968

AUTH: A/Getoff, Nikola, A./1922-  
UTTL: Wasserstoff als Energieträger : TLSP: Herstellung,  
Lagerung und Transport / N. Getoff, mit Beiträgen von  
K. J. Hartig ... (et al.).  
Springer-Verlag, Wien : New York : xvi, 419 p. : ill.  
: 24 cm.  
Includes bibliographies and index.  
LC: Hydrogen as fuel.  
NASA: / CHEMICAL FUELS/ HYDROGEN FUELS  
MAIN-AUTH TRACE-TITL\* CATLG BY-LC  
/ / In GERMAN Publ In AUSTRIA COPYRIGHT AVAIL:  
/ LANGLEY

A79-45602      Fuel uses of hydrogen in the residential/commercial/industrial sectors. N. R. Baker (Institute of Gas Technology, Chicago, Ill.). In: Hydrogen for energy distribution; Proceedings of the Symposium, Chicago, Ill., July 24-28, 1978. (A79-45576 20-44) Chicago, Institute of Gas Technology, 1979, p. 569-582. 10 refs.

In this paper, hydrogen as a fuel is discussed and its technical merits are examined. In anticipation of the time when natural gas can no longer satisfy the consumptive demand, hydrogen has been suggested as the obvious replacement. In order for hydrogen to play a major role as a residential, commercial, or industrial fuel, the effect of its substitution for natural gas in conventional combustion devices must be examined. This paper discusses several of hydrogen's combustion properties, principally in comparison with those of methane. The effect of converting existing burners to hydrogen use is discussed regarding energy input, operation, and emissions. Two differing hydrogen combustion techniques are reviewed, and their relative advantages discussed. In general, recent developments in hydrogen combustion devices have shown that such burners can be both cleaner and more efficient than their hydrocarbon counterparts.

(Author)

## HYDROGEN HOMESTEAD

Richard Stepler

Popular Science

Vol. 212 no. 3      March 1978

p. 20, 25-26

The most abundant element can cook your  
food, heat your house, and fuel your car

## HYDROGEN ENERGY SYSTEM.

Proceedings of the 2nd World Hydrogen Energy Conference  
held in Zurich, Switzerland, 21-24, August 1978.

Edited By. N. Nejat Veziroglu and Walter Seifritz.  
Volume 1-5.

A79-33231 #      Hydrogen-electric power drives. F. F. Hall (Stanford University, Stanford, Calif.). In: Brazilian Conference on Energy, 1st, Rio de Janeiro, Brazil, December 12-14, 1978, Proceedings. Volume A. (A79-33212 13-44) Rio de Janeiro, Universidade Federal do Rio de Janeiro, 1979, p. 278-287.

The paper describes briefly the following components of hydrogen-electric power drives: chilled hydrogen gas tank, liquid oxygen tank, fuel cell bank, dc/ac converter, ac drive motors, solid-state ac speed control, dc sputter-ion vacuum pumps, steam turbine generator, and steam condenser. Uses for the process steam and warm condensate are discussed, and effects on public utilities and users are weighed.

P.T.H.

A79-45577 \*      Hydrogen in the U.S. energy picture. J. H. Kelley and R. Manvi (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: Hydrogen for energy distribution; Proceedings of the Symposium, Chicago, Ill., July 24-28, 1978. (A79-45576 20-44) Chicago, Institute of Gas Technology, 1979, p. 9-26. 10 refs.

A study of hydrogen in the U.S. program performed by the Hydrogen Energy Systems Technology (HEST) investigation is reported. Historic production and use of hydrogen, hydrogen use projections, hydrogen supply, economics of hydrogen production and supply, and future research and development needs are discussed. The study found current U.S. hydrogen utilization to be dominated by chemical and petroleum industries, and to represent 3% of total energy consumption. Hydrogen uses are projected to grow by a factor of 5 to 20 during the remainder of this century, and new applications in synthetic fuel from coal manufacture and directly as energy storage or fuel are expected to develop. The study concluded that development of new methods of supplying hydrogen replacing natural gas and petroleum feedstocks with alternate sources such as coal and heavy oils, and electrolysis techniques is imperative.

A.T.

## HYDROGEN IN THE SEAWARD ADVANCEMENT OF INDUSTRIAL SOCIETIES

J. A. Hanson

International Journal of Hydrogen Energy, vol. 3,  
no. 3, 1978, p. 347-353

ORIGINAL PAGE IS  
OF POOR QUALITY

79N22613\* ISSUE 13 PAGE 1737 CATEGORY 44 RPT#:  
NASA-CR-157962 TAC-H78-004 78/10/00 65 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Hydrogen energy. A bibliography with abstracts  
TLSP: Quarterly Update, Oct. - Dec. 1978  
CORP: New Mexico Univ., Albuquerque. CSS: (Technology  
Application Center.) AVAIL:NTIS SAI: HC A04 for  
foreign requestors only. Domestic orders, Univ. of New  
Mexico Tech. Application Center, Albuquerque  
Sponsored by NASA

MAJS: /\*ABSTRACTS\*/BIBLIOGRAPHIES/-ENERGY TECHNOLOGY/  
HYDROGEN FUELS

MINS: / HYDROGEN PRODUCTION/ INDEXES (DOCUMENTATION)/  
INFORMATION DISSEMINATION/ RESEARCH/ TECHNOLOGY  
TRANSFER/ UTILIZATION

ABA: G.Y.

ABS: Hydrogen Energy is a continuing bibliographic summary  
with abstracts of research and projections on the  
subject of hydrogen as a secondary fuel and as an  
energy carrier. This update to Hydrogen Energy cites  
additional references identified during the fourth  
quarter of 1978. It is the fourth in a 1978 quarterly  
series intended to provide current awareness to those  
interested in hydrogen energy. A series of cross  
indexes are included which track directly with those  
of the cumulative volume.

TL  
505  
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1978  
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Congress of the International Council of the  
Aeronautical Sciences, 11th, Lisboa, 1978.  
ICAS proceedings, 1978 : 11th Congress  
of the International Council of the Aero-  
nautical Sciences (ICAS), 10-16 September  
1978, Lisboa, Portugal / edited by I.

Drag Reduction by Cooling in Hydrogen Fueled  
Aircraft .....  
E. RESHOTKO

Includes index.

1. Aeronautics--Congresses. 2. Astro-  
nautics--Congresses. I. Singer, J.  
(Continued on card 2)

78V41668 1978 ISS: 00 TP359.H6w67 1978 0-080032-24-8  
665 81 LC-78-40507

AUTH: A/Veziroglu, T. Nejat.; B/Seifritz, Walter.

UTTL: Hydrogen energy system : TLSP: proceedings of the 2nd  
World Hydrogen Energy Conference, held in Zurich,  
Switzerland, 21-24 August 1978 / edited by T. Nejat  
Veziroglu, Walter Seifritz ; presented by International  
Association for Hydrogen Energy.  
2d. World Hydrogen Energy Conference, Zurich, 1978.  
Pergamon Press, Oxford : New York : 5 v. (xlvii, 2876  
p.) : ill. ; 26 cm.

Advances in hydrogen energy : 1 125.00 (\$250.00)  
Includes bibliographical references and indexes.

LC: Hydrogen as fuel -- Congresses. Hydrogen --  
Congresses.

ADDED: International Association for Hydrogen Energy.

NASA: / CONFERENCES/ ENERGY CONVERSION/ ENERGY SOURCES  
/ ENERGY TECHNOLOGY/ FUEL CELLS/ HYDROGEN FUELS/  
HYDROGEN PRODUCTION/ HYDROGEN-BASED ENERGY/  
THERMOCHEMISTRY

MAIN-MEET TRACE-SERS-CORP-TITL-AUTH- CATLG BY-LC  
/ / Pub In UNITED KINGDOM COPYRIGHT AVAIL: /  
LANGLEY/ NASA HQ.

78V32680 1978 ISS: 29 TJ163.2.M43 0-250-40221-1  
621.374

AUTH: A/Meador, Roy

JTTL: Future energy alternatives : TLSP: long-range energy  
prospects for America and the world / by Roy Meador. -  
Ann Arbor Science Publications, Ann Arbor, Mich. : ix,  
197 p. : ill. ; 22 cm.

Includes bibliographical references and index.

LC: Power resources. Solar energy. Atomic energy  
NASA: / COAL UTILIZATION/ ENERGY CONSERVATION/ ENERGY  
POLICY/ ENVIRONMENT EFFECTS/ FISSION/ GEOTHERMAL  
RESOURCES/ HYDROGEN FUELS/ NUCLEAR FUSION/ SOLAR  
ENERGY/ TIDEPWR

HQ: / TJ163.2.M43

MAIN-AUTH TRACE-TITL- CATLG BY-FACILITY  
78/05/03 COPYRIGHT AVAIL: / NASA HQ.

A STUDY OF THE EFFICIENCY OF HYDROGEN LIQUEFACTION.  
C. R. Baker and R. L. Shaner  
International Journal of Hydrogen Energy, vol. 3,  
no. 3, 1978, p. 321-334

78A18826 ISSUE 6 PAGE 1006 CATEGORY 44  
77/00/00 990 PAGES UNCLASSIFIED DOCUMENT

UTTL: International Workshop on Hydrogen and Its  
Perspectives. Liege, Belgium, November 15-18, 1976.  
Proceedings. Volumes 1 & 2 SAP: PRICE OF TWO  
VOLUMES, \$60

Workshop sponsored by the Association des Ingenieurs  
Electriciens sortis de l'Institut Electrotechnique  
Montefiore. Liege. Association des Ingenieurs  
Electriciens sortis de l'Institut Electrotechnique  
Montefiore. 1977. Vol. 1. 653 p.; vol. 2. 237 p. In  
French, English, and German. (For individual items see  
A78-18827 to A78-18858)

MAJS: /\*CONFERENCES/\*ENERGY TECHNOLOGY/\*HYDROGEN PRODUCTION  
/\*HYDROGEN-BASED ENERGY

MINS: / AIRCRAFT FUELS/ COAL GASIFICATION/ ELECTROLYSIS/  
ENERGY POLICY/ HYDROGEN FUELS/ TECHNOLOGY ASSESSMENT/  
THERMOCHEMISTRY/ TOXICOLOGY

ABA: J.M.B.

ABS: Coal gasification, partial oxidation, catalytic  
cracking, electrolysis and thermochemical cycle  
techniques for obtaining hydrogen fuels are reviewed,  
and the use of hydrogen for aircraft fuel, automobile  
propulsion systems and peak-load electrical generation  
is discussed. Topics of the papers include fixed bed,  
fluidized bed and entrained phase coal gasification  
procedures, materials problems in advanced  
electrolysis systems, solid polymer electrolyte water  
electrolysis cells, computer codes for analyzing the  
feasibility of thermochemical cycles that produce  
hydrogen, the use of photosynthetic processes for  
hydrogen generation, hydrogen fuel transport and  
storage systems (including those that use metal  
hydrides), a NASA study of the feasibility of adopting  
liquid hydrogen aircraft fuel, hydrogen as used in  
chemical processing, and the toxicological effects of  
hydrogen.

78V49577 1977 ISS: 49 QD1.S85 V.8 540.82

AUTH: A/Scott, Arthur Ferdinand, A/1898

UTTL: Survey of progress in chemistry. v. 8 / edited by  
Arthur F. Scott.

Academic Press, New York : xii, 284 p. : ill.

Includes bibliographies.

LC: Chemistry--Collected works.

NASA: / BIODEGRADATION/ CARBIDES/ CATALYSIS/ CHEMISTRY  
/ ENZYMES/ HYDROGEN PRODUCTION/ NITRIDES/ ORGANIC  
COMPOUNDS/ POLYMERS/ SURVEYS/ THERMOCHEMISTRY/  
TRANSITION METALS

LA: / QD1.S85 V.8

MAIN-TITL TRACE-AUTH\* CATLG BY-FACILITY

78/09/19 AVAIL: / LANGLEY

78V33238 1977 ISS: 29 QH510.E76 1977 0-904963-16-0  
574.191

UTTL: Proceedings / sponsors : Centre National de la  
Recherche Scientific (C.N.R.S.) ... et al. -  
France. Centre-National de la Recherche Scientifique.  
European Seminar on Biological Solar Energy Conversion  
Systems, Grenoble-Autrans, France, 1977.  
s.n. : s.l. : Available from UK-ISES, London, Ill.  
162 p. : 30 cm.  
Held May 9-12, 1977. \*Includes bibliographical  
references.

LC: Solar energy--Congresses.

Bioenergetics--Congresses. Photosynthesis--Congresses.  
NASA: / ALGAE/ BIOMASS ENERGY PRODUCTION/ CONFERENCES/  
ELECTRON TRANSFER/ ENERGY POLICY/ ENERGY TECHNOLOGY/  
HYDROGEN PRODUCTION/ ORGANIC WASTES (FUEL CONVERSION),  
PHOTOSYNTHESIS/ SOLAR ENERGY CONVERSION

LA: / QH510.E76 1977

MAIN-MEET TRACE-CORP\* CATLG BY-FACILITY

78/05/01 AVAIL: / LANGLEY

A78-38055 The hydrogen energy economy: A realistic  
appraisal of prospects and impacts. E. M. Dickson, J. W. Ryan  
(Stanford Research Institute, Menlo Park, Calif.), and M. H.  
Smulyan. Research supported by the National Science Foundation;  
NSF Grant No. ERS-73-02706. New York, Praeger Publishers, Inc.,  
1977. 327 p. 460 refs. \$22.95.

Major conclusions and recommendations considered are related  
to the use of hydrogen, the transition to hydrogen, the future of  
hydrogen, and recommendations for research and development. The  
concept of technology assessment is considered along with aspects of  
hydrogen production, the storage of hydrogen, the distribution of  
hydrogen, the end-uses of hydrogen, questions of hydrogen safety,  
energy end-use alternatives to hydrogen, hydrogen costs and eco-  
nomic relationships to other fuels, impacts of hydrogen-fueled  
private and fleet automotive vehicles, and the consequences of a  
hydrogen economy for commercial aviation, the utilities, steel-  
making, and ammonia synthesis. Attention is given to energy and  
hydrogen in the future, transition scenarios in the transition to a  
hydrogen economy, and energy carrier, distribution, and storage  
alternatives to hydrogen. G.R.

TP	<b>Dickson, Edward M.</b>	
360	The hydrogen energy economy : a	
.D5	realistic appraisal of prospects and	
	impacts / Edward M. Dickson, John W.	
	Ryan, Marilyn H. Smulyan. New York :	
	Praeger, 1977.	
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TECHNICAL PROSPECTS FOR COMMERCIAL AND RESIDENTIAL  
DISTRIBUTION AND UTILIZATION OF HYDROGEN  
J. Pangborn, M. Scott and J. Sharer  
Hydrogen Energy  
Vol. 2 no. 4 1977  
p.431-445

TP	<b>Dickson, Edward M.</b>	
360	The hydrogen energy economy : a	
.D5	realistic appraisal of prospects and	
	impacts / Edward M. Dickson, John W.	
	Ryan, Marilyn H. Smulyan. New York :	
	Praeger, 1977.	
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A79-34106 Alternative energy sources: Proceedings of the  
Miami International Conference, Miami Beach, Fla., December 5-7,  
1977. Volume 8 - Hydrogen energy. Conference sponsored by the  
U.S. Department of Energy and University of Miami. Edited by T. N.  
Veziroglu (Miami, University, Coral Gables, Fla.). Washington, D.C.,  
Hemisphere Publishing Corp., 1978. 516 p. Price of eleven volumes,  
\$495. (For individual items see A79-34107 to A79-34130)

Consideration is given to hydrogen production, storage, and  
utilization. Papers are presented on such topics as the chemistry of  
water splitting, the utilization of wind and solar energy to produce  
hydrogen, the hydrogen storage potential of various materials  
(including metal hydrides and ferrotitanium alloys), and hydrogen  
energy-nuclear heat systems.  
B.J.

TECH SECTION: THE HYDROGEN HOMESTEAD  
 Roger E. Billings, Ronald L. Woolley, Barrie C.  
 Campbell, Jack H. Ruckman and Vaughn R. Anderson  
 Hydrogen Progress  
 Fall Quarter 1977  
 p. 28-36

The Hydrogen Homestead demonstrates the use of hydrogen in a family home as a replacement fuel for natural gas, propane, and gasoline. Gas appliances and vehicles operate on clean-burning hydrogen. Hydrogen is shown to be complementary to solar and electric energy systems used in the home and provides for energy storage by means of a large metal hydride vessel. The home serves as a test facility for new prototypes and the interconnection of various systems as well as a demonstration of the role hydrogen can take in future home design because of unique properties and storability. As such, the homestead serves as a forerunner of a planned thirty-home development, utilizing hydrogen.

TP Dickson, Edward M.  
 J60 The hydrogen energy economy  
 .D5 ...1977. (Card 2)

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TP Dickson, Edward M.  
 J60 The hydrogen energy economy  
 .D5 ...1977. (Card 2)

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PART VI: TRANSITION TO A HYDROGEN ECONOMY

12	SYSTEMS DESCRIPTION	165
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**Hydrogen Use as a Fuel (A Bibliography with Abstracts).**  
 Audrey S. Hundemann.  
 National Technical Information Service, Springfield, Va. Jun  
 77, 138p  
 NTIS/PS-77/0522/1WE Price code: PC N01/MF N01

Federally-funded research studies pertaining to the technical feasibility of using hydrogen as a fuel for vehicular transportation, electric power generation, and both subsonic and supersonic aircraft are discussed. Excluded are studies on hydrogen production and storage. These topics are covered in other bibliographies. (This updated bibliography contains 133 abstracts, 50 of which are new entries to the previous edition.)

TP Dickson, Edward M.  
 J60 The hydrogen energy economy  
 .D5 ...1977. (Card 2)

PART I: MAJOR CONCLUSIONS  
 AND RECOMMENDATIONS John

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Transition to Hydrogen	4
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Differences Between the Past and the Future	21
The Possible Role of Hydrogen	23
Advantages of Hydrogen	23
The Need for a Technology Assessment	24
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HYDROGEN ENERGY BIBLIOGRAPHY  
 K. E. Cox and M. Natarajan  
 International Journal of Hydrogen Energy  
 Vol. 2, no. 3, 1977,  
 pp. 341-343.

General  
 Production  
 Utilization  
 Transmission, distribution, & storage  
 Materials

A78-53453 Hydrogen: Its technology and implications.  
 Volume 1 - Hydrogen production technology. Volume 2 - Transmission  
 and storage. Edited by K. E. Cox (New Mexico, University,  
 Albuquerque, N. Mex.) and K. D. Williamson (California, University,  
 Los Alamos, N. Mex.). Cleveland, Ohio, CRC Press, Inc., 1977. Vol.  
 1, 203 p.; vol. 2, 153 p. Price of vol. 1, \$49.95; vol. 2, \$41.50. (For  
 individual items see A78-53454 to A78-53462)

Questions of hydrogen production technology are examined,  
 taking into account aspects of water electrolysis, thermochemical  
 water decomposition, hydrogen from fossil fuels, hydrogen from  
 nuclear energy, and hydrogen from solar energy. Problems of  
 hydrogen transmission and storage are also investigated, giving  
 attention to the transmission of gaseous hydrogen, metal hydrides as  
 hydrogen storage media and their applications, questions of liquid  
 hydrogen storage and transmission, and materials for hydrogen  
 service. G.R.

TN Hydrogen damage : a discriminative selection  
 690.2 of outstanding articles and papers from the  
 .H93 scientific literature / with an introd. by  
 consulting editor Cedric D. Beachem. —  
 Metals Park, Ohio : American Society for  
 Metals, c1977.  
 xxiii, 398 p. : ill. ; 29 cm.  
 Includes bibliographical references and  
 index.  
 1. Alloys—Hydrogen content—Addresses,

HYDROGEN ENERGY BIBLIOGRAPHY.  
 K.E. Cox and M. Natarajan.  
 Internat. J. Hydrogen Energy, v.2, 1977, p.69-71.

General  
 Production  
 Utilization  
 Transmission, distribution, and storage  
 Materials

ORIGINAL PAGE IS  
OF POOR QUALITY

78A53453 ISSUE 24 PAGE 4317 CATEGORY 23  
77/00/00 356 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen: Its technology and implications. Volume 1 -  
Hydrogen production technology. Volume 2 -  
Transmission and storage --- Book  
AUTH: A/COX, K. E.; B/WILLIAMSON, K. D. PAA: A/(New  
Mexico, University, Albuquerque, N. Mex.);  
B/(California, University, Los Alamos, N. Mex.) PAT:

A/(ED.) SAP: PRICE OF VOL  
Cleveland, Ohio, CRC Press, Inc., 1977. Vol. 1, 203  
p.; vol. 2, 153 p. 1, \$49.95; vol. 2, \$41.50. (For  
individual items see A78-53454 to A78-53462)

MAJS: /\*ENERGY STORAGE/\*ENERGY TECHNOLOGY/\*HYDROGEN  
PRODUCTION/\*HYDROGEN-BASED ENERGY/\*MATERIALS HANDLING  
MINS: / DECOMPOSITION/ ELECTROLYSIS/ FOSSIL FUELS/ LIQUID  
HYDROGEN/ METAL HYDRIDES/ NUCLEAR ENERGY/ SOLAR ENERGY  
/ STORAGE/ THERMOCHEMISTRY/ WATER

ABA: G.R.

ABS: Questions of hydrogen production technology are  
examined, taking into account aspects of water  
electrolysis, thermochemical water decomposition,  
hydrogen from fossil fuels, hydrogen from nuclear  
energy, and hydrogen from solar energy. Problems of  
hydrogen transmission and storage are also  
investigated, giving attention to the transmission of  
gaseous hydrogen, metal hydrides as hydrogen storage  
media and their applications, questions of liquid  
hydrogen storage and transmission, and materials for  
hydrogen service.

77N21651\*# ISSUE 12 PAGE 1619 CATEGORY 44  
CNT#: NAS7-100 76/03/00 15 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: The NASA hydrogen energy systems technology study: A  
summary

AUTH: A/LAUMANN, E. A.  
CORP: Jet Propulsion Lab., California Inst. of Tech.,  
Pasadena. AVAIL:NTIS SAP: HC A99/MF A01  
In Miami Univ. First World Hydrogen Energy Conf.  
Proc., Vol. 3 15 p (SEE N77-21626 12-44)

MAJS: /\*ENERGY POLICY/\*ENERGY TECHNOLOGY/\*HYDROGEN-BASED  
ENERGY

MINS: / COAL LIQUEFACTION/ CRUDE OIL/ FOSSIL FUELS/  
INDUSTRIES/ NATURAL GAS/ PHYSICAL CHEMISTRY

ABA: Author

ABS: The results and conclusions of the study, which found  
a significant current usage of hydrogen, dominated by  
chemical-industry needs and supplied mostly from  
natural gas and petroleum feedstocks are discussed.  
These needs are expected to increase significantly in  
the remainder of this century and to largely outgrow  
the current means of supply. Several hydrogen  
production methods were evaluated. Those not dependent  
on fossil resources were found to be presently more  
costly and technically more difficult than  
fossil-feedstock-based technologies, but it is clear  
that they will eventually need to be implemented.

78A18848# ISSUE 6 PAGE 1007 CATEGORY 44  
77/00/00 20 PAGES In FRENCH UNCLASSIFIED DOCUMENT

UTTL: Outline for a hydrogen economy in 1985-2000  
AUTH: A/VALETTE, P.; B/VALETTE, L.; C/SIEBKER, M.;  
D/LECLERCQ, J. PAA: D/(S.C.I.E.N.C.E., Brussels,  
Belgium)

In: International Workshop on Hydrogen and its  
Perspectives, Liege, Belgium, November 15-18, 1976.  
Proceedings, Volume 2. (A78-18826 06-44) Liege,  
Association des Ingenieurs Electriciens sortis de  
l'Institut Electrotechnique Montefiore, 1977. 20 p. In  
French.

MAJS: /\*DELPHI METHOD (FORECASTING)/\*ECONOMIC ANALYSIS/\*  
ENERGY REQUIREMENTS/\*HYDROGEN PRODUCTION/\*  
HYDROGEN-BASED ENERGY/\*PREDICTION ANALYSIS TECHNIQUES  
MINS: / COMMERCIAL ENERGY/ ECOLOGY/ ENERGY BUDGETS/ ENERGY  
CONSUMPTION/ ENERGY OF FORMATION/ EXTRAPOLATION/  
MATHEMATICAL MODELS

ABA: M.L.

ABS: Three methods for predicting the market share of  
hydrogen-produced energy in the 1985-2000 period are  
described. The classical method extrapolates trends,  
the Delphi method is based on a consensus of  
predictions by experts and the semi-quantitative and  
quantitative methods seek to isolate factors and

assess their significance. The results of the three  
methods are compared and discussed.

78V14871 1976 ISS: 15 TP360.W927

AUTH: A/Veziroglu, T. Nejat. PAT: A/ed.

UTTL: Conference Proceedings, 1-3 March 1976; TLSP:  
presented by International Assn. for Hydrogen  
Energy/Clean Energy Research Institute, Univ. of  
Miami. Sponsored by : Energy Research and Development  
Administration/The School of Continuing Studies, Univ.  
of Miami/edited by T. Nejat Veziroglu,  
Miami, University of, Coral Gables, Fl., Energy  
Research and Development Administration, School of  
Continuing Studies. 1st. World Hydrogen Energy  
Conference, Miami Beach, Fl., 1976.  
Univ. of Miami; Coral Gables, Fl. : 3 v. : ill.  
Distributed by Pergamon Press. Includes  
bibliographical references.

LC: Hydrogen as fuel--Congresses. Power  
resources--Congresses. Hydrogen--Congresses.  
ADDED: Title: Hydrogen Energy Conference.

NASA: / CONFERENCES/ ENERGY POLICY/ ENERGY  
REQUIREMENTS/ ENVIRONMENTAL MONITORING/ HYDROGEN/  
HYDROGEN FUELS

MAIN-MEET TRACE-CORP\*AUTH\* CATLG BY-KENNEDY  
78/01/24 COPYRIGHT AVAIL: / KENNEDY

HON10374# ISSUE 1 PAGE 52 CATEGORY 28 RPT#:  
NASA-CASE-NPO-13849-1 NASA-CASE-NPO-13907-1  
US-PATENT-4.033.133 US-PATENT APPL-SN-666783  
US-PATENT-CLASS-60-606 US-PATENT-CLASS-23-288R  
US-PATENT-CLASS-48-61 US-PATENT-CLASS-48-102A  
US-PATENT-CLASS-48-10-3 US-PATENT-CLASS-48-107  
US-PATENT-CLASS-48-117 US-PATENT-CLASS-48-DIG.8  
US-PATENT-CLASS-60-300 US-PATENT-CLASS-123-3  
US-PATENT-CLASS-123-179R US-PATENT-CLASS-123-DIG.12  
US-PATENT-CLASS-423-650 77/07/05 13 PAGES  
UNCLASSIFIED DOCUMENT

Filed 22 Mar. 1976

UTTL: Start up system for hydrogen generator used with an  
internal combustion engine TLSP: Patent  
AUTH: A/HOUSEMAN, J.; B/CERINI, D. J. PAA: A/(JPL);  
B/(JPL) PAT: B/inventors (to NASA)  
CORP: National Aeronautics and Space Administration,  
Pasadena Office, Calif.; Jet Propulsion Lab.,

California Inst. of Tech., Pasadena. SAP: Avail: US  
Patent and Trademark Office  
Sponsored by NASA

MAJS: /\*CATALYSIS/\*HIGH TEMPERATURE GASES/\*HYDROGEN  
PRODUCTION/\*INTERNAL COMBUSTION ENGINES

MINS: / EXHAUST GASES/ FUEL-AIR RATIO/ HEAT EXCHANGERS/  
HYDROGEN FUELS/ PATENTS

ABA: Official Gazette of the U.S. Patent and Trademark  
Office

ABS: A hydrogen generator provides hydrogen rich product  
gases which are mixed with the fuel being supplied to  
an internal combustion engine for the purpose of  
enabling a very lean mixture of that fuel to be used,  
whereby nitrous oxides emitted by the engine are  
minimized. The hydrogen generator contains a catalyst  
which must be heated to a pre-determined temperature  
before it can react properly. To simplify the process  
of heating up the catalyst at start-up time, either  
some of the energy produced by the engine such as  
engine exhaust gas, or electrical energy produced by  
the engine, or the engine exhaust gas may be used to  
heat up air which is then used to heat the catalyst.

77N19577# ISSUE 10 PAGE 1335 CATEGORY 44  
RPT#: NASA-CR-149864 76/12/31 39 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Hydrogen Energy: A bibliography with abstracts.  
Fourth quarter 1976

CORP: New Mexico Univ., Albuquerque. SAP: Avail: Issuing  
Activity  
Sponsored by NASA

MAJS: /\*BIBLIOGRAPHIES/\*ENERGY POLICY/\*HYDROGEN-BASED ENERGY  
MINS: / ABSTRACTS/ ENERGY CONVERSION/ ENERGY TECHNOLOGY/  
RESEARCH AND DEVELOPMENT

ABA: U.S.

ABS: A bibliography for the 3rd qtr. 1976 is presented.  
Approximately 112 abstracts are listed. Subject and  
author indexes are included.

77N28600# ISSUE 19 PAGE 2553 CATEGORY 44 RPT#:  
BNL-50590 CNT#: EY-76-C-02-0016 76/01/00 79 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Hydrogen production and storage in utility systems  
TLSP: Semiannual Progress Report, Jul. - 21 Dec. 1975

AUTH: A/SALZANO, F. J.

CORP: Brookhaven National Lab., Upton, N. Y. AVAIL:NTIS  
SAP: HC A05/MF A01

MAJS: /\*ENERGY STORAGE/\*HYDROGEN PRODUCTION/\*UTILITIES  
MINS: / COSTS/ ELECTROLYSIS/ SPECIFICATIONS

ABA: ERA

ABS: A conceptual design of an electric storage system has  
been developed. Break-even cost data for introducing  
electric storage devices into the national energy  
system have been developed. Six materials were  
evaluated as substitutes for asbestos in the alkaline  
cell for use in 20 to 30 percent KGH at 150 to 160 C.  
Three of these look promising. Tests were conducted on  
the largest hydride test bed (84 lb granular FeTi) to  
determine the length of time various flow rates could  
be sustained. In the Hydrogen Technology Advanced  
Components Test System, design specifications and cost  
goals based on small-scale tests and analysis have  
been established for the storage components. Design  
specifications and cost goals have also been  
established for electrolyzer components. Several  
compositions of the TiFe/sub y/Mn/sub z/H/sub x type  
were investigated. These compositions show greatly  
reduced dissociation and association pressures which  
subsequently may reduce the electrolysis unit and

hydride storage vessel costs.

A78-18826 International Workshop on Hydrogen and its  
Perspectives, Liège, Belgium, November 15-18, 1976, Proceedings.  
Volumes 1 & 2 (Journées Internationales d'Etude sur l'Hydrogène et  
ses Perspectives, Liège, Belgium, November 15-18, 1976, Proceed-  
ings, Volumes 1 & 2). Workshop sponsored by the Association des  
Ingenieurs Electriciens sortis de l'Institut Electrotechnique Montefiore.  
Liège, Association des Ingenieurs Electriciens sortis de  
l'Institut Electrotechnique Montefiore, 1977. Vol. 1, 653 p.; vol. 2,  
237 p. In French, English, and German. Price of two volumes, \$60.  
(For individual items see A78-18827 to A78-18858)

Coal gasification, partial oxidation, catalytic cracking, electro-  
lysis and thermochemical cycle techniques for obtaining hydrogen  
fuels are reviewed, and the use of hydrogen for aircraft fuel,  
automobile propulsion systems and peak-load electrical generation is  
discussed. Topics of the papers include fixed bed, fluidized bed and  
entrained phase coal gasification procedures, materials problems in  
advanced electrolysis systems, solid polymer electrolyte water  
electrolysis cells, computer codes for analyzing the feasibility of  
thermochemical cycles that produce hydrogen, the use of photo-  
synthetic processes for hydrogen-generation, hydrogen fuel transport  
and storage systems (including those that use metal hydrides), a  
NASA study of the feasibility of adopting liquid hydrogen aircraft  
fuel, hydrogen as used in chemical processing, and the toxicological  
effects of hydrogen.

J.M.B.

Hydrogen - Utilization

1976

TP World Hydrogen Energy Conference, 1st, Miami  
360 Beach, 1976.  
.W67 Conference proceedings: 1st World Hydro-  
1976 gen Energy Conference, 1-3 March 1976, Miami  
V.3 Beach, Florida; presented by International  
Association for Hydrogen Energy, Clean

HYDROGEN USE PROJECTIONS AND SUPPLY OPTIONS  
R. Manvi, T. Fujita, Jet Propulsion Laboratory,  
Pasadena, California U.S.A.

ECONOMICS OF NUCLEAR - ELECTROLYTIC HYDROGEN  
S. Kakac, T.N. Veziroglu, Middle East Technical  
University, Ankara, Turkey

HYDROGEN IN THE ENERGY SYSTEM OF THE NETHERLANDS  
A.J. Bogers, W. van Deelen, Special Studies Group  
Apeldoorn, The Netherlands

U.S. OPTIONS FOR A TRANSITION FROM OIL AND GAS TO  
SYNTHETIC FUELS  
A.S. Marne, Harvard University, Cambridge,  
Massachusetts U.S.A.

A SIMPLIFIED EQUILIBRIUM MODEL OF THE U.S. ENERGY  
ECONOMIC SYSTEM AND ITS USE IN COMPARING  
ALTERNATIVES  
H.J. Plass, Jr., Department of Mechanical  
Engineering, University of Miami, Coral Gables,  
Florida U.S.A.

78N70413# CATEGORY 28 RPT#: AD-A045281  
DIA-DST-1850-S-522-76 76/05/00 143 PAGES  
UNCLASSIFIED DOCUMENT  
UTTL: Hydrogen technology-foreign  
AUTH: A/BUSI, J. D.  
CORP: Army Foreign Science and Technology Center,  
Charlottesville, Va. AVAIL NTIS  
MAJS: /HYDROGEN/HYDROGEN FUELS/HYDROGEN-BASED ENERGY  
MINS: /ENERGY CONVERSION/ TECHNOLOGICAL FORECASTING/  
TECHNOLOGY ASSESSMENT

77N21647# ISSUE 12 PAGE 161B CATEGORY 44  
76/03/00 15 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Reciprocating pump for conversion of liquid hydrogen  
to high pressure gaseous hydrogen  
AUTH: A/MESEROLE, J. S., JR.; B/DEBOER, P. C. T.  
CORP: Cornell Univ., Ithaca, N. Y. CSS: (Sibley School of  
Mechanical and Aerospace Engineering.) AVAIL NTIS  
SAP: HC A95/MF A01  
In Miami Univ. First World Hydrogen Energy Conf  
Proc., Vol. 3 15 p (SEE N77-21626 12-44) Sponsored in  
part by DOT and NSF  
MAJS: /ENERGY CONVERSION/ENERGY POLICY/HYDROGEN-BASED  
ENERGY/INTERNAL CONVERSION/LIQUID HYDROGEN/  
ENGINES  
MINS: /DESIGN ANALYSIS/ QUALITY CONTROL/ SYSTEMS  
ENGINEERING/ THERMODYNAMICS  
ABA: Author  
ABS: The design, construction and testing of a  
reciprocating device are presented. The device uses  
two pistons of different diameter on a common shaft.  
The small piston compresses the liquid hydrogen, which  
is then gasified by passing it through a heat

exchanger. Part of the resulting mechanical work is  
used to drive the larger piston. The hydrogen flow is  
governed by a suitable valving arrangement, controlled  
by magnetic position sensors together with an  
electronic logic network. A brief thermodynamic  
analysis is presented of the expander cycle on which  
the device is based. The prototype built was tested  
with liquid nitrogen. Various sealing and design  
considerations are discussed, as are possibilities for  
future improvements. The device has potential  
application for relatively small scale uses of high  
pressure hydrogen, such as in vehicles incorporating  
direct cylinder injection.

76V19580 1976 ISS: 19 Z7914.FBU62 662.6  
UTTL: Hydrogen fuels : TLSP: a bibliography. -  
United States. Energy Research and Development  
Administration.  
National Technical Information Service, U. S.  
Department of Commerce, Springfield, Va., iv, 479 p.  
: 28 cm. -  
ERDA TID -3358  
LC: Hydrogen fuel--Bibliographies.  
Fuels--Bibliographies.  
ADDED: U. S. Energy Research and Development  
Administration; TID-3358.  
NASA: /BIOSYNTHESIS/ CHEMISORPTION/ COAL GASIFICATION  
/ CRYOGENIC STORAGE/ ELECTROLYSIS/ HYDROGEN FUELS/  
MARKETING/ THERMOCHEMISTRY  
JPL: / Z7914.FBU59  
MAIN-CORP TRACE-TITLE CATLG BY-FACILITY  
76/04/19 AVAIL: / JPL/ NASA HQ.

TP 360  
.W67  
1976  
V.3

World Hydrogen Energy Conference, 1st, Miami Beach, 1976.  
Conference proceedings: 1st World Hydrogen Energy Conference, 1-3 March 1976, Miami Beach, Florida; presented by International Association for Hydrogen Energy, Clean Energy Research Institute, University of Miami / sponsored by: Energy Research and Development Administration, the School of Continuing Studies, University of Miami edited by T. Nejat Veriroğlu. --  
(Continued on card 2)

A NEW LOOK AT HYDROGEN IN ENERGY SYSTEMS\*\*  
K.H. Weil, Stevens Institute of Technology, Hoboken, New Jersey U.S.A.

HYDROGEN ENERGY - ITS POTENTIAL PROMISES AND PROBLEMS  
G.D. Sauter, Lawrence Livermore Laboratory, Livermore, California U.S.A.

ANALYSIS OF A DELPHI STUDY ON HYDROGEN  
P. Valette, L. Valette, M. Siebker, S.C.I.E.N.C. Brussels, Belgium

ERDA's HYDROGEN PROGRAMS  
A. Landgrebe, Energy Research and Development Administration, Washington, D.C. U.S.A.

THE ECONOMIC IMPLICATIONS OF THE CANHO H<sub>2</sub>/O<sub>2</sub> MHD ENERGY STORAGE SYSTEM EMPLOYING HYDROGEN AS THE RE-CYCLED ENERGY CARRIER FOR DEDICATED USE WITHIN AN ELECTRIC POWER PLANT\*  
S.J. Townsend, SJT Consultants Limited, Thornhill Ontario, Canada

LIQUID FUEL AND FERTILIZER USING NUCLEAR POWER, AIR AND WATER\*  
M. Steinberg, Brookhaven National Laboratory, Department of Applied Science, Upton, New York U.S.A.

COMMODITY HYDROGEN FROM OFF-PEAK ELECTRICITY  
K. Darrow, N. Biederman, A. Konopka, Institute of Gas Technology, Chicago, Illinois U.S.A.

PERSPECTIVES ON THE EVOLUTION INTO A HYDROGEN ECONOMY  
L.W. Jones, University of Michigan, Ann Arbor, Michigan U.S.A.

WORLD ENERGY PRODUCTION\*  
J.C. Denton, National Center for Energy Management and Power, University of Pennsylvania, Philadelphia, Pennsylvania U.S.A.

TOWARDS A DECENTRALISED HYDROGEN ECONOMY\*  
P.A. Sermon, School of Chemistry, Brunel University, Uxbridge, England

TECHNOLOGY IMPACT ASSESSMENT OF THE HYDROGEN ECONOMY CONCEPT - KEY FINDINGS  
E.M. Dickson, Stanford Research Institute, Menlo Park, California U.S.A.

THE ENVIRONMENTAL IMPLICATIONS OF BUILDING AND OPERATING LARGE-SCALE HYDROGEN PRODUCTION-STORAGE FACILITIES\*

D. Myrha, Westinghouse Electric Corporation, Pittsburgh, Pennsylvania U.S.A.

POSSIBLE POLLUTION AND COST ANALYSIS FROM WIDE USE OF HYDROGEN FUEL IN TRANSPORTATION

S.P. Chakravarty, K.S. Varde, University of Michigan, Dearborn, Michigan U.S.A.

OPERATION COUGH DROP

R.M. Zweig, M.D., PCRI, Riverside, California U.S.A.

SELF-LIMITING EXPLOSIVE PROPERTIES OF LIQUID HYDROGEN AND OXYGEN\*\*

W.H. Boggs, NASA Kennedy Space Center, Cape Canaveral, Florida U.S.A.

THE NASA HYDROGEN ENERGY SYSTEMS TECHNOLOGY STUDY SUMMARY

E.A. Laumann, Jet Propulsion Laboratory, Pasadena California U.S.A.

77V13414 1976 ISS: 50 TP360.M37 338.47: 665.81 LC-76-17938

AUTH: A/Mathis, David A.

UTTL: Hydrogen technology for energy.

Noyes Data Corp., Park Ridge, N. J. xi, 285 p. ill, 24 cm.

Energy technology review, no. 9. \$32.00 Bibliography p. 283-285

LC: Hydrogen as fuel. Power resources. Fuel.

NASA: / BIBLIOGRAPHIES/ CLEAN ENERGY/ FUELS/ HYDRIDES/ HYDROGEN/ HYDROGEN FUELS/ LIQUID HYDROGEN/ SOLAR ENERGY

AM-ATL: / TP360.M37 JPL: / TP245.H9M431

MAIN-AUTH TRACE-SERS\*TITL\* CATLG BY-FACILITY

76/12/07 COPYRIGHT AVAIL: / AMES-ATL/ JOHNSON/ JPL/

LANGLEY/ LEWIS

TP  
343  
.S88  
1976

Symposium on Future Automotive Fuels--Prospects, Performance, and Perspective, General Motors Research Laboratories, 1976.

Future automotive fuels : prospects, performance, perspective : [proceedings of the Symposium on Future Automotive Fuels--Prospects, Performance, and Perspective, held at the General Motors Research Laboratories, Warren, Michigan, card 2]

Attention is given to the future demand for automotive fuels, the U.S. energy outlook through 1990, aspects of energy conservation and fuel-vehicle optimization, and opportunity for maximizing transportation energy conservation, the matching of future automotive fuels and engines for optimum energy efficiency, coal as a source of automotive fuels, motor fuels from oil shale, and the influence of nuclear energy on transportation fuels. The automotive utilization of intermediate-term future fuels is discussed, taking into account the characteristics of conventional fuels from nonpetroleum sources, the application of a new combustion analysis method in the study of alternate fuel combustion and emission characteristics, engine performance and exhaust emission characteristics of a methanol-fueled automobile, the combustion of methanol in an automotive gas turbine, and alternative fuels for automotive diesel engines. Hydrogen as a reciprocating engine fuel is considered in connection with an evaluation of long-term future fuels. The use of hydronitrogens, such as hydrazine and ammonia, as future automotive fuels is also discussed. G.R.

77A49107 ISSUE 23 PAGE 4017 CATEGORY 44 CNT#: NSF AER-75-00647 76/00/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: An assessment of hydrogen as a means to store solar energy

AUTH: A/RAMAKUMAR, R. PAA: A/(Oklahoma State University, Stillwater, Okla.)

In: Sharing the sun: Solar technology in the seventies: Proceedings of the Joint Conference, Winnipeg, Canada, August 15-20, 1976. Volume B. (A77-48910 23-44) Cape Canaveral, Fla., International Solar Energy Society, 1976, p. 163-175. ERDA-supported research

MAJS: /\*COST EFFECTIVENESS/ ENERGY CONVERSION EFFICIENCY/ ENERGY STORAGE/ HYDROGEN PRODUCTION/ SOLAR ENERGY CONVERSION/ TECHNOLOGY ASSESSMENT

MINS: / ECONOMIC ANALYSIS/ ELECTROLYSIS/ ENERGY TECHNOLOGY/ HYDROGEN-BASED ENERGY/ SYSTEM EFFECTIVENESS

ABA: (Author)

ABS: A brief review and assessment of the use of hydrogen as a means to store solar energy is presented. Electrolytic and non-electrolytic methods proposed for hydrogen production from solar energy, hydrogen storage methods and utilization techniques are surveyed. Overall system concepts with several manifestations of solar energy as inputs are discussed along with their efficiencies and economic aspects.

77A33413# ISSUE 14 PAGE 2375 CATEGORY 44  
CNT#: NAS7-100 76/00/00 15 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: The NASA Hydrogen Energy Systems Technology study - A  
summary

AUTH: A/LAUMANN, E. A. PAA: A/(California Institute of  
Technology, Jet Propulsion Laboratory, Pasadena,  
Calif.)

CORP: Jet Propulsion Lab., California Inst. of Tech.,  
Pasadena.  
In: World Hydrogen Energy Conference, 1st, Miami  
Beach, Fla., March 1-3, 1976, Proceedings, Volume 3,  
(A77-33326 14-44) Coral Gables, Fla., University of  
Miami: New York, Pergamon Press, 1976, p. 1C-45 to  
1C-59.

MAJS: /ENERGY TECHNOLOGY/HYDROGEN-BASED ENERGY/NASA  
PROGRAMS/TECHNOLOGY ASSESSMENT

MINS: / COAL GASIFICATION/ COAL LIQUEFACTION/ ENERGY STORAGE  
/ HYDROGEN

ABA: M.L.

ABS: This study is concerned with: hydrogen use,  
alternatives and comparisons, hydrogen production,  
factors affecting application, and technology  
requirements. Two scenarios for future use are  
explained. One is called the reference hydrogen use  
scenario and assumes continued historic uses of  
hydrogen along with additional use for coal  
gasification and liquefaction, consistent with the  
Ford technical fix baseline (1974) projection. The  
expanded scenario relies on the nuclear electric  
economy (1973) energy projection and assumes the  
addition of limited new uses such as experimental  
hydrogen-fueled aircraft, some mixing with natural  
gas, and energy storage by utilities. Current uses and  
supply of hydrogen are described, and the  
technological requirements for developing new methods  
of hydrogen production are discussed.

TA Institute of Environmental Sciences.  
1 Technical division proceedings including  
.I39813 career guidance forum notes. Mt. Prospect,  
1975 Ill., IES [1975]  
v.1 xx, 184 p. illus. 28 cm.  
"21st annual im,  
Calif., April:   
Vol. 2 of 2 3 1176 00044 7186  
Energy and the

HYDROGEN ENERGY AND THE ENVIRONMENT ties,  
By W. Hausz . . . P. 134 . . . rd 2)  
3 14 14 12 9-75

*W. Hausz*

TP  
360  
.W67  
1976  
V.3

World Hydrogen Energy Conference, 1st, Miami  
Beach, 1976.

Conference proceedings: 1st World Hydro-  
gen Energy Conference, 1-3 March 1976, Miami  
Beach, Florida; presented by International  
Association for Hydrogen Energy, Clean  
Energy Research Institute, University of  
Miami / sponsored by: Energy Research and  
Development Administration, the School of

TECHNICAL PROSPECTS FOR COMMERCIAL AND RESIDENTIAL  
DISTRIBUTION AND UTILIZATION OF HYDROGEN  
J. Pangborn, M. Scott, J. Sharer, Institute of  
Gas Technology, Chicago, Illinois U.S.A.

A CLOSED BRAYTON CYCLE USING HYDROGEN AS A WORK  
FLUID\*

F.J. Salzano, J.R. Powell, W.S. Yu, J. Milau,  
Brookhaven National Laboratory, Department of  
Applied Science, Upton, New York U.S.A.

75V38411 1975 ISS: 00 OC100.U57 NO. 419 1975 389.08 S  
LC-75-8798 TP360: SOD C 13.10:419

AUTH: A/Parrish, W. R.

UTTL: Selected topics on hydrogen fuel / W. R. Parrish ...  
(et al.), Institute for Basic Standards, National  
Bureau of Standards, Boulder, Colo. ; J. Hord, editor.  
U.S. Dept. of Commerce, National Bureau of Standards :  
for sale by the Supt. of Docs., U.S. Govt. Print.  
Off., Washington : 212 p. In various pagings : ill. :  
26 cm.

National Bureau of Standards Special publication : 419  
Includes bibliographies.

LC: Hydrogen as fuel.

ADDED: United States. Institute for Basic Standards.  
United States. National Bureau of Standards. Special  
publication : 419.

NASA: / AUTOMOBILE FUELS/ BIBLIOGRAPHIES/ COSTS/  
CRYOGENICS/ HYDROGEN FUELS/ MATERIALS/ PRODUCTION/  
SOLAR ENERGY

LE: / OC100.U57 NO.419 1975

MAIN-AUTH TRACE-SERS-CORP-AUTH\* CATLG BY-LC

/ / AVAIL: / LEWIS

75V46705 1975 ISS: 00 QC100.U5753 NO. 664 389.60B S;  
016.66581 LC-75-600002 TP360  
AUTH: A/Olien, N. A.; B/Schiffmacher, S. A.; PAT: B/Joint  
author.  
UTTL: Hydrogen-future fuel : TLSP: a bibliography (with  
emphasis on cryogenic technology) / N. A. Olien, S. A.  
Schiffmacher.  
U.S. Dept. of Commerce, National Bureau of Standards :  
for sale by the Supt. of Docs., U.S. Govt. Print.  
Off., Washington : viii, 122 p. : 27 cm.  
\$1.95 NBS technical note : 664 Includes index.  
LC: Hydrogen as fuel -- Bibliography.  
ADDED: United States. National Bureau of Standards.  
Technical note : 664.  
MAIN-AUTH TRACE-SERS-CORP-TITL-AUTH\* CATLG BY-LC  
/ /

TP  
360  
.I57  
Introduction to hydrogen energy / edited by  
T. Nejat Veziroglu. -- Coral Gables, Fla. :  
International Association for Hydrogen  
Energy, c1975.  
v, 175 p. : ill.  
Includes bibliographies.  
1. Hydrogen as fuel--Addresses, essays,  
lectures. 2. Synthetic fuels--Addresses,  
essays, lectures. I. Veziroglu, T. Nejat,  
ed. II. Title: Hydrogen energy.

78V27411 1975 ISS: 00 QC100.U57 NO. 419. 1975 389.08 S  
LC-75-8798 TP360: SOD C 13.10:419  
AUTH: A/Parrish, W. R.  
UTTL: Selected topics on hydrogen fuel / W. R. Parrish ...  
(et al.) ; J. Hord, editor.  
U.S. Dept. of Commerce, National Bureau of Standards :  
for sale by the Supt. of Docs., U.S. Govt. Print.  
Off., Washington : 212 p. In various pagings : ill. :  
26 cm.  
National Bureau of Standards Special publication : 419  
Includes bibliographical references.  
LC: Hydrogen as fuel.  
ADDED: United States. National Bureau of Standards.  
Special publication : 419.  
MAIN-AUTH TRACE-SERS-CORP-AUTH\* CATLG BY-LC  
/ /

77V13411 1975 ISS: 50 TP360.I57 338.47  
AUTH: A/Veziroglu, T. Nejat. PAT: A/ed.  
UTTL: Introduction to hydrogen energy / Hydrogen energy,  
edited by T. Nejat Veziroglu.  
International Association for Hydrogen Energy, Coral  
Gables, Fla. v, 175 p. : ill.  
Includes bibliographies.  
LC: Hydrogen as fuel--Addresses, essays, lectures.  
Synthetic fuels--Addresses, essays, lectures.  
ADDED: Title: Hydrogen energy.  
NASA: / CLEAN ENERGY/ HYDROGEN/ HYDROGEN FUELS/  
SYNTHETIC FUELS  
AM-ATL: / TP360.V4 JPL: / TP245.H9V597  
MAIN-TITL TRACE-TITL-AUTH\* CATLG BY-FACILITY  
76/12/07 COPYRIGHT AVAIL: / AMES-ATL/ FLIGHT/ JPL/  
LANGLEY/ LEWIS

77V14151 1975 ISS: 51 TP360.U5B  
AUTH: A/Veziroglu, T., Nejat.; B/Ohta, Tokio PAT:  
A/Coordinator; B/Coordinator  
UTTL: Key technologies for the hydrogen energy system: TLSP:  
seminar proceedings.  
U. S. National Science Foundation. #Nippon Gakujutsu  
Shinkohai. U. S.-Japan Joint Seminar, Tokyo, 1975.  
Yokohama National University, Yokohama, Japan, 328 p.  
illus.  
Sponsored by National Science Foundation, U. S. A.,  
and Japan Society for Promotion of Science, Japan.  
LC: Hydrogen as fuel--Congresses.  
NASA: / AUXILIARY POWER SOURCES/ CONFERENCES/ HYDROGEN  
FUELS  
AM-ATL: / TP360.K4 1975  
MAIN-MEET TRACE-CORP-TITL-AUTH\* CATLG BY-JOHNSON  
76/12/14 AVAIL: / AMES-ATL/ JOHNSON

Z  
5P53  
.P83  
W53  
RR  
Wind energy bibliography. Mukwonago,  
Wisconsin, Windworks, 1974.  
1 v. (unpaged) 23 cm.  
Cover title.  
1. Power resources--Bibliography.  
2. Wind power--Bibliography. I.  
Windworks (Firm)

8 HYDROGEN  
Production  
Storage  
Use  
General

75V13229 1972 ISS: 00 TP360.H92 665.77 LC-73-601970  
UTTL: Hydrogen and other synthetic fuels; TLSP: a summary of  
the work of the Synthetic Fuels Panel.  
Atomic Energy Commission); for sale by the Supt. of  
Docs., U.S. Govt. Print. Off., (Washington, 131 p.  
illus. 2R cm.  
"TID-26136"; "UC-80." Prepared for the Federal Council  
for Science and Technology's Committee on Energy  
Research and Development (R&D) Goals, under the  
cognizance of the U.S. Atomic Energy Commission,  
Division of Reactor Development and Technology.  
LC: Synthetic fuels. Hydrogen as fuel.  
ADDED: Synthetic Fuels Panel. United States. Federal  
Council for Science and Technology. Committee on  
Energy Research and Development (R&D) Goals. Atomic  
Energy Commission. Division of Reactor Development and  
Technology. United States. Atomic Energy Commission.  
Division of Reactor Development and Technology.  
MAIN-TITL TRACE-CORP\* CATLG BY-LC  
/ /

SP-4404 Hydrogen

Liquid Hydrogen as a Propulsion Fuel, 1945-1959

When the Soviet Union launched the first satellite in 1957,  
the United States was woefully behind in launch vehicle  
capability. Technical decisions taken in 1958 and 1959 to  
use liquid hydrogen in the upper stages of the Centaur and  
Saturn launch vehicles led to the dramatic successes of the  
nation's manned space flight program. Nevertheless, the  
decision to liquefy and use the highly hazardous fuel  
associated with the Hindenburg disaster of 1937 was par-  
ticularly bold in light of the serious reservations of  
many experienced engineers. Hydrogen had been considered  
in astronautics and aeronautics several times before but  
in each case had been abandoned in the face of seemingly  
formidable problems. In this case, the decision by NASA  
turned out to be the correct one. This book tells the  
story of the confidence within the young space agency

77N70488 CATEGORY 98 RPT#: M72-189 72/11/00 120  
PAGES UNCLASSIFIED DOCUMENT  
UTTL: Technical design and economic viability of large-scale  
solar-cell/hydrogen-fuel energy systems: A research  
proposal  
AUTH: A/GREELEY, R. S.  
CORP: Mitre Corp., McLean, Va.  
Sponsored by NSF  
MAJS: /\*ENERGY REQUIREMENTS/\*HYDROGEN FUELS/\*SOLAR CELLS  
MINS: / ECONOMIC ANALYSIS/ RESEARCH MANAGEMENT/ SOLAR ENERGY  
CONVERSION/ SYSTEMS ANALYSIS

78N76322# CATEGORY 28 RPT#: IRT-7020-001 CNT#: 1  
EY-76-C-03-0936-047 76/07/00 68 PAGES  
UNCLASSIFIED DOCUMENT  
UTTL: Radiolytic production of hydrogen using laser fusion  
TLSP: Final Report  
AUTH: A/VAGELATOS, N.: B/LURIE, N. A.: C/VROOM, D. A.:  
D/HOUSTON, D. H.: E/BAIRD, R. D.: F/ROGERS, V. C.  
CORP: IRT Corp., San Diego, Calif. AVAIL. NTIS  
MAJS: /\*HYDROGEN PRODUCTION/\*LASER FUSION/\*RADIOLYSIS  
MINS: / COST ANALYSIS/ FUSION REACTORS/ POWER REACTORS

## HYDROGEN - STORAGE

### PHYSICAL, CHEMICAL AND ENERGY ASPECTS OF UNDERGROUND HYDROGEN STORAGE. P. O. Carden and L. Paterson.

International Journal of Hydrogen Energy, vol 4, no 6, 1979, p. 559-569.

**Abstract**—Large scale energy storage is becoming an important consideration as we turn more towards nuclear power and the utilization of renewable sources such as solar energy. Underground storage of hydrogen in aquifers has been suggested as an inexpensive method of providing the required energy storage. With this theme in mind, the losses associated with gas storage in aquifers are discussed. These losses include physical leakage of gas, loss of gas through underground chemical reactions and the energy requirements associated with storing and recovering the gas.

Although underground storage of hydrogen appears a most promising solution to the problem of large scale energy storage it is shown that much work remains to be done to confirm this. For example, better estimates of hydrogen diffusion through water saturated porous media are required.

### SOLAR ENERGY STORAGE AS HYDROGEN AND BROMINE FROM HYDROGEN BROMIDE.

Edward A. Fletcher.

Energy, vol 4, no 1, February 1979, p. 61-66.

**Abstract**—The use of hydrogen bromide as the working fluid for a one-step thermochemical solar energy storage device is considered. When dissociation of  $Br_2$  into Br at moderately high temperatures is taken into account, the system becomes one in which high-temperature separation of hydrogen from bromine in one step appears attractive.

A79-37877

Energy storage using metallic hydrides. H. C. Angus (MPD Technology, Ltd., Birmingham, England). In: International Conference on Future Energy Concepts, London, England, January 30-February 1, 1979, Proceedings. (A79-37842 15-44) London, Institution of Electrical Engineers, 1979, p. 199-206. 9 refs.

A brief survey is presented of the role of rechargeable metallic hydrides in future energy concepts, with emphasis on hydrogen storage and heat pumping. New alloys are described which have unique properties particularly suited to a variety of systems under development. Particular consideration is given to the properties of Mg-based systems, FeTi, LaNi5, and NiTi.

B.J.

79N30413# ISSUE 21 PAGE 279B CATEGORY 28 RPT#  
NTIS/PS-79/0581 79/06/00 135 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Hydrogen storage, part 1. Storage as a gas or liquid  
A bibliography with abstracts TLSP: Progress Report  
1974 - May 1979

AUTH: A/CAVAGNARO, D. M.

CORP: National Technical Information Service, Springfield,  
Va. AVAIL:NTIS SAP: HC \$28.00/MF \$28.00

MAJS: /\*BIBLIOGRAPHIES/\*CRYOGENIC FLUID STORAGE/\*FUEL TANKS  
/\*HYDROGEN FUELS/\*LIQUID HYDROGEN/\*STORAGE TANKS

MINS: / ABSTRACTS/ AUTOMOBILE FUELS/ ECONOMICS/  
ELECTROCHEMISTRY/ ENVIRONMENT EFFECTS

ABA: GRA

ABS: This bibliography references aspects of storing hydrogen fuels as a liquid or gas. Topics covered include fuel storage, energy storage, and the construction of storage tanks. Batteries, fuel cells and solar cells, if related to hydrogen storage, are also mentioned.

79N26224# ISSUE 17 PAGE 2245 CATEGORY 28 RPT#:  
AD-A067709 AFAPL-TR-79-2014 79/02/00 24 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Fuel hydrogen content as an indicator of radiative heat transfer in an aircraft gas turbine combustor  
TLSP: Final Report, Jun. - Nov. 1976  
AUTH: A/JACKSON, I. A.; B/BLAZOWSKI, W. S.  
CORP: Air Force Aero Propulsion Lab., Wright-Patterson AFB, Oh. O. AVAIL.NTIS SAP: HC A02/MF A01  
Presented at the Am. Soc. of Mech. Engr. Winter Ann. Meeting, Atlanta, 27 Nov. - 2 Dec. 1977  
MAJS: /-COMBUSTION CHAMBERS/-GAS TURBINES/-HYDROGEN FUELS/-JET ENGINE FUELS/-SYNTHETIC FUELS  
MINS: / AIRCRAFT ENGINES/ CHEMICAL COMPOSITION/ COMBUSTION PRODUCTS/ HYDROCARBONS/ RADIATIVE HEAT TRANSFER  
ABA: Author (GRA)  
ABS: Eleven fuels representing a wide range of hydrogen content were studied using a T56 single can combustor rig. Test fuels included single and double ring aromatic types as well as paraffins blended with each other and with JP-4. Fuel mixtures with hydrogen contents ranging from 9.9 to 15.9 per cent by weight were examined. The combustor inlet conditions simulated the discharge from both low and high pressure ratio gas turbine compressors operating at the cruise condition. Thermocouple data from the T56 liner are correlated with fuel hydrogen content using a new, nondimensional combustor liner temperature parameter. Least-squares mathematical treatment of the data resulted in an excellent second order correlation between the nondimensional temperature parameter and fuel hydrogen content and a simplified radiation analysis is presented which also explains the resulting empirical trends.

A THERMODYNAMIC ANALYSIS OF HYCSOS, A HYDROGEN CONVERSION AND STORAGE SYSTEM, by Dieter M. Gruen, Felix Schreiner and Irving Sheft

International Journal of Hydrogen Energy, vol. 3, no. 3, 1978, p. 303-310

80N10402# ISSUE 1 PAGE 55 CATEGORY 28 RPT#:  
NTIS/FS-79/0772/B 79/08/00 29 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen storage as a hydride. Citations from the international aerospace abstracts data base TLSP Report, 1975 - Jul. 1979  
AUTH: A/ZOLLARS, G. F.  
CORP: New Mexico Univ., Albuquerque. CSS: (Technology Application Center.) AVAIL.NTIS SAP: HC 526.00/MF \$26.00  
Springfield, Va. NTIS Sponsored by NTIS  
MAJS: /-BIBLIOGRAPHIES/-ENERGY STORAGE/-HYDROGEN-BASED ENERGY/-METAL HYDRIDES  
MINS: / ABSTRACTS/ CHEMISORPTION/ ELECTROCHEMISTRY/ INTERMETALLICS/ THERMOCHEMISTRY/ THERMODYNAMIC PROPERTIES  
ABA: GRA  
ABS: Articles from the international literature concerning the storage of hydrogen in various metal hydrides are cited. Binary and intermetallic hydrides are considered. Specific alloys discussed are iron-titanium, lanthanum-nickel, magnesium-copper, and magnesium-nickel among others. This bibliography contains 97 entries.

79N26510# ISSUE 17 PAGE 2283 CATEGORY 44 RPT#:  
BNL-25263 CNT#: EY-76-C-02-0016 76/00/00 10 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Hydrogen storage devices for automobiles  
AUTH: A/STRICKLAND, G.  
CORP: Brookhaven National Lab., Upton, N. Y. AVAIL.NTIS SAP: HC A42/MF A01  
MAJS: /-AUTOMOBILE FUELS/-ENERGY STORAGE/-HYDROGEN FUELS/-LIQUID HYDROGEN/-METAL HYDRIDES  
MINS: / CRYOGENIC FLUID STORAGE/ ENERGY TECHNOLOGY/ INTERNAL COMBUSTION ENGINES/ PRESSURE VESSELS/ STORAGE TANKS/ THERMAL INSULATION  
ABA: DOE  
ABS: Three hydrogen storage devices are discussed. The first two, a cryogenic container (Dewar) of liquid hydrogen (LH2) and a pressure vessel filled with metal hydride (reservoir), were successfully demonstrated in working vehicles; whereas the third is a low-pressure container of glass microballoons containing highly pressurized hydrogen and is still in the conceptual stage. Each of these devices supplies hydrogen to an internal-combustion engine modified for hydrogen service.

ORIGINAL PAGE IS  
OF POOR QUALITY

UTTL: A study on reformed fuel for an automotive gasoline engine

AUTH: A/ONODA, K.

CORP: Toyota Motor Co., Tokyo (Japan). AVAIL.NTIS SAP:  
HC A22/MF A01

In NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 p 759-768 (SEE N78-30370 21-31)

MAJS: /\*COMBUSTION EFFICIENCY/\*FUEL-AIR RATIO/\*HYDROGEN FUELS/\*INTERNAL COMBUSTION ENGINES

MINS: / COMBUSTION STABILITY/ FUEL CONSUMPTION/ GASOLINE/ HYDROGEN/ JAPAN/ MOTOR VEHICLES/ NITROGEN OXIDES

ABA: Author

ABS: A prototype on-board fuel reformer was developed and laboratory tests were conducted to determine the effects of the amount of reformed fuel on combustion. The results of these tests are discussed in this paper. On the Japanese test cycle, an extremely low NOx emission level was attained with relatively good fuel economy. However, in a limited combination of engine size and vehicle weight, engine power was sacrificed somewhat because of this lean combustion. A solution to this problem, while maintaining the lower NOx emission level, is to adopt a richer air-fuel ratio and a higher EGR rate. In this approach, the amount of hydrogen must be increased to improve combustion stability. For this purpose, methanol reforming was introduced whereby the additional hydrogen was supplied without any deterioration in energy efficiency.

A79-21676 Hydrides for energy storage. Proceedings of the International Symposium, Geilo, Norway, August 14-19, 1977. Symposium sponsored by the Institutt for Atomenergi and Allied Chemical Corp. Edited by A. F. Anderson (Institutt for Atomenergi, Kjeller, Norway) and A. J. Maeland (Allied Chemical Corp., Morristown, N.J.). Oxford, Pergamon Press, Ltd., 1978. 611 p. \$60. (For individual items see A79-21677 to A79-21717)

Consideration is given to the prospects of hydrogen as an energy carrier for the future, structure and bonding in metal hydrides, the nature of He-3 confinement in transition metal hydrides, hydrogen adsorption in rare earth intermetallic compounds, and the use of FeTi-hydrides for production and storage of suprapure hydrogen. Papers are also presented on such topics as hysteresis effects in metal-hydrogen systems, electrochemical utilization of metal hydrides, hydrogen storage electrode systems, the hydrogen/hydride energy concept, and the metallurgy and production of rechargeable hydrides. B.J.

UTTL: The performance of hydrogen-fueled reciprocating engines

AUTH: A/COLE, R. B.

CORP: Stevens Inst. of Tech., Hoboken, N. J. AVAIL.NTIS  
SAP: HC A22/MF A01

In NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 p 739-740 (SEE N78-30370 21-31)

MAJS: /\*COMBUSTION EFFICIENCY/\*HYDROGEN FUELS/\*PISTON ENGINES/\*THERMODYNAMICS

MINS: / COMBUSTION PHYSICS/ ENGINE TESTS/ FUEL-AIR RATIO/ HYDROGEN/ IGNITION/ SPARK IGNITION

ABA: Author

ABS: The thermodynamics and emissions performance of diverse experimental engines fueled with hydrogen are summarized and compared with theoretical (fuel/air cycle) analysis of such engines. Most of the experimental data are from naturally-aspirated spark-ignition engines though several data sets are from fuel-injected engines. The data are found to be highly consistent with fuel/air-cycle analysis, and it is concluded that fuel/air-cycle analysis provides both: (1) an apt (if often neglected) baseline against which to compare both past and future engine performance data and also (2) a suitable basis for describing the potential performance of hydrogen-fueled engines.

TP  
359  
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Hydrogen manufacture by electrolysis, thermal decomposition and unusual techniques / edited by M. S. Casper. — Park Ridge, N.J. : Nova Data Corp., 1978.

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79A38632 ISSUE 16 PAGE 2953 CATEGORY 25  
78/00/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: A solar assisted economy --- system for peak electrical generation and off-peak storage or fuel production

AUTH: A/POTTER, A. G. PAA: A/(Iowa State University of Science and Technology, Ames, Iowa)  
In: International Solar Forum, 2nd, Hamburg, West Germany, July 12-14, 1978, Reports, Volume 2. (A79-38576 16-44) Munich, Deutsche Gesellschaft fuer Sonnenenergie, 1978, p. 277-290.

MAJS: /\*ECONOMIC ANALYSIS/\*HYDROCARBON FUEL PRODUCTION/\*HYDROGEN PRODUCTION/\*SOLAR ENERGY CONVERSION/\*SOLAR GENERATORS/\*SYSTEMS ANALYSIS

MINS: / AMMONIA/ ELECTRIC ENERGY STORAGE/ ELECTROLYSIS/ ENERGY TECHNOLOGY/ FERTILIZERS/ HYDROGEN-BASED ENERGY/ METHANE/ METHYL ALCOHOLS

ABA: C.K.D.

ABS: A solar energy-assisted economy in which off-peak solar generated electricity is stored for later peaking use or utilized in the production of methanol, methane, or ammonia from hydrogen obtained by electrolysis of water and atmospheric or chemical process carbon dioxide is described. Hydrogen serves only as an intermediate product used for producing peaking power or for fuel synthesis. The system maximizes the use of solar energy in peak period generation and minimizes its use in electrical off-peak loads served by coal or nuclear-generated energy. The on- and off-peak prices paid by the utility per kilowatt hour of solar energy would be adjusted to offset losses due to solar displacement of the electrical load.

THERMODYNAMICS OF PRESSURE PLATEAUS IN METAL-HYDROGEN SYSTEMS, by P. S. Rudman.  
International Journal of Hydrogen Energy, vol. 3, no. 4, 1978, p. 431-447.

79A34120 ISSUE 13 PAGE 2424 CATEGORY 44  
78/00/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: State-of-the-art summary of the technical problems involved in the storage of hydrogen via metal hydrides

AUTH: A/STRICKLAND, G. PAA: A/(Brookhaven National Laboratory, Upton, N.Y.)  
In: Alternative energy sources; Proceedings of the Miami International Conference, Miami Beach, Fla., December 5-7, 1977, Volume 8. (A79-34106 13-44) Washington, D.C., Hemisphere Publishing Corp., 1978, p. 3699-3711. Research sponsored by the U.S. Department of Energy.

MAJS: /\*ENERGY STORAGE/\*ENERGY TECHNOLOGY/\*HYDROGEN FUELS/\*METAL HYDRIDES/\*TECHNOLOGY ASSESSMENT

MINS: / AUTOMOBILES/ TRANSPORTATION ENERGY

ABA: J.M.B.

ABS: The storage of hydrogen fuel in metal hydrides is discussed, with emphasis placed on experience gained from TiFe-based hydrides. The production of hydride-quality TiFe alloys and their behavior during extended cycling are considered. Vessel strain resulting from volumetric changes undergone by hydrides during cycling is also analyzed. Safety factors, cost-effective heat exchangers for hydride storage systems, and methods of enhancing heat transfer in the hydride beds receive attention. In addition, the design of hydride storage systems for automobiles is mentioned.

79N16994\*# ISSUE 8 PAGE 959 CATEGORY 28 RPT#:  
NASA-SP-4404 78/00/00 346 PAGES UNCLASSIFIED DOCUMENT

UTTL: Liquid hydrogen as a propulsion fuel, 1945-1959

AUTH: A/SLOOP, J. L.

CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL NTIS SAP: MF A01; HC S0D

MAJS: /\*FUELS/\*HYDROGEN FUELS/\*LIQUID HYDROGEN/\*PROPULSION

MINS: / ENGINES/ HISTORIES/ PROPELLANTS/ SPACE PROGRAMS/ TECHNOLOGY ASSESSMENT

ANN: A historical review is presented on the research and development of liquid hydrogen for use as a propulsion fuel. The document is divided into three parts: Part 1 (1945-1950); Part 2 (1950-1957); and Part 3 (1957-1958), encompassing eleven topics. Two appendixes are included. Hydrogen Technology Through World War 2; and Propulsion Primer. Performance Parameters and Units.

78N31085# ISSUE 22 PAGE 2895 CATEGORY 5 RPT#:  
NASA-CR-145069 VOL-1 LR-28384-VOL-1 CNTR: NAS1-14614  
78/07/00 2 VOLS 202 PAGES UNCLASSIFIED DOCUMENT

UTTL: Study of fuel systems for LH2-fueled subsonic  
transport aircraft, volume 1 TLSP: Final Report,  
Sep. 1976 - Dec. 1977  
AUTH: A/BREWER, G. D.; B/MORRIS, R. E.; C/DAVIS, G. W.;  
D/VERSAW, E. F.; E/CUNNINGTON, G. R., JR.; F/RIPLE,  
J. C.; G/BAERST, C. F.; H/GARMONG, G. PAA:  
E/(Lockheed Missiles and Space Co., Inc.);  
F/(AResearch Mfg. Co.); G/(AResearch Mfg. Co.);  
H/(Rocketdyne)  
CORP: Lockheed-California Co., Burbank. AVAIL.NTIS SAP:  
HC A10/MF A01

ABA: Author

ABS: Several engine concepts examined to determine a  
preferred design which most effectively exploits the  
characteristics of hydrogen fuel in aircraft tanks  
received major emphasis. Many candidate designs of  
tank structure and cryogenic insulation systems were  
evaluated. Designs of all major elements of the  
aircraft fuel system including pumps, lines, valves,  
regulators, and heat exchangers received attention.  
Selected designs of boost pumps to be mounted in the

LH2 tanks, and of a high pressure pump to be mounted  
on the engine were defined. A final design of  
LH2-fueled transport aircraft was established which  
incorporates a preferred design of fuel system. That  
aircraft was then compared with a conventionally  
fueled counterpart designed to equivalent technology  
standards.

78N30410# ISSUE 21 PAGE 2708 CATEGORY 37  
78/02/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Comparative efficiencies of alternative future  
automotive power systems

AUTH: A/FETTERMAN, G. P.

CORP: Exxon Enterprises, Inc., New York. AVAIL.NTIS  
SAP: HC A22/MF A01

In NATO Proc. of the 4th Intern. Symp. on Automotive  
Propulsion Systems, Vol. 2 p 855-864 (SEE N78-30370  
21-31)

ABA: Author

ABS: An analysis of the overall energy efficiency of a  
small (2 + 2) urban vehicle powered by five different  
power trains, all with similar acceleration  
performance and payload capabilities is presented. The  
drive trains compared are: a  
hydrogen-fueled-spark-ignition engine, an advanced  
gasoline-fueled-spark-ignition engine, diesel engine,  
a diesel/electric hybrid, and a pure electric with an  
advanced motor/controller and battery. The test weight  
of each vehicle is varied so that differences in both  
power system weight and chassis weight propagation are  
reflected. Each vehicle is mathematically modeled and  
driven over the EPA urban driving cycle so that its  
road load energy requirements are generated. The  
energy usage of each vehicle is then traced through  
its drive train and fuel processing efficiencies and  
measured in terms of raw energy in the ground.  
Estimates are made of the energy used in the  
production of each vehicle, and the total life cycle  
energy consumption is calculated.

78N30401# ISSUE 21 PAGE 2797 CATEGORY 85  
78/02/00 6 PAGES UNCLASSIFIED DOCUMENT

UTTL: A hydrogen-powered mass transit system

AUTH: A/WOOLEY, R. L.

CORP: Billings Energy Research Corp., Provo, Utah.  
AVAIL.NTIS SAP: HC A22/MF A01

In NATO Proc. of the 4th Intern. Symp. on Automotive  
Propulsion Systems, Vol. 2 p 768-773 (SEE N78-30370  
21-31)

ABA: G.Y.

ABS: Hydrogen's application to mass transit systems is  
considered. A 21 passenger bus is converted to  
hydrogen using an engine which was modified for high  
compression operation. Backfiring and nitric oxide  
pollution formation are controlled by a water  
injection technique. Hydrogen fuel storage for the  
experimental prototype is accomplished by two metal  
hydride containers using an iron-titanium alloy. Data  
are presented regarding equipment conversion and  
design, energy resource utilization, economics, and  
safety.

78N30403# ISSUE 21 PAGE 2797 CATEGORY 28  
78/02/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Refueling hydrogen transit fleets, part B: Data

AUTH: A/BEYER, R. B.

CORP: Billings Energy Research Corp., Provo, Utah.

AVAIL.NTIS SAP: HC A22/MF A01

In NATO Proc. of the 4th Intern. Symp. on Automotive  
Propulsion Systems, Vol. 2 p 784-789 (SEE N78-30370

CONDUCTIVITY/ TIME DEPENDENCE

ABA: Author

ABS: Data were collected while refueling a prototype  
hydrogen bus. The refueling operation more severely  
limits the design of the vehicle tanks than does the  
discharge condition since the heat transfer must be  
accomplished in a shorter time. These data indicate  
that 30 minutes is an attainable refueling period. A  
significant fraction (40 percent) of the refueling  
takes place without heat transfer as the hydride  
increases in temperature. This characteristic can be  
enhanced and used to advantage such that a fleet based  
on an hourly quick recharge has a lower operational  
cost. Sorption characteristics and thermal  
conductivity for the FeTi hydride used in the vehicle  
are reported.

79N24492# ISSUE 15 PAGE 2006 CATEGORY 44 RPT#:

BNL-25212 CONF-781142-3 CNT#: EY-76-C-02-0016  
78/00/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen halogen energy storage system

AUTH: A/SPAZIANTE, P. M.; B/SIOLI, G. C.; C/TROTTA, R.;

D/PEREGO, A.; E/MCBREIN, J. PAA: A/(Oronzio de Nora

Impianti Elettrochimici S.P.A. Milano, Italy);

B/(Oronzio de Nora Impianti Elettrochimici S.P.A.,

Milano, Italy); C/(Oronzio de Nora Impianti

Elettrochimici S.P.A., Milano, Italy); D/(Oronzio de

Nora Impianti Elettrochimici S.P.A. Milano, Italy)

CORP: Brookhaven National Lab., Upton, N. Y. AVAIL.NTIS

SAP: HC A02/MF A01

Presented at Chem. Hydrogen Energy Systems Contracts

Rev., Washington, D. C., 28 Nov. 1978

FACTORS/ TRANSPORT PROPERTIES

ABA: DOE

ABS: The hydrogen/chlorine energy storage system was  
considered for large scale energy storage. In FY1978  
work included an assessment of system safety and cost  
investigations of cell performance under conditions  
elevated pressure and temperature, determination of  
the transport properties of Nafion membranes and  
electrochemical engineering studies. Results are  
summarized.

78N23094# ISSUE 14 PAGE 1806 CATEGORY 7 RPT#:  
NASA-TP-1174 L-11811 78/05/00 61 PAGES

UNCLASSIFIED DOCUMENT

UTTL: Interaction between step fuel injectors on opposite  
walls in a supersonic combustor model

AUTH: A/MCCLINTON, C. R.

CORP: National Aeronautics and Space Administration, Langley  
Research Center, Hampton, Va. AVAIL.NTIS SAP: HC

A04/MF A01

ABA: Author

ABS: Results are presented from an experimental  
investigation of perpendicular, hydrogen fuel  
injection and combustion from opposing walls in a  
scramjet combustor model using a longitudinally staged  
laterally inline step-injection configuration. The  
model represents a portion of the flow in the Langley  
integrated modular scramjet engine combustor operating  
at a flight Mach number of 7. When operating at a  
ratio of jet pressure to free-stream dynamic pressure  
of 3, the injectors produce a bulk equivalence ratio  
of unity. This investigation represents part of a  
continuing study of the modular engine fuel injectors  
and is specifically designed to eliminate the adverse  
lateral pressure gradient observed at the injector  
location in a previous test. Flow survey contours at  
three axial locations, ranging from one-third of the  
engine combustor length to the total engine combustor  
length, are used to determine mixing efficiency and  
fuel distribution. Wall static pressures are analyzed  
by using one-dimensional theory to determine the  
combustion efficiency. Results show a significant  
improvement over previous injector designs tested in  
this duct geometry.

78N10186\*# ISSUE 1 PAGE 27 CATEGORY 15 RPT#:  
NASA-TP-1045 77/00/00 41 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Parametric study of ascent performance of a vertically launched hydrogen-fueled single-stage reusable transport

AUTH: A/REHDER, J. J.

CORP: National Aeronautics and Space Administration, Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /\*CLIMBING FLIGHT/\*LAUNCH VEHICLES/\*PROPULSION SYSTEM PERFORMANCE/\*ROCKET THRUST

MINS: / ASCENT/ DESIGN ANALYSIS/ HYDROGEN ENGINES/ INDEPENDENT VARIABLES/ SPACECRAFT PROPULSION

ABA: Author

ABS: Ascent performance characteristics were studied for a vertical-take-off, horizontal-landing, single-stage-to-orbit transport vehicle powered by hydrogen fuel rocket with a mixture of fixed- and dual-position nozzles. The analysis was made by systematically varying two sets of trajectory similarity parameters based on the propulsive and aerodynamic characteristics of the vehicle and by calculating a trajectory for each combination of the parameters. The propulsion parameters were the initial thrust-weight ratio, engine combination, and the two expansion ratios of the dual-position rocket nozzles. The aerodynamic parameters were the ratio of reference area to initial weight and the ratio of maximum allowable normal force to initial weight. A first-order analysis was carried out to determine the effect on the performance of including the engine mass penalty. This analysis indicates that the configuration with the lowest initial mass for a given payload requires all dual-position nozzles with initial expansion ratio of 50 and a final expansion ratio of 150.

THE HYDROGEN/HYDRIDE ENERGY CONCEPT, by H. Buchner.  
International Journal of Hydrogen Energy, vol. 3,  
no. 4, 1978, p.385-406.

The storage of hydrogen for mobile (vehicle) and stationary (domestic) applications is best undertaken by the aid of suitable metal hydrides. Hydride research at Daimler Benz not only produced the world's first combination hydride vehicles, it also led to the discovery and further development of a series of possible applications for hydrides.

78N10306\*# ISSUE 1 PAGE 46 CATEGORY 28 RPT#:  
NASA-TM-74089 77/09/00 28 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: The Liquid Hydrogen Option for the Subsonic Transport: A status report

AUTH: A/KORYCINSKI, P. F.

CORP: National Aeronautics and Space Administration, Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A03/MF A01  
Presented at 12th Intersoc. Energy Conversion Eng. Conf., Washington, D. C., 28 Aug. - 2 Sep. 1977

MAJS: /\*AIRCRAFT FUELS/\*ENERGY POLICY/\*LIQUID HYDROGEN/\*NASA PROGRAMS/\*SUBSONIC AIRCRAFT/\*TRANSPORT AIRCRAFT

MINS: / AIRCRAFT DESIGN/ AIRCRAFT FUEL SYSTEMS/ AIRPORTS/ COAL GASIFICATION/ CRYOGENIC FLUID STORAGE

ABA: Author

ABS: Continued subsonic air transport design studies include the option for a liquid hydrogen fuel system as an aircraft fuel conservation measure. Elements of this option discussed include: (1) economical production of hydrogen; (2) efficient liquefaction of hydrogen; (3) materials for long service life LH2 fuel tanks; (4) insulation materials; (5) LH2 fuel service and installations at major air terminals; (6) assessment of LH2 hazards; and (7) the engineering definition of an LH2 fuel system for a large subsonic passenger air transport.

A79-34120 State-of-the-art summary of the technical problems involved in the storage of hydrogen via metal hydrides. G. Strickland (Brookhaven National Laboratory, Upton, N.Y.). In: Alternative energy sources; Proceedings of the Miami International Conference, Miami Beach, Fla., December 5-7, 1977. Volume 8. (A79-34106 13-44) Washington, D.C., Hemisphere Publishing Corp., 1978, p. 3699-3711. 30 refs. Research sponsored by the U.S. Department of Energy.

The storage of hydrogen fuel in metal hydrides is discussed, with emphasis placed on experience gained from TiFe-based hydrides. The production of hydride-quality TiFe alloys and their behavior during extended cycling are considered. Vessel strain resulting from volumetric changes undergone by hydrides during cycling is also analyzed. Safety factors, cost-effective heat exchangers for hydride storage systems, and methods of enhancing heat transfer in the hydride beds receive attention. In addition, the design of hydride storage systems for automobiles is mentioned. J.M.B.

78A18844# ISSUE 6 PAGE 957 CATEGORY 34  
77/00/00 21 PAGES UNCLASSIFIED DOCUMENT

JTTL: Hydrogen cryogenic storage - liquid for automotive applications and cryoadsorbents for pipeline distribution systems

AUTH: A/PESCHKA, W.; B/CARPELIS, C. PAA: B/(Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Cologne, West Germany)  
In: International Workshop on Hydrogen and its Perspectives, Liege, Belgium, November 15-18, 1976. Proceedings, Volume 1. (A78-18826 06-44) 11pp

Association des Ingenieurs Electriciens sortis de l'Institut Electrotechnique Montefiore, 1977. 21 p.

MAJS: /\*ADSORPTION/\*AUTOMOBILE FUELS/\*CRYOGENIC FLUID STORAGE/\*HYDROGEN ENGINES/\*HYDROGEN FUELS/\*LIQUID HYDROGEN

MINS: / AUTOMOBILE ENGINES/ ENERGY STORAGE/ HYDROGEN-BASED ENERGY

ABA: J.M.B.

ABS: The design of a compact cryogenic tank for storing the liquid hydrogen used in an automobile engine is described, and a cryogenic storage system which would employ adsorbent materials at liquid nitrogen temperatures and moderate pressures is proposed. The design of the cryogenic tank would include a metal hydride to achieve a loss-free storage period of eight to ten days; a prototype tank with a complete pressure and valve control system has been tested. Low-pressure cryogenic storage facilities making use of such adsorbents as activated charcoal or nickel-silicate compounds are also mentioned. If regenerative heat recovery is introduced into the system, the cryoadsorbents may offer a more efficient means of storage than conventional liquid hydrogen tanks.

#### SELECTION OF STRUCTURAL MATERIALS FOR HYDROGEN PIPELINES AND STORAGE VESSELS.

Anthony W. Thompson and I. M. Bernstein

International Journal of Hydrogen Energy, vol. 2, no. 2, 1977, p. 163-173

The feasibility, both of using present transmission lines, and of developing new resistant line pipe and pressure vessel steels, is explored.

77N25455# ISSUE 16 PAGE 2127 CATEGORY 34  
RPT#: NASA-CR-2829 REPT-8653-950001 CNT#: NAS1-10969  
77/06/00 124 PAGES UNCLASSIFIED DOCUMENT

UTTL: Development and validation of purged thermal protection systems for liquid hydrogen fuel tanks of hypersonic vehicles

AUTH: A/HELENDROOK, R. D.; B/COLT, J. Z.  
CORP: Bell Aerospace Co., Buffalo, N. Y.; Little (Arthur D.), Inc., Cambridge, Mass. AVAIL.NTIS SAP: HC A06/MF A01

Washington NASA Prepared in cooperation with Arthur D. Little, Cambridge, Mass.

MAJS: /\*FUEL TANKS/\*LIQUID HYDROGEN/\*REUSABLE HEAT SHIELDING /\*THERMAL PROTECTION

MINS: / CRYOGENIC FLUID STORAGE/ HYPERSONIC FLIGHT/ MULTILAYER INSULATION/ THERMAL CYCLING TESTS

ABA: Author

ABS: An economical, lightweight, safe, efficient, reliable, and reusable insulation system was developed for hypersonic cruise vehicle hydrogen fuel tanks. Results indicate that, a nitrogen purged, layered insulation system with nonpermeable closed-cell insulation next to the cryogenic tank and a high service temperature fibrous insulation surrounding it, is potentially an attractive solution to the insulation problem. For the postulated hypersonic flight the average unit weight of the purged insulation system (including insulation, condensate and fuel boil off) is 6.31 kg/sq m (1.29 psf). Limited cyclic tests of large specimens of closed cell polyurethane foam indicate it will withstand the expected thermal cycle.

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Intersociety Energy Conversion Engineering Conference, 12th, Washington, 1977. Proceedings ...c1977

779146 — A New Family of Hydrogen Storage Alloys Based on the System Nickel-Mischmetal-Calcium, G. D. Sandrock, *International Nickel Co.*, Suffern, N.Y. .... 951

779148 — A Hydrogen-Halogen Storage System for Electric Utility Applications, A. Beaufreire, R. S. Yeo, S. Srinivasan, *Brookhaven National Lab.*, Upton, N.Y.; J. McElroy, *General Electric Co.*; G. Hart, *Energy Development Assoc.* ..... 959

78N22073\*# ISSUE 13 PAGE 1661 CATEGORY 5 RPT#:  
 NASA-TM-78330 NOTE-77-30 ISBN-2-7170-0455-6 77/00/00  
 37 PAGES UNCLASSIFIED DOCUMENT

UTTL: Alternate-fueled transport aircraft possibilities  
 AUTH: A/AIKEN, W. S.  
 CORP: National Aeronautics and Space Administration,  
 Washington, D. C. AVAIL.NTIS SAP: HC A03/MF A01  
 France Assoc. Aeronautique et Astronautique de  
 France Presented at The 13th Congr. Intern. Aeron.  
 Paris, 2-3 Jun. 1977  
 MAJS: /\*CRYOGENICS/\*HYDROGEN FUELS/\*LIQUID HYDROGEN/\*NASA  
 PROGRAMS/\*TRANSPORT AIRCRAFT  
 MINS: / DESIGN ANALYSIS/ FUEL SYSTEMS/ MANAGEMENT/ PROJECT  
 PLANNING  
 ABA: Author  
 ABS: The paper is organized to describe: (1) NASA's  
 cryogenically fueled aircraft program; (2) LH2  
 subsonic and supersonic transport design possibilities  
 (3) the fuel system and ground side problems  
 associated with LH2 distribution; (4) a comparison of  
 LCH4 with LH2; (5) the design possibilities for LCH4  
 fueled aircraft; and (6) a summary of where NASA's  
 cryogenically fueled programs are needed.

TP Dickson, Edward M.  
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TP Dickson, Edward M.  
 360 The hydrogen energy economy  
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#### STRUCTURAL MATERIALS USE IN A HYDROGEN ENERGY ECONOMY

Anthony W. Thompson  
 International Journal of Hydrogen Energy  
 Vol. 2, no. 3  
 pp.299-307.

THE BEHAVIOUR OF IRON TITANIUM HYDRIDE TEST BEDS  
 LONG-TERM EFFECTS, RATE STUDIES AND MODELING  
 G. Strickland, J. Milau and W-S. Yu  
 International Journal of Hydrogen Energy  
 Vol. 2, no. 3, 1977,  
 p. 309-327.

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OF POOR QUALITY

INTERSTITIAL COMPOUNDS.

L.H. Bennett, et al.

Physics Today, v.30, no.9, Sept.1977, p.34-41.

Two applications of interstitial compounds are inherent in the design of this forklift truck, developed by the US Army at Fort Belvoir, Va. Carbide catalysts are appropriate for its hydrogen-powered fuel cells, and metal hydrides for hydrogen storage may eventually supplant the pressure tanks shown here, to yield a factor of three in volume reduction and some weight savings as well.

77N21620# ISSUE 12 PAGE 1615 CATEGORY 44  
76/03/00 3 VOLS 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Physical metallurgy of FeTi-hydride and its behavior in a hydrogen storage container

AUTH: A/PICK, M. A.; B/WENZEL, H.

CORP: Kernforschungsanlage, Juellich (West Germany). CSS: (Inst. fuer Festkoerperforschung.) AVAIL.NTIS SAP: HC A99/MF 401

In Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 13 p (SEE N77-21591 12-44)

MAJS: /\*HYDROGEN-BASED ENERGY/\*IRON COMPOUNDS/\*METALLURGY/\*STORAGE TANKS/\*TITANIUM

MINS: / CESIUM COMPOUNDS/ CONCENTRATION (COMPOSITION)/ METALLOGRAPHY/ SPECIFIC HEAT/ X RAY DIFFRACTION

ABA: Author

ABS: FeTi samples were prepared and characterized by metallography, X-ray diffraction, neutron diffraction and specific heat measurements. The conditions for the presence of the ordered CsC' structure at room temperature were investigated. This material was used to study FeTi hydrides, especially the structure, phase transition, and the heat of reaction as a function of the hydrogen concentration. The FeTi material was used to build and operate a small hydrogen storage container as an alternative to high pressure hydrogen gas containers.

QD Electrochemical Society,  
552 Extended abstracts...c1977. (Card 2)  
.E42 trolytic, Organic and Biological Electro-  
1977 chemistry, and Physical Electrochemistry  
v.77-1 Divisions.

Model Predictions for the Stability of Ternary Metallic Hydrides

A. R. Miedema, K. H. J. Buschow, and H. H. van Mal.... 923

Hydrogen Storage by LaNi<sub>5</sub>: Fundamentals and Applications

T. B. Flanagan and S. Tanaka..... 925

Absorption of Hydrogen by the Intermetallics NiNi<sub>5</sub> and LaNi<sub>5</sub>Cu and a Correlation of Cell Volumes and Desorption Pressures

D. M. Gruen, M. H. Mendelsohn, and I. Sheft....(over) 927

77N21600# ISSUE 12 PAGE 1613 CATEGORY 44  
76/03/00 3 VOLS 27 PAGES UNCLASSIFIED DOCUMENT

UTTL: A farm energy system employing hydrogen storage

AUTH: A/TISON, R. R.; B/BIEDFRMAN, N. P.

CORP: Institute of Gas Technology, Chicago, Ill.

AVAIL.NTIS SAP: HC A99/MF 401

In Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 27 p (SEE N77-21591 12-44)

MAJS: /\*ENERGY STORAGE/\*ENERGY TECHNOLOGY/\*FARMLANDS/\*HYDROGEN-BASED ENERGY

MINS: / ENERGY CONVERSION/ HYDROGEN FUELS/ WINDPOWER UTILIZATION/ WINDPOWERED GENERATORS

ABA: Author

ABS: Short-range, small volume storage to integrate the operation of the wind energy conversion systems with fluctuations in wind availability and load requirements appears feasible. In some cases, hot water storage for thermal loads is preferable to hydrogen. Non-optimized costs for power supplied to a 100 head dairy farm discussed in this paper are in the range of 27 cents to 57 cents/kWhr. Optimized costs are anticipated, however, to be as low as 10 cents/kWhr.

TP World Hydrogen Energy Conference, 1st, Miami  
360 Beach, 1976.

.W67 Conference proceedings: 1st World Hydro-  
1976 gen Energy Conference, 1-3 March 1976, Miami  
V.2 Beach, Florida; presented by International  
Association for Hydrogen Energy, Clean  
Energy Research Institute, University of  
Miami / sponsored by: Energy Research and  
Development Administration, the School of

THERMODYNAMIC ANALYSIS OF ALTERNATE ENERGY  
CARRIERS, HYDROGEN AND CHEMICAL HEAT PIPES  
K.E. Cox, R.H. Carty, W.L. Conger, M.A. Soliman,  
J.E. Funk, University of New Mexico, Albuquerque,  
New Mexico U.S.A.

THE INTEGRATION OF DISTILLATE OIL/HYDROGEN FUELED  
FUEL CELLS INTO THE NATIONAL ENERGY SYSTEM\*  
C. Braun, E.A. Cherniavsky, F.J. Salzano, Brookha  
National Laboratory, Department of Applied Science  
Upton, New York U.S.A.

OCEAN THERMAL ENERGY DELIVERY SYSTEMS BASED ON  
CHEMICAL ENERGY CARRIERS

A. Konopka, A. Talib, N. Biederman, B. Yudow,  
Institute of Gas Technology, Chicago, Illinois U

1<sub>2</sub> ENERGY CABLE\*  
3. O. Voth, J. Hord, U.S. Department of Commerce,  
National Bureau of Standards, Boulder, Colorado U

77N21615# ISSUE 12 PAGE 1615 CATEGORY 44  
76/03/00 3 VOLS 9 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Hydrogen vehicular fuel storage as a step in a water  
splitting cycle  
AUTH: A/RUDMAN, P. S.  
CORP: Technion - Israel Inst. of Tech., Haifa. CSS: (Dept.  
of Physics.) AVAIL.NTIS SAP: HC A99/MF A01  
In Miami Univ. 1st World Hydrogen Energy Conf. Proc.,  
Vol. 2 9 p (SEE N77-21591 12-44)  
MAJS: /\*ENERGY STORAGE/\*HYDROGEN FUELS/\*MOTOR VEHICLES/\*  
REFUELING  
MINS: / CHEMICAL REACTIONS/ LIQUID HYDROGEN/ SPLITTING/  
THERMOCHEMISTRY  
ABA: Author  
ABS: Hydrogen vehicular refueling is generally conceived of  
as similar to present-day hydrogen refueling. However,  
for hydrogen produced in a thermochemical water  
splitting cycle, a unique refueling cycle is possible.  
Rather than storing hydrogen, other products of the

water splitting cycle are stored, and hydrogen fuel is  
released by their chemical reaction in situ.  
Preliminary considerations of the comparative  
advantages and disadvantages of such a hydrogen  
refueling system are presented.

77N21613# ISSUE 12 PAGE 1615 CATEGORY 44  
76/03/00 3 VOLS 15 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Technical and environmental aspects of underground  
hydrogen storage  
AUTH: A/WALTERS, A. B.  
CORP: Southern California Gas Co., Los Angeles.  
AVAIL.NTIS SAP: HC A99/MF A01  
In Miami Univ. 1st World Hydrogen Energy Conf. Proc.,  
Vol. 2 15 p (SEE N77-21591 12-44)  
MAJS: /\*DEMAND (ECONOMICS)/\*ENVIRONMENT EFFECTS/\*  
HYDROGEN-BASED ENERGY/\*UNDERGROUND STORAGE  
MINS: / ENERGY CONSUMPTION/ ENERGY CONVERSION/ ENVIRONMENTAL  
SURVEYS/ NUCLEAR POWER PLANTS  
ABA: B.B.  
ABS: Underground storage of hydrogen is discussed as the  
most feasible method of matching hydrogen production  
sources to variable consumer demands. Environmental  
impact of underground storage is also presented.

TP World Hydrogen Energy Conference, 1st, Miami  
360 Beach, 1976.  
.W67 Conference proceedings...1976. (Card 2)  
1976 Coral Gables, Fla. : University of Miami,  
1976.  
V. 2 3 v. : ill. ; 26 cm.

A WIND ENERGY SYSTEM UTILIZING HIGH PRESSURE  
ELECTROLYSIS AS A STORAGE MECHANISM  
H. J. Allison, School of Electrical Engineering,  
Oklahoma State University, Stillwater, Oklahoma

A NEW STORAGE HYDROGEN ELECTRODE\*  
J. Sarradin, G. Bronoel, M. Bonnemay, A. Perchero  
L. Schlapbach, J.C. Achard, Laboratoire d'Electro  
du C.N.R.S., Bellevue, France

A STUDY OF THE EFFICIENCY OF HYDROGEN LIQUEFACTIO  
C.R. Baker, R.L. Shaner, Union Carbide Corporatio  
Linde Division, Tonawanda, New York U.S.A.

A SYSTEM CONSIDERATION OF THE CRYOGENIC STORAGE  
TANK FOR LIQUID HYDROGEN FUELED VEHICLES AND THE  
RESULTING TANK CONCEPT FOR A PASSENGER CAR  
W. Peschka, C. Carpetis, DFVLR-Institute for Ener  
Conversion, Stuttgart, Federal Republic of German

TECHNICAL AND ENVIRONMENTAL ASPECTS OF UNDERGROUN  
HYDROGEN STORAGE  
A.B. Walters, Southern California Gas Company,  
Los Angeles, California U.S.A.

77A33378# ISSUE 14 PAGE 2327 CATEGORY 31  
76/00/00 21 PAGES UNCLASSIFIED DOCUMENT

UTTL: A system consideration of the cryogenic storage tank  
for liquid hydrogen fueled vehicles and the resulting  
tank concept for a passenger car  
AUTH: A/PESCHKA, W.: B/CARPETIS, C. PAA: B/(Deutsche  
Forschungs- und Versuchsanstalt fuer Luft- und  
Raumfahr.: Institut fuer Energiewandlung und  
Elektrische Antriebe, Stuttgart, West Germany)  
In: World Hydrogen Energy Conference, 1st, Miami  
Beach, Fla., March 1-3, 1976, Proceedings, Volume 2.  
(A77-33326 14-44) Coral Gables, Fla., University of

Miami; New York, Pergamon Press, 1976, p. 2B-43 to  
2B-63.

MAJS: /\*AUTOMOBILES/\*CRYOGENIC FLUID STORAGE/ HYDROGEN FUELS  
/\*LIQUID HYDROGEN/\* STORAGE TANKS

MINS: / ENERGY TECHNOLOGY/ PERFORMANCE TESTS/ PROTOTYPES/  
SYSTEMS ENGINEERING/ TRANSPORTATION ENERGY

ABA: M.L.

ABS: A cryogenic liquid hydrogen fuel tank, designed for  
automobiles which use hydrogen for fuel, is described.  
Consideration is given to liquid hydrogen as an  
alternative fuel, liquid hydrogen storage in a  
vehicle, and fuel processing. Performance data and  
test results involving a compact cryogenic fuel tank  
are provided.

TJ  
810  
.S48  
1976  
v, 8

Storage, water heater, data communication,  
education : joint conference, American  
Section, International Solar Energy So-  
ciety and Solar Energy Society of Canada,  
inc., August 15-20, 1976, Winnipeg / editor  
K. W. Boer. — Cape Canaveral, Fla. : Ameri-  
can Section of the International Solar  
Energy Society, c1976.  
x, 371 p. : ill. ; 28 cm. — (Sharing  
the sun ; v. 8)

(Continued on card 2)

AN ASSESSMENT OF HYDROGEN AS A MEANS  
TO STORE SOLAR ENERGY

163

TP World Hydrogen Energy Conference, 1st, Miami  
360 Beach, 1976.  
.W67 Conference proceedings: 1st World Hydro-  
1976 gen Energy Conference, 1-3 March 1976, Miami  
V. 2 Beach, Florida; presented by International

'AL HYDRIDE STORAGE (Session 8B)

TITANIUM ALLOY HYDRIDES: THEIR PROPERTIES AND APPLICATIONS

J.J. Reilly, J.R. Johnson, Brookhaven National Laboratory, Upton, New York U.S.A.

PHYSICAL METALLURGY OF FeTi-HYDRIDE AND ITS BEHAVIOUR IN A HYDROGEN STORAGE CONTAINER

M.A. Pick, H. Wenzl, Institut fur Festkorperforse  
517 Julich, West Germany

THE BEHAVIOR OF IRON TITANIUM HYDRIDE TEST BEDS: LONG-TERM EFFECTS, HEAT TRANSFER AND MODELING

G. Strickland, J. Milau, W.S. Yu, Brookhaven National Laboratory, Upton, New York U.S.A.

A THERMODYNAMIC ANALYSIS OF HYCSOS, A HYDROGEN CONVERSION AND STORAGE SYSTEM

D.M. Gruen, F. Schreiner, I. Sheft, Chemistry Di  
Argonne National Laboratory, Argonne, Illinois

HYDROGEN STORAGE VIA IRON-TITANIUM: ENGINEERING DESIGN AND ANALYSIS\*

A. Beaufriere, F.J. Salzano, R.J. Isler, W.S. Yu, Brookhaven National Laboratory, Department of Applied Science, Upton, New York U.S.A.

77N21617# ISSUE 12 PAGE 1615 CATEGORY 44  
76/03/00 3 VOLS 10 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Methods of on-board generation of hydrogen for vehicular use  
AUTH: A/ULLMAN, A. Z.; B/VANVORST, W. D.  
CORP: California Univ., Los Angeles. CSS: (School of Engineering and Applied Science.) AVAIL.NTIS SAP: HC A99/MF A01  
In Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 10 p (SEE N77-21591 12-44)  
MAJS: /\*COMBUSTION EFFICIENCY/\*ENERGY SOURCES/\*HYDROGEN FUELS/\*MOTOR VEHICLES  
MINS: / AUTOMOBILES/ HYDROGEN-BASED ENERGY/ LIQUID HYDROGEN/

METAL HYDRIDES

ABA: Author  
ABS: Possible alternative means of storage of hydrogen, both for use as the sole or major fuel, and as a supplementary fuel for enhancement of the combustion behavior is reviewed. Chemical storage means which may prove more attractive than metal hydrides are presented.

77N21637# ISSUE 12 PAGE 1617 CATEGORY 44  
76/03/00 11 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Automotive hydride tank design  
AUTH: A/MACKAY, D. B.  
CORP: Billings Energy Research Corp., Provo, Utah. AVAIL.NTIS SAP: HC A99/MF A01  
In Miami Univ. First World Hydrogen Energy Conf. Proc., Vol. 3 11 p (SEE N77-21626 12-44)  
MAJS: /\*AUTOMOBILE FUELS/\*ENERGY POLICY/\*FUEL TANKS/\*HYDRIDES/\*HYDROGEN FUELS/\*THERMODYNAMIC PROPERTIES  
MINS: / FUEL SYSTEMS/ FUEL TANK PRESSURIZATION/ HEAT EXCHANGERS/ HEAT TRANSFER/ TRANSPORTATION ENERGY  
ABA: Author  
ABS: Automotive hydride tanks must be designed as both pressure vessels and heat exchangers. Hydride heat transfer properties are presented using heat exchange data and results from theoretical investigations and prototype testing. Discussion of promising designs and directions for future activity are included. Tabular designs which avoid many previously encountered difficulties are analyzed.

TP World Hydrogen Energy Conference, 1st, Miami,  
360 Beach, 1976.  
.W67 Conference proceedings...1976. (Card 2)  
1976 Coral Gables, Fla. : University of Miami,  
V. 2 1976.

SERIALS ASPECTS (Session 9B)

A SIMPLE APPROACH TO METAL HYDRIDE ALLOY  
OPTIMIZATION

D.D. Lawson, C.G. Miller, R.F. Landel, Jet  
Propulsion Laboratory, Pasadena, California U.S.

HYDROGEN TRANSPORT AND EMBRITTLEMENT IN STRUCTURAL  
METALS\*

M.R. Louthan, Jr., G.R. Caskey, Jr., Savannah River  
Laboratory, E.I. du Pont de Nemours & Company,  
Aiken, South Carolina U.S.A.

POTENTIAL STRUCTURAL MATERIAL PROBLEMS IN A HYDROGEN  
ENERGY SYSTEM

H.R. Gray, H.G. Nelson, R.E. Johnson, W.B. McPherson,  
F.S. Howard, J.H. Swisher, NASA Lewis Research Center  
Cleveland, Ohio U.S.A.

STATUS OF ERDA PROGRAM ON HYDROGEN COMPATIBILITY  
STRUCTURAL MATERIALS FOR PRESSURE VESSELS AND PIPELINES

J.H. Swisher, A.J. West, S.L. Robinson, Sandia  
Laboratories, Livermore, California U.S.A.

SELECTION OF STRUCTURAL MATERIALS FOR HYDROGEN  
PIPELINES AND STORAGE VESSELS

A.W. Thompson, I.M. Bernstein, Science Center,  
Rockwell International, Thousand Oaks, California U.S.A.

77A19073 ISSUE 6 PAGE 867 CATEGORY 44 76/00/00  
11 PAGES UNCLASSIFIED DOCUMENT

UTTL: On the storage of solhydrogen  
AUTH: A/ABDEL-AAL, H. K.; B/NAZMY, M. Y. PAA:  
B/(University of Petroleum and Minerals, Dhahran,  
Saudi Arabia)  
In: Heliotechnique and development; Proceedings of the  
International Conference, Dhahran, Saudi Arabia,  
November 2-6, 1975. Volume 1. (A77-19043 06-44)  
Cambridge, Mass.. Development Analysis Associates,  
Inc., 1976. p. 418-428.

MAJS: /\*ENERGY STORAGE/\*HYDROGEN-BASED ENERGY/\*SOLAR ENERGY  
CONVERSION

MINS: / AMMONIA/ FUEL CELLS/ LIQUID HYDROGEN/ METAL HYDRIDES  
ABA: B.J.

ABS: The two main methods of storing hydrogen produced by  
solar energy are examined: ammonia storage and metal  
hydride storage. In the latter process, metal hydrides  
such as magnesium or iron-titanium hydride are  
decomposed releasing absorbed hydrogen, while the  
metal can be reused in a closed cycle. Attention is  
also given to the use of liquid hydrogen for overseas  
transportation and to the use of hydrogen in fuel  
cells.

77A13539 ISSUE 3 PAGE 322 CATEGORY 25 76/10/20  
4 PAGES UNCLASSIFIED DOCUMENT

UTTL: A new hydrogen storage electrode  
AUTH: A/BRONOEL, G.; B/SARRADIN, J.; C/BONNEMAY, M.;  
D/PERCHERON, A.; E/ACHARD, J. C.; F/SCHLAPBACH, L.  
PAA: C/(CNRS, Laboratoire d'Electrolyse, Meudon,  
Hauts-de-Seine, France); F/(CNRS, Laboratoire des  
Terres Rares, Meudon, Hauts-de-Seine, France)  
International Journal of Hydrogen Energy, vol. 1, Oct.  
20, 1976. p. 251-254.

ABA: (Author)  
ABS: This paper presents experimental evidence that it is  
possible to use a cathodic charge to store hydrogen on  
compounds such as LaNi5. Using an alkaline medium (KOH  
5N) in an unpressurized system at 20 C, the mass  
capacity was found to be approximately 330 gH/g  
(5H/mol LaNi5). Comparison of these results with the  
solid-gas isotherms indicated that the hydrogen is  
held in a nonequilibrium state. The influence of  
temperature, stoichiometry and substitution in the  
LaNi5 on the capacity are presented.

ORIGINAL PAGE IS  
OF POOR QUALITY

77N21612# ISSUE 12 PAGE 1614 CATEGORY 44  
76/03/00 3 VOLS 21 PAGES UNCLASSIFIED DOCUMENT

UTTL: A system consideration of the cryogenic storage tank for liquid hydrogen fueled vehicles and the resulting tank concept for a passenger car

AUTH: A/PESCHKA, W.; B/CARPETIS, C.

CORP: Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (west Germany). AVAIL NTIS  
SAP: HC A99/MF A01

In Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2, 21 p (SEE N77-21591 12-41)

ABA: Author

ABS: Hydrogen as a replacement for fossile hydrocarbons offers excellent possibilities if an overall hydrogen economy is to be introduced. This depends fundamentally on the development of economic production processes based on thermal or thermoelectrical water splitting using nuclear or solar heat. Within this frame, the use of liquid hydrogen as an alternate fuel will be feasible. Although a number of liquid hydrogen fueled cars were successfully operated, more detailed investigation of the cryogenic system on board a vehicle is necessary. Some essential parameters are considered in order to optimize the cryogenic system. A compact cryogenic fuel tank for a liquid hydrogen powered vehicle integrated to a unit with the fuel processing system is described. Performance data and test results are given.

**Israel Journal of Technology**  
v.14, nos.4-5

**PROCEEDINGS OF THE TENTH ISRAEL CONFERENCE ON MECHANICAL ENGINEERING.** (Held at Ben-Gurion University of the Negev, June 21-22, 1976. Selected papers).

**Israel (Annual) Conference on Mechanical Engineering** June 21-22, 1977  
**Conference on Mechanical Engineering** June 21-22, 1977

The possible utilization of metal hydrides for fuel storage in hydrogen fueled vehicles is discussed. Comparison is made with three other alternatives for hydrogen storage systems, from which metal hydrides seem to exhibit the most convenient properties. The various factors involved in the hydride selection are analysed. A minimum hydrogen content (wt %) of 6-7% is shown to be essential in choosing the appropriate hydride, which excludes most metal-hydrogen systems. Considering some other factors, it is concluded that the only suitable systems are certain magnesium-alloy hydrides. Recent research done in this field is reviewed.

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1976

✓ 3

World Hydrogen Energy Conference, 1st, Miami Beach, 1976.

Conference proceedings: 1st World Hydrogen Energy Conference, 1-3 March 1976, Miami Beach, Florida; presented by International Association for Hydrogen Energy. Clean

ENERGY STORAGE POSSIBILITIES OF ATOMIC HYDROGEN  
R. D. Ethers, J.V. Dugan, Jr., R. Palmer, Colorado State University, Fort Collins, Colorado U.S.A.

ON THE STORAGE OF HYDROGEN BY USE OF CRYO-ADSORBENT  
C. Carpetis, W. Peschka, DFVLR-Institute for Energy Conversion, Stuttgart, Federal Republic of Germany

RECIPROCATING PUMP FOR CONVERSION OF LIQUID HYDROGEN TO HIGH PRESSURE GASEOUS HYDROGEN  
J.S. Meserole, Jr., P.C.T. de Boer, Sibley School of Mechanical and Aerospace Engineering, Cornell University, Ithaca, New York U.S.A.

WILL THE LARGE-SCALE PRODUCTION OF HYDROGEN BE PART OF THE ENERGY PROBLEM OR PART OF ITS SOLUTION?  
G.D. Sauter, Lawrence Livermore Laboratory, Livermore, California U.S.A.

77A33380# ISSUE 14 PAGE 2327 CATEGORY 31  
76/00/00 27 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen storage on highway vehicles - Update '76  
AUTH: A/ECKLUND, E. E.; B/KESTER, F. L. PAA: A/(ERDA,  
Washington, D.C.); B/(IIT Institute of Gas  
Technology, Chicago, Ill.)  
In: World Hydrogen Energy Conference, 1st, Miami  
Beach, Fla., March 1-3, 1976, Proceedings, Volume 2,  
(A77-33326 14-44) Coral Gables, Fla., University of  
Miami; New York, Pergamon Press, 1976, p. 38-3 1  
3B-29.

ABA: S.D.

ABS: The paper presents a brief overview of some of the  
more recent work on hydrogen storage media and a  
rudimentary comparison of these storage methods. In  
addition to the vehicle weight comparisons, a  
comparison of overall fuel utilization efficiencies  
for the various storage concepts is made. The net  
efficiencies are compared for the conversion of coal  
or nuclear fuel to a transportable fuel, transmission  
of the fuel to the vehicle, and the net work performed  
by the vehicle on the road. Factors influencing the  
near-term potential of hydrogen-fueled highway  
vehicles, especially in relation to electric vehicles,  
are identified. It is shown that hydrogen-fueled  
vehicles will not be competitive with electric  
vehicles until large-scale hydrogen production  
facilities are developed.

72V37425 1968 ISS: 00 TL521.3.C6A3 NO. 1216 621.359  
LC-70-601229

UTTL: High-performance light-weight electrodes for  
hydrogen-oxygen fuel cells, by D. Gershberg (and  
others.  
American Cyanamid Company,  
National Aeronautics and Space Administration; for  
sale by the Clearinghouse for Federal Scientific and  
Technical Information, Springfield, Va. Washington)  
xv, 175 p. illus. 27 cm.  
\$3.00 NASA contractor report, NASA CR-1216 Prepared  
under contract no. NAS 3-8524 for Lewis Research  
Center. Bibliography: p. 175.

LC: Fuel cells.

ADDED: Gershberg, D. United States. Lewis Research  
Center, Cleveland. United States. National Aeronautics  
and Space Administration. NASA contractor report  
CR-1216

MAIN-CORP TRACE-SERS-CORP-TITL-AUTH CATLG BY-LC

77A12777 ISSUE 2 PAGE 184 CATEGORY 26 76/00/00  
7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Metallurgical considerations in the production and use  
of FeTi alloys for hydrogen storage  
AUTH: A/SANDROCK, G. D.; B/REILLY, J. J.; C/JOHNSON, J. R.  
PAA: A/(International Nickel Co., Inc., Paul D. Merica  
Research Laboratory, Suffern, N.Y.); C/(Brookhaven  
National Laboratory, Upton, N.Y.)  
In: Intersociety Energy Conversion Engineering  
Conference, 11th, State Line, Nev., September 12-17,  
1976, Proceedings, Volume 1, (A77-12662 02-44) New  
York, American Institute of Chemical Engineers, 1976,  
p. 965-971. ERDA-supported research.

MAJS: /ENERGY STORAGE/HYDROGEN FUELS/IRON ALLOYS/METAL  
HYDRIDES/TITANIUM ALLOYS

MINS: /CRYSTAL STRUCTURE/HYDROGEN-BASED ENERGY/  
INTERMETALLICS/LATTICE PARAMETERS/METALLURGY/  
MICROSTRUCTURE/PHASE DIAGRAMS/TRANSITION METALS

ABA: (Author)

ABS: Hydriding alloys based on the intermetallic compound  
FeTi have potential for the safe and convenient  
storage of hydrogen, both for mobile and stationary  
applications. Optimum technical and economic use of  
these alloys requires an understanding of the physical  
metallurgy of the system and its relation to the  
hydriding behavior. This paper provides an  
introduction to some of the metallurgical factors that  
affect hydriding behavior in FeTi and related alloys.  
Properties considered are hydrogen storage capacity,  
activation, decrepitation (particle size breakdown)  
and hydride stability (dissociation pressure).

72V37985 1970 ISS: 00 TL521.3.C6A3 NO. 1663 621.359  
LC-70-610160

AUTH: A/Astrin, Robert F.

UTTL: Hydrogen-oxygen electrolytic regenerative fuel cells,  
by Robert F. Astrin and Martin G. Klein. Prepared by  
Electro-Optical Systems for Lewis Research Center,  
National Aeronautics and Space Administration; (for  
sale by the Clearinghouse for Federal Scientific and  
Technical Information, Springfield, Va.) Washington,  
vii, 95 p. illus. 27 cm.  
\$3.00 NASA contractor report, NASA CR-1683 Cover  
title.

LC: Fuel cells.

ADDED: Klein, Martin G., 1936- joint author.  
Electro-Optical Systems, Inc., Pasadena, Calif. United  
States. Lewis Research Center, Cleveland. United  
States. National Aeronautics and Space Administration.  
NASA contractor report, NASA CR-1683

MAIN-AUTH TRACE-SERS-CORP-TITL-AUTH CATLG BY-LC

## HYDROGEN - TRANSMISSION AND SAFETY

### IS HYDROGEN A SAFE FUEL?

J. Hord

International Journal of Hydrogen Energy,  
Vol. 3, No. 2, 1978, p. 157-176.

**Abstract**—The safety aspects of hydrogen are systematically examined and compared with those of methane and gasoline. Physical and chemical property data for all three fuels are compiled and used to provide a basis for comparing their various safety features. Each fuel is examined to evaluate its fire hazard, fire damage, explosive and explosive damage characteristics. The fire characteristics of hydrogen, methane and gasoline, while they do not largely favor the preferred use of any one of the three fuels; however, the threat of fuel-air explosion in confined spaces is greatest for hydrogen. Safety criteria for the storage of liquid hydrogen, liquefied natural gas (LNG) and gasoline are compiled and presented. Gasoline is believed to be the easiest and perhaps the best fuel to store because of its lower volatility and narrower flammable and detonable limits. It is concluded that three fuels can be safely stored and used; however, the comparative safety and level of risk for each fuel will be required to establish the relative safety of different fuels for each specific fuel application and step-down accident. The technical data supplied in this paper will provide much of the framework for such analyses.

HYDROGEN IN METALS, by Donald G. Westlake,  
Cameron B. Satterthwaite and John H. Weaver.  
Physics Today, vol. 31, no. 11, November 1978,  
p. 32-39.

Today, many scientists, motivated by concern about the world's energy future, have developed schemes involving hydrogen and metal hydrides for the conservation, conversion and transmission of energy. Many believe that a "hydrogen economy" will have a prominent place in the energy picture of the future. Despite some lay resistance—sometimes referred

to as the "Hindenburg syndrome"—research is going forward on numerous aspects of hydrogen technology. While the old bugaboo, embrittlement, is recognized as an essential consideration in nearly all aspects of this technology, there is probably no reason to consider it an insurmountable problem in any of them.

TP Hydrogen : its technology and implications,  
359 v. 2. Transmission and storage edi-  
.H8 tors: Kenneth E. Cox, K. D. Williamson. —  
H9 Cleveland : CRC Press, c1977.  
v.2 1 1/2 p. : ill. ; 23 cm.  
RR Includes bibliographical references and  
index.

Chapter 1  
Transmission of Gaseous Hydrogen. . . . p. 3 . . . . .  
G. G. Leeth

Chapter 2  
Metal Hydrides as Hydrogen Storage Media and Their Applications . . . p. 13 . . . . .  
J. J. Reilly

Chapter 3  
Liquid Hydrogen Storage and Transmission . . . . p. 51 . . . . .  
F. J. Edeskuty and K. D. Williamson, Jr.

Chapter 4  
Materials for Hydrogen Service. . . . . p. 85 . . . . .  
A. W. Thompson

### STRUCTURAL MATERIALS USE IN A HYDROGEN ENERGY ECONOMY

Anthony W. Thompson  
International Journal of Hydrogen Energy  
Vol. 2, no. 3, 1977,  
p. 299-307.

77A33374\*# ISSUE 14 PAGE 2346 CATEGORY 34  
76/00/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Thermodynamic analysis of alternate energy carriers,  
hydrogen and chemical heat pipes

AUTH: A/COX, K. E.; B/CARTY, R. H.; C/CONGER, W. L.;  
D/SOLIMAN, M. A.; E/FUNK, J. E. PAA: A/(New Mexico,  
University, Albuquerque, N. Mex.); E/(Kentucky,  
University, Lexington, Ky.)

CORP: New Mexico Univ., Albuquerque.; Kentucky Univ.,  
Lexington.

In: World Hydrogen Energy Conference, 1st, Miami  
Beach, Fla., March 1-3, 1976, Proceedings, Volume 2,  
(A77-33326 14-44) Coral Gables, Fla., University of  
Miami; New York, Pergamon Press, 1976, p. 1B-3 to  
1B-16. Research supported by the Westinghouse  
Electric Corp., Electric Power Research Institute and  
NASA.

MAJS: /\*CHEMICAL ENERGY/\*ENERGY TECHNOLOGY/\*HEAT PIPES/\*  
HYDROGEN-BASED ENERGY/\*THERMODYNAMIC PROPERTIES

MINS: / ENERGY STORAGE/ HEAT TRANSMISSION/ THERMAL  
DEGRADATION/ THERMOCHEMISTRY/ TRANSMISSION EFFICIENCY

ABA: S.D.

ABS: The paper discusses the production concept and  
efficiency of two new energy transmission and storage  
media intended to overcome the disadvantages of  
electricity as an overall energy carrier. These media  
are hydrogen produced by water-splitting and the  
chemical heat pipe. Hydrogen can be transported or  
stored, and burned as energy is needed, forming only  
water and thus obviating pollution problems. The  
chemical heat pipe envisions a system in which heat is  
stored as the heat of reaction in chemical species.  
The thermodynamic analysis of these two methods is  
discussed in terms of first-law and second-law  
efficiency. It is concluded that chemical heat pipes  
offer large advantages over thermochemical hydrogen  
generation schemes on a first-law efficiency basis  
except for the degradation of thermal energy in  
temperature thus providing a source of low-temperature  
(800 K) heat for process heat applications. On a

second-law efficiency basis, hydrogen schemes are  
superior in that the amount of available work is  
greater as compared to chemical heat pipes.

77N21635# ISSUE 12 PAGE 1617 CATEGORY 44  
76/03/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: Crash test of a liquid hydrogen automobile

AUTH: A/FINEGOLD, J. G.; B/VANVORST, W. D.

CORP: California Univ., Los Angeles. AVAIL.NTIS SAP: HC  
A99/MF A01

In Miami Univ. First World Hydrogen Energy Conf.  
Proc., Vol. 3 13 p (SEE N77-21626 12-44)

MAJS: /\*AUTOMOBILE ACCIDENTS/\*AUTOMOBILE FUELS/\*HYDROGEN  
FUELS/\*IMPACT RESISTANCE/\*LIQUID HYDROGEN

MINS: / CRASHES/ CRYOGENIC FLUID STORAGE/ FUEL SYSTEMS/  
SAFETY/ TRUCKS

ABA: Author

ABS: Details of the conversion of a U.S. Postal Service  
mail truck to hydrogen-fueled operation are given.  
Specific reference is made to design safety  
considerations. A traffic accident is described that  
caused the mail truck (mounted on a trailer) to turn  
on its side at approximately 20 mph and to finally  
slide to a stop and turn upside down. No one was  
injured, and there was essentially no damage to the  
liquid hydrogen fuel system. The mail truck was driven  
away from the scene of the accident. Suggestions to  
insure the safety of hydrogen-fueled experimental  
vehicles are made.

TJ  
153  
.E4733  
pt.2

Energy development II ... c1976. (Card 2)  
covering papers presented at the National  
Power Engineering Society meetings."  
1. Power resources—Congresses. 2.  
Electric power—Congresses. I. IFEF  
Power Engineering Society. IEFEP Power  
Generation Committee. Energy Development  
Subcommittee. II. Series.

621.4

Hydrogen Transmission: The Significance of Efficiency,  
by C. A. Falcone.....

## HYDROGEN - TRANSPORTATION APPLICATIONS

BOA13199 ISSUE 3 CATEGORY 44 79/00/00 33 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Hydrogen-powered vs. battery-powered automobiles  
AUTH: A/DONNELLY, J. J., JR.; B/GREAYER, W. C.; C/NICHOLS,  
R. J.; D/ESCHER, W. J. D.; E/ECKLUND, E. E. PAA:  
C/(Aerospace Corp., El Segundo, Calif.); D/(Escher  
Technology Associates, St. Johns, Mich.); E/(U.S.  
Department of Energy, Washington, D.C.)  
International Journal of Hydrogen Energy, vol. 4, no.  
5, 1979, p. 411-443.  
MAJS: /\*ELECTRIC AUTOMOBILES/\*HYDROGEN ENGINES/\*  
HYDROGEN-BASED ENERGY/\*LIQUID HYDROGEN/\*METAL HYDRIDES  
/\*STORAGE BATTERIES  
MINS: / COST ESTIMATES/ ECONOMIC FACTORS/ ENERGY TECHNOLOGY/  
HYDROGEN FUELS/ PRODUCT DEVELOPMENT/ PRODUCTION  
MANAGEMENT/ TECHNOLOGICAL FORECASTING/ TECHNOLOGY  
ASSESSMENT/ USER REQUIREMENTS  
ABA: (Author)  
ABS: Two future candidate automobile propulsion systems  
which do not rely upon petroleum or natural gas as an  
energy source have been studied and the resultant  
vehicle characteristics identified. The first vehicle  
system employs a gaseous hydrogen-fueled internal  
combustion engine (ICE) and either a liquid or metal  
hydride energy storage system. The second vehicle  
system employs an electronically controlled electric  
motor power-train and a battery energy storage system.  
Major tasks included in this study were the technical  
and economic assessments of the state of the art and  
future alternatives in hydrogen production and  
delivery, the hydrogen vehicle assessment, the  
battery-electric vehicle assessment and the comparison  
of the principal vehicle alternative in 1985, 1990 and  
2000. The comparison includes weight, size, cost,  
energy and design range relationships and the  
implications on expenditure of all major energy  
sources. The study is summarized, results presented  
and conclusions drawn. Comments are made on the future  
roles of hydrogen and electricity in automobile  
propulsion.

RON13297# ISSUE 4 PAGE 454 CATEGORY 28 RPT#:  
LA-UR-79-621 CONF-790815-2 CNT#: W-7405-ENG-36  
79/00/00 17 PAGES UNCLASSIFIED DOCUMENT

UTTL: Liquid hydrogen as an automotive fuel  
AUTH: A/STEWART, W. F.  
CORP: Los Alamos Scientific Lab., N. Mex. AVAIL.NTIS  
SAP: HC A02/MF A01  
Presented at the 1979 Cryog. Eng. Conf., Madison,  
Wis., 21-24 Aug. 1979  
MAJS: /\*AUTOMOBILE FUELS/\*ENERGY POLICY/\*HYDROGEN FUELS/\*  
LIQUID HYDROGEN/\*TRUCKS  
MINS: / AUTOMATIC CONTROL/ CRYOGENIC FLUID STORAGE/ FUEL  
TANKS  
ABA: DOE  
ABS: Hydrogen fuel projects involving six vehicles and six  
hydrogen liquid container designs are discussed. It is  
shown that service (refueling) stations and bulk  
distribution systems can be built using present  
technology. These can be similar in concept to the  
present service stations and distribution systems.  
Vehicle refueling and bulk liquid hydrogen transfer  
will probably be computer controlled as completely as  
possible. Liquid hydrogen can begin its entry into the  
automotive fuel picture as a fuel for fixed base  
vehicles such as trucks, buses, taxis, etc., and  
expand into the private sector as its availability  
increases.

LIQUID HYDROGEN FUELLED, EXPERIMENTAL CARGO AIRLINE.

Aircraft Engineering, vol 51, no 12, December 1979,  
p. 17-18.

BON10328 ISSUE 1 PAGE 45 CATEGORY 25 79/00/00  
116 PAGES UNCLASSIFIED DOCUMENT

UTTL: A two-dimensional model of the interaction of a transverse jet in a supersonic stream with application to supersonic combustion TLSP: Ph.D. Thesis

AUTH: A/ROGERS, R. C.

CORP: North Carolina State Univ. at Raleigh. SAP: Avail: Univ. Microfilms Order No. 7923066

MAJS: /\*COMBUSTION CHAMBERS/\*DUCTED FLOW/\*HYDROGEN FUELS/\* JET MIXING FLOW/\*SUPERSONIC JET FLOW

MINS: / COMPUTER PROGRAMS/ FUEL INJECTION/ MATHEMATICAL MODELS/ TWO DIMENSIONAL FLOW

ABA: Dissert. Abstr.

ABS: The ability of the present model to approximate the elliptic flow in the transverse jet region is evaluated by comparison of the predictions from the numerical calculation with experimental data. These data were obtained for the mixing and reaction downstream of a transverse hydrogen jet in a supersonic reacting flow configuration representative of a supersonic combustor. The generally favorable agreement in the trend of these data and the theoretical predictions indicate that the present model can provide the needed computational tool for the analysis and design of supersonic combustors with transverse fuel injection.

79N27140\*# ISSUE 18 PAGE 2365 CATEGORY 7 RPT#:  
NASA-TM-79196 E-062 79/00/00 22 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Turbine engine altitude chamber and flight testing with liquid hydrogen

AUTH: A/CONRAD, E. W.

CORP: National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A02/MF A01

Presented at the Intern. DGLR/DFVLR Symp. on Hydrogen

In Air Transportation, Stuttgart, 11-14 Sep. 1979

MAJS: /\*ALTITUDE TESTS/\*FLIGHT TESTS/\*LIQUID HYDROGEN/\* TURBINE ENGINES

MINS: / BOOSTER ROCKET ENGINES/ COMMERCIAL AIRCRAFT/ ENGINE TESTS/ FLIGHT TESTS/ FUEL CONSUMPTION/ HYDROGEN/ JET AIRCRAFT/ PUMPS/ TURBINE PUMPS

ABA: S.E.S.

ABS: Flight engine experiments using liquid hydrogen fuel were reviewed. A few implications of the results to modern turbine engines are presented. A subsequent contract dealing with a positive displacement pump operating on liquid hydrogen is discussed, and some aspects of liquid hydrogen propellant systems, reflected by rocket booster experience are treated.

79A51846 ISSUE 23 PAGE 4378 CATEGORY 44  
79/00/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Cryogenic hydrogen storage and refueling for automobiles

AUTH: A/PESCHKA, W.; B/CARPETIS, C. PAA: B/(Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Technische Physik, Stuttgart, West Germany)

In: Intersociety Energy Conversion Engineering Conference, 14th, Boston, Mass., August 5-10, 1979.

Proceedings, Volume 1. (A79-51276 23-44) Washington, D.C.: American Chemical Society, 1979, p. 763-767.

MAJS: /\*AUTOMOBILE FUELS/\*CRYOGENIC FLUID STORAGE/\* HYDROGEN-BASED ENERGY/\*LIQUID HYDROGEN/\*TRANSPORTATION ENERGY

MINS: / BLOCK DIAGRAMS/ CRYOGENIC EQUIPMENT/ ENERGY TECHNOLOGY/ TABLES (DATA)

ABA: (Author)

ABS: Based on earlier papers, new test results and experiences are reported about two tanks for liquid hydrogen, specially developed for automobile applications. Test results about evaporation rate, filling procedure and safety aspects are given. Further test results from a semi-automatic filling station for liquid hydrogen are given. Handling and comfort of the refueling unit is comparable to that of self-service gas stations. This refueling unit, designed and constructed only for the purpose of demonstration of liquid hydrogen handling by untrained people, makes it possible to represent a basis for corresponding industrial developments.

79N18057\*# ISSUE 9 PAGE 1105 CATEGORY 28 RPT#:  
NASA-CR-158991 CNT#: NAS1-14698 79/02/00 70 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Study of hydrogen recovery systems for gas vented while refueling liquid-hydrogen fueled aircraft

AUTH: A/BAKER, C. R.

CORP: Union Carbide Corp., Tonawanda, N.Y. AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /\*AIRCRAFT FUELS/\*GAS RECOVERY/\*LIQUID HYDROGEN  
MINS: / AIRCRAFT DESIGN/ COLD GAS/ COST ESTIMATES/ ECONOMIC ANALYSIS/ ENERGY CONSERVATION/ FLIGHT TESTS/ HYDROGEN FUELS/ VENTS

ABA: S.E.S.

ABS: Methods of capturing and reliquefying the cold hydrogen vapor produced during the fueling of aircraft designed to utilize liquid hydrogen fuel were investigated. An assessment of the most practical, economic, and energy efficient of the hydrogen recovery methods is provided.

79A51100\*# ISSUE 23 PAGE 4306 CATEGORY 28  
79/09/00 37 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Comparison of alternate fuels for aircraft  
AUTH: A/WITCOFSKI, R. D. PAA: A/(NASA, Langley Research Center, Hampton, Va.)  
CORP: National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.  
Deutsche Gesellschaft fuer Luft- und Raumfahrt and Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, International Symposium on Hydrogen in Air Transportation, Stuttgart, West Germany, Sept. 11-14, 1979. Paper, 37 p.  
MAJS: /\*AIRCRAFT FUEL SYSTEMS/\*AIRPORTS/\*HYDROGEN FUELS/\*JET ENGINE FUELS/\*LIQUEFIED GASES/\*SYNTHANE  
MINS: / AIRCRAFT FUELS/ COST ESTIMATES/ HYDROCARBON FUELS/ LIQUID HYDROGEN/ SYNTHETIC FUELS/ TECHNOLOGY

#### ASSESSMENT

ABA: V.T.

ABS: A comparison of candidate alternate fuels for aircraft is presented. The fuels discussed include liquid hydrogen, liquid methane, and synthetic aviation kerosene. Each fuel is evaluated from the standpoint of production, transmission, airport storage and distribution facilities, and use in aircraft. Technology deficient areas for cryogenic fuels, which should be advanced prior to the introduction of the fuels into the aviation industry, are identified, as are the cost and energy penalties associated with not achieving those advances. Environmental emissions and safety aspects of fuel selection are discussed. A detailed description of the various fuel production and liquefaction processes and their efficiencies and economics is given.

A Plan for active development of LH<sub>2</sub> for use in Aircraft  
By: G.D. Brewer

Int. J. Hydrogen Energy, Vol. 4, No. 3, 1979, P. 169-177

**Abstract**—This statement reviews the probable future fuel problem facing the commercial air transport industry and suggests an innovative course of action. The plan involves creation of an experimental airline equipped with four liquid hydrogen-fueled, wide-body aircraft flying commercial cargo on a regularly scheduled basis between the United States, Western Europe and the Middle East. Development of facilities incorporating advanced technologies for production and liquefaction of hydrogen at each of four major air terminals is an integral part of the plan.

79A45600 ISSUE 20 PAGE 3722 CATEGORY 3  
79/00/00 10 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Liquid hydrogen fueled commercial aircraft  
AUTH: A/BREWER, G. D. PAA: A/(Lockheed-California Co., Burbank, Calif.)  
In: Hydrogen for energy distribution; Proceedings of the Symposium, Chicago, Ill., July 24-28, 1978. (A79-45576 20-44) Chicago, Institute of Gas Technology, 1979, p. 541-550.  
MAJS: /\*AIRCRAFT FUELS/\*AIRLINE OPERATIONS/\*COMMERCIAL AIRCRAFT/\*HYDROGEN FUELS/\*LIQUID HYDROGEN  
MINS: / AIR CARGO/ AIRCRAFT CONFIGURATIONS/ CIVIL AVIATION/ COAL GASIFICATION/ FEASIBILITY ANALYSIS/ TRANSPORT AIRCRAFT  
ABA: (Author)

ABS: This statement reviews the probable future fuel problem facing the commercial air transport industry and suggests an innovative course of action. The plan involves creation of an experimental airline equipped with four liquid hydrogen-fueled, wide-body aircraft flying commercial cargo on a regularly scheduled basis between the United States, Western Europe, and the Middle East. Development of facilities incorporating advanced technologies for production and liquefaction of hydrogen at each of four major air terminals is an integral part of the plan.

79N33347# ISSUE 24 PAGE 3197 CATEGORY 28 RPT#:  
NTIS/PS-79/0779/3 NTIS/PS-78/0635 NTIS/PS-77/0522  
NTIS/PS-76/0458 79/08/00 191 PAGES UNCLASSIFIED DOCUMENT  
Supersedes NTIS/PS-78/0635; NTIS/PS-77/0522;  
NTIS/PS-76/0458

UTTL: Hydrogen use as a fuel. Citations from the NTIS data base TLSP: Progress Report, 1964 - Jun. 1979  
AUTH: A/HUNDEMANN, A. S.  
CORP: National Technical Information Service, Springfield, Va. AVAIL NTIS SAP: HC \$28.00/MF \$28.00  
MAJS: /\*BIBLIOGRAPHIES/\*ELECTRIC GENERATORS/\*HYDROGEN FUELS /\*MOTOR VEHICLES/\*TRANSPORTATION  
MINS: / AIRCRAFT FUELS/ MATERIALS HANDLING/ STORAGE/ TECHNOLOGY ASSESSMENT  
ABA: GRA

ABS: Federally-funded research studies pertaining to the technical feasibility of using hydrogen as a fuel for vehicular transportation, electric power generation, and both subsonic and supersonic aircraft are discussed. One hundred and eighty six abstracts, 24 of which are new entries to the previous edition are reported.

BOA13225 ISSUE 3 CATEGORY 44 79/11/00 3 PAGES

UNCLASSIFIED DOCUMENT

UTTL: Gasoline's alternatives are feasible

AUTH: A/MISKELL, J. T.

Energy, vol. 4, Fall 1979, p. 22-24.

MAJS: /\*COAL LIQUEFACTION/\*ELECTRIC MOTOR VEHICLES/\*GASOHOL (FUEL)/\*HYDROCARBON FUEL PRODUCTION/\*HYDROGEN FUELS/\*SYNTHANE

MINS: / COAL UTILIZATION/ ENERGY TECHNOLOGY/ RESEARCH MANAGEMENT/ TABLES (DATA)/ TECHNOLOGY ASSESSMENT

ABA: A. L. W.

ABS: Various alternatives to petroleum-derived gasoline for use as automobile fuels are discussed. Results of a recent American Gas Association study which indicate substantial cost savings (with costs comparable to gasoline) to be obtained with coal-derived methane gas as compared with synthetic gasoline derived from coal or shale oil or with electricity are presented. The major features of gasoline, natural gas and electric automobiles are compared, noting similarities between gasoline and natural gas vehicles, and hydrocarbon and sulfur oxide emissions in fuel processing and utilization are compared for electric, coal gas, coal gasoline, shale oil gasoline, natural gas and conventional gasoline vehicles. Limitations on the use of methane-fueled vehicles, including current conversion costs and the lack of a fuel distribution system, are indicated.

A Plan for active development of LH<sub>2</sub> for use in Air-craft  
By: G.D. Brewer

Int. J. Hydrogen Energy, Vol. 4, No. 3, 1979, P. 169-177

Abstract. This statement reviews the probable future fuel problem facing the commercial air transport industry and suggests an innovative course of action. The plan involves creation of an experimental airline equipped with four liquid hydrogen-fueled, wide-body aircraft flying commercial cargo on a regularly scheduled route between the United States, Western Europe and the Middle East. Development of facilities incorporating advanced technologies for production and liquefaction of hydrogen at each of four major air terminals is a integral part of the plan.

LOCKHEED URGES HYDROGEN FUEL.

Interavia, vol 34, September 1979. p. 872-873.

BOA10034\*# ISSUE 1 PAGE 7 CATEGORY 7 79/09/00

20 PAGES UNCLASSIFIED DOCUMENT

UTTL: Turbine engine altitude chamber and flight testing with liquid hydrogen

AUTH: A/CONRAD, E. W. PAA: A/(NASA, Lewis Research Center, Cleveland, Ohio)

CORP: National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

Deutsche Gesellschaft fuer Luft- und Raumfahrt and

Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, International Symposium on Hydrogen in Air Transportation, Stuttgart, West Germany, Sept. 11-14, 1979, Paper, 20 p.

MAJS: /\*ENGINE TESTS/\*HYDROGEN FUELS/\*LIQUID HYDROGEN/\*PROPULSION SYSTEM PERFORMANCE/\*TURBINE ENGINES

MINS: / ALTITUDE TESTS/ COMBUSTION EFFICIENCY/ FLIGHT TESTS/ GRAPHS (CHARTS)/ TEMPERATURE DISTRIBUTION

ABA: (Author)

ABS: In the late fifties the Lewis Research Center evaluated experimentally the use of hydrogen using three different turbojet engines in altitude test chambers. One of these engines was later flown experimentally using liquid hydrogen fuel. This paper is a brief overview of the significant aspects of this exploratory research and gives a few implications of the results to modern turbine engines. A subsequent contract dealing with a positive displacement pump operating on liquid hydrogen is discussed and some aspects of liquid hydrogen propellant systems, reflected by rocket booster experience are treated briefly. Areas requiring further research and technology effort are delineated.

HYDROGEN AIRCRAFT EXPERIMENT RECEIVES FAVORABLE RESPONSE. A. Reed

Air Transport World, vol 16, no 11, November 1979, p. 105-108.

EXPERIMENTAL AIRLINE WOULD FLY HYDROGEN-FUELED FREIGHTERS.

Machine Design, vol 51, no 27, November 22, 1979, p. 12.

79A51850 ISSUE 23 PAGE 4306 CATEGORY 31 CNT#:  
EC-77-X-01-2752 79/00/00 6 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Survey of liquid hydrogen container technology for  
highway vehicle fuel system applications

AUTH: A/ESCHER, W. J. D.; B/ECKLUND, E. E. PAA:  
A/(Escher: Foster Technology Associates, Inc., St.  
Johns, Mich.); B/(U.S. Department of Energy,  
Washington, D.C.)

In: Intersociety Energy Conversion Engineering  
Conference, 14th, Boston, Mass., August 5-10, 1979,  
Proceedings, Volume 1. (A79-51726 23-44) Washington,  
D.C., American Chemical Society, 1979, p. 796-795.

MAJS: /AUTOMOBILE FUELS/CRYOGENIC FLUID STORAGE/  
HYDROGEN-BASED ENERGY/LIQUID HYDROGEN

MINS: /AUTOMOBILES/CRYOGENIC EQUIPMENT/ENERGY TECHNOLOGY/  
PRODUCT DEVELOPMENT/RESEARCH AND DEVELOPMENT/  
TRANSPORTATION ENERGY

ABA: V.T.

ABS: A review of several development and demonstration  
projects involving liquid hydrogen containers for  
fuel-system service in highway transportation systems  
is presented. Preliminary cryogenic container industry  
projections of rough-estimate production costs of  
liquid hydrogen containers specifically engineered for  
vehicle use are studied. A semiautomatic liquid  
hydrogen service station developed in West Germany is  
described. Three different cryogenic hydrogen  
container systems were evaluated in vehicle testing in  
which the engine was converted to hydrogen operation.

78A36445 ISSUE 15 PAGE 2760 CATEGORY 44  
78/05/00 3 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen fuel and its application to vehicular systems

AUTH: A/BILLINGS, R. E. PAA: A/(Billings Energy Corp.,  
Provo, Utah)  
Energy, vol. 3, Spring 1978, p. 28-30.

ABA: M.L.

ABS: Some hydrogen storage systems for hydrogen-fuel  
automobiles are surveyed, and the engine efficiency of  
gasoline and hydrogen fuel automobiles is compared.  
Advantages and disadvantages of iron-titanium hydride  
and cryogenic hydrogen storage systems are examined,  
safety tests of a metal hydride tank are reported, and  
the lack of air pollution caused by hydrogen  
combustion is noted. The operational economics of  
hydrogen fuel use is considered with attention to the  
efficiencies of generating synthetic hydrogen,  
methanol, gasoline, and electricity from coal. It is  
suggested that a taxi fleet could be used to test the  
application of hydrogen as a vehicular fuel sometime  
during the 1980-1985 period.

79A51782 ISSUE 23 PAGE 4438 CATEGORY 85  
79/00/00 6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Prediction of vehicle performance and its sensitivity  
to component improvements Application to electric and  
H2-fueled vehicles

AUTH: A/MCALEVY, R. F., III PAA: A/(Stevens Institute of  
Technology, Hoboken, N.J.)

In: Intersociety Energy Conversion Engineering  
Conference, 14th, Boston, Mass., August 5-10, 1979,  
Proceedings, Volume 1. (A79-51726 23-44) Washington,  
D.C., American Chemical Society, 1979, p. 337-342.

ABA: (Author)

ABS: Simple, algebraic equations were used to relate  
vehicle mass, WT, and energy consumption, C, to  
parameters describing vehicle components  
characteristics. By differentiation, the sensitivity  
of WT and C to component improvements was determined  
and used to formulate a rational R & D investment  
policy. For H2-fueled vehicles and electric vehicles,  
EV's, R & D investment in improving vehicle  
energy-storage device was predicted to produce greater  
decreases in WT and C than investment in the  
power-train. Using a published forecast of component  
characteristics, WT and C for both kinds of vehicles  
were projected into future time-frames. Numerical  
results are presented.

80A14703# ISSUE 3 CATEGORY 85 79/00/00 12 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Hydrogen fuel applications for urban transit

AUTH: A/MACCARLEY, C. A. PAA: A/(Denver, University,  
Denver, Colo.)

In: Society and Aerospace Technology Workshop, Los  
Angeles, Calif., November 15, 1979, Proceedings,  
(A80-14701 03-85) Los Angeles, American Institute of  
Aeronautics and Astronautics, Inc., North Hollywood,  
Calif., Western Periodicals Co., 1979, p. 45-62.

ABS: It is noted that hydrogen represents a fuel that is  
independent of oil supplies and virtually  
non-polluting. Also NASA and the aerospace industry  
have contributed to an increased understanding of the  
fuel properties of hydrogen, and its increased range  
of applications. It is reported that technology now  
exists for the conversion of city buses, trucks and  
rail systems to hydrogen fuel. The paper discusses the  
technical aspects of hydrogen vehicle systems, and  
summarizes past and present working examples. Finally,  
an integrated refuse disposal hydrogen fueled transit  
system for Denver, Colorado is proposed.

79A45601 ISSUE 20 PAGE 3837 CATEGORY 85  
79/00/00 17 PAGES UNCLASSIFIED DOCUMENT

UTTL: Assessment of hydrogen-fueled intercity trucking and rail transportation  
AUTH: A/FOSTER, R. W. PAA: A/(Escher Technology Associates, St. Johns, Mich.)  
In: Hydrogen for energy distribution: Proceedings of the Symposium, Chicago, Ill., July 24-28, 1978. (A79-45576 20-44) Chicago, Institute of Gas Technology, 1979. p. 551-567.  
MAJS: /\*AUTOMOBILE FUELS/\*HYDROGEN FUELS/\*RAIL TRANSPORTATION/\*TRANSPORTATION ENERGY  
MINS: / COST ESTIMATES/ ECONOMIC FACTORS/ ENERGY TECHNOLOGY/ LIQUID HYDROGEN/ SAFETY FACTORS/ TABLES (DATA)  
ABA: M.E.P.  
ABS: Hydrogen is generally acknowledged to be a 'long term' alternative fuel candidate which will begin to see significant use in the post 2000 time frame. The use of hydrogen as an alternative fuel in both the automotive industry and the rail industry is discussed. Attention is given to technological considerations such as engine conversion, fuel delivery system design, safety and reliability, as well as the effects on business operation practices and business economics. While it is concluded that there are significant problems to be overcome these problems do not preclude this fuel conversion. However, while the safety problems associated with fuel production, transmission and distribution appear acceptable based on past experience, no analysis of the risk management problems associated with the use of hydrogen in these transportation systems has been accomplished to date.

TJ Energy Technology Conference, 5th, Washington, D.C., 1978.  
153 Energy technology V : challenges to  
.E4787 technology : proceedings of the fifth  
1978 Energy Technology Conference, February 27-  
March 1, 1978, Washington, D.C. / edited by  
Richard P. Hill. -- Washington : Government  
Institutes, 1978.  
xiii, 1063 p. : ill.  
1. Power (Mechanics)--Congresses.

HYDROGEN ECONOMY: AN ALTERNATIVE *p. 1036*  
Barrie C. Campbell, Vice President, Research, Billings Energy Corporation

LRC-69800

79N16999\*# ISSUE 8 PAGE 959 CATEGORY 28  
78/00/00 18 PAGES UNCLASSIFIED DOCUMENT

UTTL: NACA research on hydrogen for high altitude aircraft  
CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS SAP: MF A01; HC S0D  
In Its Liquid Hydrogen as a Propulsion Fuel, 1945-1959 p 95-112 (SEE N79-16994 08-28)  
MAJS: /\*HIGH ALTITUDE/\*HIGH SPEED/\*HYDROGEN/\*HYDROGEN FUELS /\*RESEARCH  
MINS: / B-57 AIRCRAFT/ ENGINE DESIGN/ FUEL TANKS/ HISTORIES/ SUPERSONIC AIRCRAFT/ TECHNOLOGY ASSESSMENT/ TURBOJET ENGINES  
ABA: G.Y.  
ABS: In 1954, the fuels and propulsion panel of the Scientific Advisory Board met to survey the major aspects of the propulsion program of the Air Force. The panel was greatly interested in high-energy fuels and the Air Force program on them. A proposal was introduced to use hydrogen in a high altitude aircraft powered by a unique engine called Rex 1. This touched off a strong renewal of interest in liquid hydrogen for aircraft. The historical investigations, during 1954-1957, of liquid hydrogen for high altitude aircraft and missiles are discussed. The experiments began with an investigation of low pressure combustion in a single turbojet combustor, extended to other components and complete turbojet engine systems, and culminated in the first (and only) flight experiments.

A partial list of the many contributions of this research effort is presented.

78N30324# ISSUE 21 PAGE 2787 CATEGORY 37  
78/03/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Data for design of a hydrogen engine: A progress report  
AUTH: A/ADT, R. R., JR.; B/SWAIN, M. R.  
CORP: Miami Univ., Fla. AVAIL.NTIS SAP: HC A20/MF AG1  
In DOE Highway Vehicle Systems p 341-350 (SEE N78-30293 21-31)  
MAJS: /\*DATA BASES/\*ENGINE DESIGN/\*HYDROGEN ENGINES  
MINS: / DATA PROCESSING/ ENERGY TECHNOLOGY/ FUEL SYSTEMS  
ABA: L.S.  
ABS: A data base is developed for hydrogen engine design and also hydrogen fuel system design. A secondary objective is to try to make sense out of existing hydrogen engine data. Much of the existing data is incoherent.

80A15993 ISSUE 4 CATEGORY 44 CNT#: EEC-07076-EHF  
78/00/00 25 PAGES UNCLASSIFIED DOCUMENT DCAF  
A324000

UTTL: Technico economic study of the use of hydrogen and methanol for road transport

AUTH: A/BREELLE, Y.; B/CHAUVEL, A.; C/LEPRINCE, P.;  
D/MEYER, C.; E/GELIN, P.; F/PETIT, G. PAA:  
D/(Institut Francais du Petrole, Rueil-Malmaison,  
Hauts-de-Seine, France); F/(Commissariat a l'Energie  
Atomique, Centre d'Etudes Nucleaires de Saclay,  
Gif-sur-Yvette, Essonne, France)  
In: Seminar on Hydrogen as an Energy Vector: Its  
Production, Use and Transportation, 1st. Brussels,  
Belgium, October 3, 4, 1978, Proceedings. (ABO-15976  
04-25) Luxembourg, Commission of the European  
Communities, 1978, p. 506-530. European Economic  
Communities

ABA: A.L.W.

ABS: In 1977, the French Commissariat a l'Energie Atomique and the Institut Francais du Petrole began a study of the technical and economic feasibility of using hydrogen and methanol as automotive energy sources. The paper details the portion of the study related to hydrogen distribution and summarizes the main conclusions concerning methanol. Options for the large-scale storage and transportation of gaseous and liquid hydrogen and hydrides are examined, and different systems of energy conversion and vehicular hydrogen storage are considered. Hydrogen distribution stations are discussed, and evaluations of the economics and energetics of hydrogen use as an automotive fuel are presented. It is concluded that hydrogen internal combustion engines cannot compete with gasoline engines in the areas of primary energy consumption and fuel cost, however a hydrogen fuel cell provides appreciable energy savings at a fuel cost comparable to that of gasoline. The optimal use of methanol has been found to be as a 15 percent methanol-gasoline mixture with methanol produced in a local unit and delivered to the service station by barge and trailer.

### SOME EARLY PERSPECTIVES ON GROUND REQUIREMENTS OF LIQUID HYDROGEN AIR TRANSPORTS

P. F. Korycinski

International Journal of Hydrogen Energy, vol. 3, no. 3, 1978, p. 335-346

79N17000\*# ISSUE 8 PAGE 960 CATEGORY 28  
78/00/00 27 PAGES UNCLASSIFIED DOCUMENT

UTTL: New Initiatives in high altitude aircraft

CORP: National Aeronautics and Space Administration,  
Washington, D. C. AVAIL:NTIS SAP: MF A01; HC S0D  
In its Liquid Hydrogen as a Propulsion Fuel, 1945-1959  
p 112-139 (SEE N79-16994 08-28)

MAJS: /\*ENGINE DESIGN/\*HIGH ALTITUDE/\*HYDROGEN FUELS/\*  
TECHNOLOGY ASSESSMENT

MINS: / AIRCRAFT ENGINES/ ECONOMIC ANALYSIS/ HISTORIES/  
HYDROGEN ENGINES/ HYDROGEN OXYGEN ENGINES/  
RECONNAISSANCE AIRCRAFT/ TURBOJET ENGINES/ TURBOCKET  
ENGINES/ U-2 AIRCRAFT

ABA: G.Y.

ABS: The Air Force began planning work to achieve very-high altitude flight in late 1952. In 1954, a high-altitude reconnaissance airplane that was sponsored by the government was proposed. This became the U-2 aircraft. In 1954, a novel hydrogen fueled subsonic airplane capable of high-altitude flight was proposed. Although never built, it spawned considerable interest and activity on the potential of hydrogen as a fuel. An account of the contract work undertaken to develop the airplane and its engine is presented. As interest grew and specifications changed from a subsonic to a supersonic airplane the required engine power increased. This meant a much larger hydrogen fueled engine. The growth in engine size effectively took the contractor out of competition. This case history of an inventor and contractor and their frustrations with a single customer (U.S. Government) is analyzed.

78V10219 1978 ISS: 00 TL785.558 629.47522 LC-77-26960

AUTH: A/Sloop, John L.

UTTL: Liquid hydrogen as a propulsion fuel, 1945-1959 / John L. Sloop.

Scientific and Technical Information Office, National Aeronautics and Space Administration, Washington : xiv, 325 p. : ill. : 25 cm.  
The NASA history series NASA SP : 4404 includes index. Bibliography: p.

LC: Rockets (Aeronautics) -- Fuel. Hydrogen as fuel.

ADDED: United States, National Aeronautics and Space Administration. The NASA history series. United States, National Aeronautics and Space Administration. NASA SP : 4404.

NASA: / HYDROGEN FUELS/ LIQUID HYDROGEN/ LIQUID ROCKET PROPELLANTS

KN: / TL785.5634 MA: / TL785.5634 1978

MAIN-AUTH TRACE-SERS-CORP-TITL\* CATLG BY-LC

/ / AVAIL: / JOHNSON/ KENNEDY/ LANGLEY/ MARSHALL

79A27656 ISSUE 10 PAGE 1750 CATEGORY 7  
78/00/00 18 PAGES UNCLASSIFIED DOCUMENT

UTTL: Cryohydrogen-fuel for tomorrow's commercial aircraft

AUTH: A/BREWER, G. D. PAA: A/(Lockheed-California Co.,  
Burbank, Calif.)

In: Applications of cryogenic technology. Volume 7 -  
Proceedings of the Conference on Cryogenic Energy  
Systems, Oak Brook, Ill., May 16-18, 1978. (A79-27651  
10-44) Flushing, N.Y., Scholium International, Inc.,  
1978, p. 87-104.

MAJS: /\*AIRCRAFT FUELS/\*COMMERCIAL AIRCRAFT/\*HYDROGEN FUELS  
/\*LIQUID HYDROGEN

MINS: / CRYOGENIC FLUID STORAGE/ ENERGY TECHNOLOGY/ FUEL  
TANKS/ HYDROGEN-BASED ENERGY/ TRANSPORTATION ENERGY  
ABA: B.J.

ABS: Studies performed for NASA on the potential use of  
liquid hydrogen as an aircraft fuel are summarized.  
Particular consideration is given to a recently  
completed study on how utilization of LH2 will affect  
the design of the engine and fuel system for a  
representative subsonic passenger transport. It is  
concluded that adoption of cryohydrogen as the fuel  
for future commercial aircraft will reduce the need  
for oil imports, reduce pollution, and provide lower  
cost and more energy-efficient transportation.

79A20773 ISSUE 7 PAGE 1117 CATEGORY 5 78/12/11  
12 PAGES UNCLASSIFIED DOCUMENT

UTTL: The potential of liquid hydrogen as a military  
aircraft fuel

AUTH: A/MIKOLOWSKY, W. T.; B/NOGGLE, L. W. PAA: A/(Rand  
Corp., Washington, D.C.); B/(USAF, Wright-Patterson  
AFB, Ohio)

International Journal of Hydrogen Energy, vol. 3, Dec.  
11, 1978, p. 449-460.

MAJS: /\*AIRCRAFT FUELS/\*HYDROGEN FUELS/\*LIQUID HYDROGEN/\*  
MILITARY TECHNOLOGY

MINS: / COST ANALYSIS/ HYDROGEN PRODUCTION/ HYDROGEN-BASED  
ENERGY/ MILITARY AIRCRAFT

ABA: M.L.

ABS: The paper is concerned with the possible use of liquid  
hydrogen as a fuel for very large aircraft (with  
maximum gross weights in excess of one million  
pounds). Life-cycle costs and life-cycle energy  
consumption for both synthetic jet-fuel and liquid  
hydrogen-fueled aircraft are compared, and it is found  
for these coal-derived fuels that synthetic jet fuel  
is more attractive than liquid hydrogen as a military  
aircraft fuel. Strategic airlift mission and  
station-keeping missions are considered.

79A21699 ISSUE 7 PAGE 1233 CATEGORY 44 CNT#:  
EY-76-C-02-0016 78/00/00 22 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Synthesis and properties of useful metal hydrides - A  
review of recent work at Brookhaven National  
Laboratory

AUTH: A/REILLY, J. J. PAA: A/(Brookhaven National  
Laboratory, Upton, N.Y.)

In: Hydrides for energy storage; Proceedings of the  
International Symposium, Gello, Norway, August 14-19,  
1977. (A79-21676 07-44) Oxford, Pergamon Press, Ltd.,  
1978, p. 301-322.

MAJS: /\*HYDROGEN-BASED ENERGY/\*HYDROGENATION/\*INTERMETALLICS  
/\*METAL HYDRIDES/\*SYNTHESIS/\*THERMODYNAMIC PROPERTIES

MINS: / CHEMICAL REACTIONS/ CHROMIUM ALLOYS/ CRYSTAL  
STRUCTURE/ DECOMPOSITION/ ENERGY TECHNOLOGY/ FREE  
ENERGY/ MAGNESIUM ALLOYS/ METASTABLE STATE/ NICKEL  
ALLOYS/ TITANIUM ALLOYS

ABA: M.L.

ABS: Intermetallic hydride properties and the application  
of intermetallic compounds to the storage of hydrogen  
are discussed. Systems considered include Mg-Cu  
alloys, Mg-Ni alloys, iron-titanium alloys, and Ti-Cr

alloys. Predictive criteria are presented for  
selecting intermetallic compounds likely to form  
hydrides and ascertaining certain properties of the  
hydrides.

79N17001\*# ISSUE 8 PAGE 960 CATEGORY 28  
78/00/00 26 PAGES UNCLASSIFIED DOCUMENT

UTTL: Suntan

CORP: National Aeronautics and Space Administration,  
Washington, D. C. AVAIL.NTIS SAP: MF 401; HC 50D  
In its Liquid Hydrogen as a Propulsion Fuel, 1945-1959  
p 131-166 (SEE N79-16994 08-28)

MAJS: /\*AIRCRAFT DESIGN/\*ENGINE DESIGN/\*HYDROGEN FUELS/  
LIQUID HYDROGEN

MINS: / ENGINE TESTS/ HEAT EXCHANGERS/ LOCKHEED AIRCRAFT/  
ROCKET ENGINES/ SUPERSONIC AIRCRAFT/ TURBOFAN ENGINES  
ABA: G.Y.

ABS: The largest and most extraordinary project for using  
hydrogen as a fuel was carried out by the Air Force in  
1956-1958 in supersecrecy. The project was code-named  
Suntan, and even this was kept secret. Suntan was an  
effort by the Air Force to develop a hydrogen-fueled  
airplane with performance superior to the secret spy  
plane, the U-2. The aircraft and engine design for  
this project is reviewed. Due to technological  
problems and conflicting technical views over its  
feasibility and the best way to accomplish  
reconnaissance, the Suntan project simply faded away  
and was cancelled in 1959.

TP Applications of cryogenic technology. v. 7  
 480 ...cl<sup>078</sup> (Card ?)  
 .A6 ISBN 0-87936-000-7  
 v.7 1. Low temperature engineering--Addresses,  
 essays, lectures. I. Missig, James P.  
 II. Vance, Robert W. III. Cryogenic  
 Society of America. IV. CPVO-78, Oak  
 Brook, Ill., 1978.

6-5. Hydrogen Use **P82** .....

Cryohydrogen--Fuel for Tomorrow's Commercial Aircraft  
 by G. Daniel Brewer .....87

7-1. Introduction .....87

7-2. The Problem .....87

7-3. Alternatives .....89

7-4. LH<sub>2</sub> Aircraft Studies .....92

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7-6. Summary of Effect of LH<sub>2</sub> .....101

7-7. Conclusion .....103

Hydrogen--Potential Key to Tomorrow's Energy Utility  
 by Robert M. Lundberg .....105

Space Shuttle--Bringing Cryohydrogen Technology  
 Down to Earth  
 by James B. Odom .....111

Hydrogen Energy--A Look into the Future  
 by Derek P. Gregory .....127

HYDROGEN BUS COULD ALSO HEAT ITS OWN GARAGE, by  
 David Scott.  
 Popular Science, vol. 213, no. 6, December 1978,  
 p. 72-73.

"We're ready now," Dr. Helmut  
 Buchner of Mercedes-Benz told  
 me. "We could save our city of  
 Stuttgart over one million gallons  
 of petroleum fuel a year by con-  
 verting its fleet of 300 urban buses  
 to run on hydrogen. Heating--and  
 air conditioning--would be free  
 spinoffs, consuming no extra ener-  
 gy."

79N16998\*# ISSUE 8 PAGE 959 CATEGORY 28  
 78/00/00 21 PAGES UNCLASSIFIED DOCUMENT  
 UTTL: NACA research on high-energy propellants  
 CORP: National Aeronautics and Space Administration,  
 Washington, D. C. AVAIL.NTIS SAP: MF A01; HC S0D  
 In its Liquid Hydrogen as a Propulsion Fuel, 1945-1959  
 p 73-93 (SEE N79-16994 (08-28)  
 G. Y.  
 ABA: G. Y.  
 ABS: The National Advisory Committee for Aeronautics  
 (NACA), established in 1915 to develop practical  
 solutions for the problems of flight, showed interest  
 in liquid hydrogen as a fuel in 1939 but did nothing  
 about it for over a decade. In 1950, after  
 organizational changes, NACA sponsored a meeting of  
 rocket experts to discuss the selection of rocket  
 propellants for long range missiles. They recommended  
 the use of liquid hydrogen. A historical account of  
 the research activities which went into advancing  
 liquid hydrogen technology for use as a high-energy  
 propellant is presented.

BON10383# ISSUE 1 PAGE 53 CATEGORY 28 RPT#:  
 HCP/M2752-01 CNT#: EC-77-X-01-2752 78/11/00 66  
 PAGES UNCLASSIFIED DOCUMENT  
 UTTL: Survey of liquid hydrogen container techniques for  
 highway vehicle fuel system applications  
 AUTH: A/ESCHER, W. J. D.  
 CORP: Escher Technology Associates, St. Johns, Mich.  
 AVAIL.NTIS SAP: HC AC4/MF A01  
 MAJS: /HYDROGEN FUELS/LIQUID HYDROGEN/MATERIALS HANDLING  
 /TECHNOLOGY ASSESSMENT/TRANSPORTATION  
 WINS: /CRYOGENIC FLUID STORAGE/ECONOMIC FACTORS/  
 MANUFACTURING/PACKAGING  
 ABA: DOE  
 ABS: The design and operational features of four different  
 liquid hydrogen container types, three of which have  
 served operationally as vehicle fuel tanks, and rough  
 production-lot cost estimates for a nominal 50 gallon  
 horizontal cylindrical liquid hydrogen container  
 applicable to vehicle service are reported. A unique  
 semiautomatic liquid hydrogen service station  
 developed in Germany is described. A general  
 assessment of the state of technology of vehicle  
 hydrogen containers and associated systems is given,  
 including the identification of pacing items  
 recommended to be addressed initially in prospective R  
 and D activities in this field.

✓ 79A21676 ISSUE 7 PAGE 1233 CATEGORY 44  
78/00/00 611 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Hydrides for energy storage; Proceedings of the  
International Symposium, Gellø, Norway, August 14-19,  
1977  
AUTH: A/ANDERSON, A. F.; B/MAELAND, A. J. PAA:  
A/(Institutt for Atomenergi, Kjeller, Norway);  
B/(Allied Chemical Corp., Morristown, N.J.) PAT:  
A/(ED.) SAP: \$60  
Symposium sponsored by the Institutt for Atomenergi  
and Allied Chemical Corp Oxford, Pergamon Press, Ltd.,  
1978. 611 p (For individual items see A79-21677 to  
A79-21717)  
ABA: B.J.  
ABS: Consideration is given to the prospects of hydrogen as  
an energy carrier for the future. structure and  
bonding in metal hydrides, the nature of He-3  
confinement in transition metal hydrides, hydrogen  
adsorption in rare earth intermetallic compounds and  
the use of FeTi-hydrides for production and storage of  
suprapure hydrogen. Papers are also presented on such  
topics as hysteresis effects in metal-hydrogen  
systems, electrochemical utilization of metal  
hydrides, hydrogen storage electrode systems, the  
hydrogen/hydride energy concept, and the metallurgy  
and production of rechargeable hydrides.

✓ 79N21429\*# ISSUE 12 PAGE 1573 CATEGORY 39  
CNT#: NASB-27980 78/00/00 55 PAGES UNCLASSIFIED  
DOCUMENT  
UTTL: Hydrogen embrittlement and its control in  
hydrogen-fueled engine systems  
AUTH: A/CHANDLER, W. T.  
CORP: Rocketdyne, Canoga Park, Calif. AVAIL. NTIS SAP:  
HC A23/MF A01  
In NASA, Langley Res. Center Recent Advan. in  
Structures for Hypersonic Flight, Pt. 1, p 195-249  
(SEE N79-21422 12-39)  
ABA: J.M.S.  
ABS: The nature of hydrogen embrittlement by high pressure  
gaseous hydrogen is described and methods of designing  
SSME gaseous hydrogen systems, including techniques of  
hydrogen embrittlement prevention, are discussed. The  
effects of gaseous hydrogen environments are  
emphasized. Results of extensive investigations of  
gaseous hydrogen environments on metals conducted  
under the SSME program are presented.

#### HYDROGEN - POWERED POSTAL DELIVERY VEHICLE.

Vaughn R. Anderson

Hydrogen Progress, Winter 1978, p. 19-26

A United States Postal Service delivery vehicle (¼ ton DJ-5F) has been converted to operate on hydrogen fuel, under Contract No. 1-4231-B77-0073 with the United States Postal Service. This paper presents details and general specifications of the vehicle and engine conversion, including design of the iron-titanium storage system and of the related controls and safety equip-

ment. Engine modifications include: a gaseous fuel IMPCO carburetor, a water induction system and changes in the ignition system. Power control is obtained by throttling the air-hydrogen mixture. Waste heat in the engine water cooling system is circulated through the hydride tank to drive off hydrogen. The method for recharging the system is also described.

#### THE POTENTIAL OF LIQUID HYDROGEN AS A MILITARY AIRCRAFT FUEL, by W. T. Mikolowsky.

International Journal of Hydrogen Energy, vol. 3, no. 4, 1978, p.449-460.

Abstract—As domestic petroleum supplies diminish and prices escalate, the U.S. Air Force will need to consider the implications of relying on primary energy resources other than petroleum for its aviation fuel needs. Our recent studies have examined various candidate synthetic fuels and the types of vehicles in which they might be employed. In this paper, we have emphasized those results which highlight the possible use of liquid hydrogen as a fuel for very large airplanes (with maximum gross weights in excess of one million pounds).

Comparisons are provided of the life-cycle costs and life-cycle energy consumption for both synthetic jet-fuel and liquid hydrogen fueled airplanes. Both fuels are assumed to be synthesized from coal. In addition, the relative cost-effectiveness and energy-effectiveness of the two alternatives are presented for a variety of mission applications.

These results suggest that a synthetic jet-fuel (similar to today's Jet-A or JP-4) derived from coal is more attractive than liquid hydrogen as a military aircraft fuel.

#### HYDROGEN USAGE IN AIR TRANSPORTATION.

G. D. Brewer

International Journal of Hydrogen Energy,  
Vol. 3, No. 2, 1978, p. 217-229.

Abstract—Advanced versions of commercial transport aircraft which are designed to begin service in the 1990 decade may well be fueled with liquid hydrogen. Conventional petroleum-base jet fuel is predicted to become economically unattractive in that time period as the world's crude oil is consumed. Synthetic jet fuel, liquid methane and liquid hydrogen are the best alternative fuels to succeed the petroleum-base product. Studies have shown liquid hydrogen offers significant advantages over jet fuel in aircraft applications. LH<sub>2</sub>-fueled aircraft are lighter, quieter, have smaller wing area, require shorter runways and minimize pollution. They also use less energy, not only in terms of the fuel required to fly the design mission, but also including the energy required to manufacture the alternate fuels from coal and water. The advantage for hydrogen increases as the aircraft fuel requirement for the design mission increases. Using hydrogen as fuel in supersonic transport aircraft is particularly advantageous. Liquid methane has not yet been evaluated on an equitable basis as a fuel for transport aircraft.

NASA SP-4404

1978

Hydrogen - Utilization, Transportation  
**LIQUID HYDROGEN AS A PROPULSION FUEL, 1945-1959.**  
John L. Sloop. (The NASA History Series).  
1978. 325p.

Air Force research on Hydrogen  
Hydrogen-oxygen for a navy satellite  
Hydrogen technology from thermohuclear research  
NACA research on hydrogen for high-altitude aircraft  
Suntan  
The early U.S. space program  
Early high energy upper stages  
Large engines and vehicles, 1958  
Saturn, 1959  
Hydrogen technology thru WW II.  
Propulsion primer, performance parameters, and units

AIR TERMINALS AND LIQUID HYDROGEN COMMERCIAL  
AIR TRANSPORTS.  
P. F. Korycinski  
International Journal of Hydrogen Energy,  
Vol. 3, No. 2, 1978, p. 231-250.

Abstract—An initial appraisal is made of results of two studies of the ground requirements of liquid hydrogen (LH<sub>2</sub>) air transports. The studies were made for the NASA Langley Research Center by the Boeing Commercial Airplane Company and by the Lockheed California Company. Each hypothesized the use of a 400-passenger, 5500 nautical mile range subsonic commercial LH<sub>2</sub> transport. Two of the world's busiest commercial airports, Chicago O'Hare International and San Francisco International were selected for study: O'Hare by Boeing and San Francisco by Lockheed. The current and predicted wide-body traffic at these airports was assumed to simulate the LH<sub>2</sub> transport traffic at these airports in the 1990-1995 time period. Both studies produced conceptual designs for facilities to generate the required quantities of fuel from pipeline gaseous hydrogen and to deliver liquid hydrogen to the airplanes. Although the LH<sub>2</sub> and jet fuel facilities were kept apart, both study teams found it practical to converge the fuel supply lines so that with proper safety and operational procedures and specialized LH<sub>2</sub> equipment both LH<sub>2</sub> and jet fuel transports can use common ramp and gate facilities.

THE LIQUID HYDROGEN OPTION FOR THE SUBSONIC TRANSPORT-  
A STATUS REPORT  
Peter F. Korycinski  
NASA Technical Memorandum 74089  
September 1977

A78-36445 Hydrogen fuel and its application to vehicular systems. R. E. Billings (Billings Energy Corp., Provo, Utah). *Energy*, vol. 3, Spring 1978, p. 28-30. 14 refs.

Some hydrogen storage systems for hydrogen-fuel automobiles are surveyed, and the engine efficiency of gasoline and hydrogen fuel automobiles is compared. Advantages and disadvantages of iron-titanium hydride and cryogenic hydrogen storage systems are examined, safety tests of a metal hydride tank are reported, and the lack of air pollution caused by hydrogen combustion is noted. The operational economics of hydrogen fuel use is considered with attention to the efficiencies of generating synthetic hydrogen, methanol, gasoline, and electricity from coal. It is suggested that a taxi fleet could be used to test the application of hydrogen as a vehicular fuel sometime during the 1980-1985 period. M.L.

S- 576  
HYDROGEN FUEL AUTOS READIED FOR U.S. USE.  
R. Laytner.  
The Virginian-Pilot, July 10, 1977, Section D,  
p.D1-D6.

Japanese auto manufacturers using American technology may crack the world energy crisis this fall when they export to the United States cars that will run on hydrogen gas.

FUEL SUBSYSTEMS FOR LH<sub>2</sub> AIRCRAFT: R & D REQUIREMENTS

A. M. Momeny

International Journal of Hydrogen Energy, vol. 2, no. 2, 1977, p. 155-162

Design characteristics of the fuel subsystem for subsonic LH<sub>2</sub> fueled commercial aircraft are discussed in terms of requirements and technology availability.

ORIGINAL PAGE IS  
OF POOR QUALITY

77A1977B-# ISSUE 7 PAGE 997 CATEGORY 25 RPT\*:  
AIAA PAPER 77-17 77/01/00 11 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Influence of fuel temperature on supersonic mixing and  
combustion of hydrogen  
AUTH: A/ROGERS, R. C. PAA: A/(NASA, Langley Research  
Center, Hampton, Va.)  
CORP: National Aeronautics and Space Administration, Langley  
Research Center, Hampton, Va.  
American Institute of Aeronautics and Astronautics,  
Aerospace Sciences Meeting, 15th, Los Angeles, Calif.,  
Jan. 24-26, 1977, 11 p.

ABA: (Author)  
ABS: Results are presented from an experimental  
investigation of the influence of fuel stagnation  
temperature on the mixing and reaction of hydrogen  
injected transverse to a supersonic flow in a duct.  
The hydrogen fuel was injected stoichiometrically at

stagnation temperatures of 300 K and 800 K from a row  
of five circular orifices in the duct wall. Detailed  
measurements in the flow at the duct exit are used to  
determine the overall amount of mixing accomplished at  
each of three test conditions. Static pressure  
distributions are used with duct wall temperatures and  
heat flux in a one-dimensional analysis to deduce the  
fraction of fuel reacted along the duct. Results from  
the one-dimensional analyses of the tests with hot  
fuel indicated slightly more fuel reacted at the exit;  
however, differences in the accomplished mixing  
obtained from integrations of exit surveys were small.

NASA TN D-6487

1977

EMISSIONS AND TOTAL ENERGY CONSUMPTION OF A  
MULTICYLINDER PISTON ENGINE RUNNING ON GASOLINE  
AND A HYDROGEN-GASOLINE MIXTURE. John F.  
Cassidy, LaRC. May 1977. 35p.

HYDROGEN PEROXIDE EMISSION LEVELS FROM A  
HYDROGEN FUELED COMBUSTION ENGINE

K. S. Varde and D. K. Lewis

Journal of the Air Pollution Control Association  
July 1977, vol. 27, no. 1, p. 678-679

77A23721 ISSUE 9 PAGE 1417 CATEGORY 37  
77/01/20 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Water induction in hydrogen-powered IC engines  
AUTH: A/WOOLLEY, R. L.; B/HENRIKSEN, D. L. PAA:  
B/(Billings Energy Research Corp., Provo, Utah)  
(Energy Research and Development Administration, World  
Hydrogen Energy Conference, 1st, Miami Beach, Fla.,  
Mar. 1-3, 1976.) International Journal of Hydrogen  
Energy, vol. 1, Jan. 20, 1977, p. 401-412.

ABA: (Author)  
ABS: Addition of water to the hydrogen-air mixture in the  
intake manifold is an effective means of both  
suppressing the tendency to backflash and reducing the  
production of oxides of nitrogen. Tests are run on a  
Dodge 440 CID V8 engine having a compression ratio of  
12:1. Dramatic reduction in oxides of nitrogen is  
observed as the water flow is increased, yet  
essentially no change is observed in either power or

efficiency. Exhaust temperature, NOx, and equivalence  
ratio is measured at each exhaust valve. It is found  
that a large cylinder to cylinder variation in NOx  
production is caused by slight nonuniformity in mixing  
of the hydrogen-air streams. It is further shown that  
NOx production is an exponential function of  
equivalence ratio, water to hydrogen mass ratio, and  
engine speed.

77A16575# ISSUE 5 PAGE 632 CATEGORY 5 RPT\*:  
DGR PAPER 76-198 76/09/00 44 PAGES In GERMAN  
UNCLASSIFIED DOCUMENT

UTTL: layout and flight performance of a hypersonic  
transport /HST/

AUTH: A/BRUENING, G.; B/KLOSTER, M.; C/KRAMMER, H. PAA:  
C/(Munchen, Technische Universitaet, Munich, West  
Germany)  
Deutsche Gesellschaft fuer Luft- und Raumfahrt,  
Jahrestagung, 9th, Munich, West Germany, Sept. 14-16,  
1976. 44 p. In German.

ABA: R.D.V.  
ABS: General considerations for planning and reference  
designs for a hypersonic transport aircraft (HST) are  
laid out. Selection criteria for airfoils are  
discussed, including a conventional wing-fuselage  
combination, wedge airfoils, and surfboard type  
airfoils. Projections for flight range, propulsion  
plant organization, and drag value assignments in  
computer models are discussed. High-Mach diagrams are  
plotted for performance in throttling, maneuvering,  
acceleration, and under loading. Literature data for  
thrust, fuel consumption, and drag are found to be  
realistic. Flight noise is considered moderate, and  
hydrogen fuel with water vapor as exhaust gas is  
environmentally safe.

IP Dickson, Edward M.  
 360 The hydrogen energy economy  
 .DS . . . 1977. (Card 2)

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77A19B24# ISSUE 7 PAGE 1029 CATEGORY 34 RPT#:  
 AIAA PAPER 77-97 77/01/00 9 PAGES UNCLASSIFIED  
 DOCUMENT

UTTL: Transition and structure of turbulent jet diffusion  
 flame

AUTH: A/TAKENO, T.; B/KOTANI, Y. PAA: B/(Tokyo,  
 University, Tokyo, Japan)  
 American Institute of Aeronautics and Astronautics,  
 Aerospace Sciences Meeting, 15th, Los Angeles, Calif.,  
 Jan. 24-26, 1977. 9 p.

ABA: (Author)

ABS: An experimental study on transition and structure of  
 turbulent jet diffusion flame developing in a  
 coflowing air stream was made using hydrogen and  
 acetylene as fuel gases. These fuels have shown  
 distinct transition mechanisms from laminar to  
 turbulent flame. For hydrogen it is caused as the  
 result of flow instability very near the axis of fuel  
 free jet, while for acetylene it is caused by  
 intermittent fluctuations of pipe flow inside the  
 injector. In the turbulent acetylene flame, the small  
 scale fluctuations originated in the pipe flow develop  
 as they flow downstream into large scale eddies of  
 luminous flame.

77N10G36\* ISSUE 1 PAGE 89 CATEGORY 44 RPT#:  
 NASA-CASE-NPO-13560-1 NASA-CASE-NPO-13561-1  
 US-PATENT-3,982,910 US-PATENT APPL-SN-487156  
 US-PATENT-CLASS-48-61 US-PATENT-CLASS-23-281  
 US-PATENT-CLASS-48-116 US-PATENT-CLASS-48-117  
 US-PATENT-CLASS-48-197R US-PATENT-CLASS-48-212  
 US-PATENT-CLASS-123-3 US-PATENT-CLASS-252-373  
 US-PATENT-CLASS-423-650 US-PATENT-CLASS-431-11  
 US-PATENT-CLASS-431-41 US-PATENT-CLASS-431-116  
 US-PATENT-CLASS-431-162 US-PATENT-CLASS-431-170  
 76/09/28 15 PAGES UNCLASSIFIED DOCUMENT  
 Filed 10 Jul. 1974 Supersedes N76-18460 (14 - 09 p  
 1127)

UTTL: Hydrogen-rich gas generator TLSP: Patent

AUTH: A/HOUSEMAN, J.; B/CERINI, D. J. PAA: A/(JPL);  
 B/(JPL) PAT: B/inventors (to NASA)

CORP: National Aeronautics and Space Administration,  
 Pasadena Office, Calif.; Jet Propulsion Lab.,  
 California Inst. of Tech., Pasadena. SAP: Avail: US  
 Patent Office

Sponsored by NASA  
 OXIDATION/PATENTS/POLLUTION CONTROL

ABA: Official Gazette of the U.S. Patent Office

ABS: A process and apparatus are described for producing  
 hydrogen-rich product gases. A spray of liquid  
 hydrocarbon is mixed with a stream of air in a startup  
 procedure and the mixture is ignited for partial  
 oxidation. The stream of air is then heated by the  
 resulting combustion to reach a temperature such that  
 a signal is produced. The signal triggers a two way  
 valve which directs liquid hydrocarbon from a spraying  
 mechanism to a vaporizing mechanism with which a  
 vaporized hydrocarbon is formed. The vaporized  
 hydrocarbon is subsequently mixed with the heated air  
 in the combustion chamber where partial oxidation  
 takes place and hydrogen-rich product gases are  
 produced.

## COMBUSTION IMPROVEMENT IN A HYDROGEN FUELED ENGINE

S. Furuhashi, K. Yamane and I. Yamaguchi  
 International Journal of Hydrogen Energy

Vol. 2; no. 3

pp.329-340

77A36343 ISSUE 16 PAGE 2781 CATEGORY 85  
77/00/00 21 PAGES UNCLASSIFIED DOCUMENT

UTTL: A comparison of operational economics of transportation vehicles operated on gasoline and coal-generated hydrogen

AUTH: A/BILLINGS, R. E. PAA: A/(Billings Energy Research Corp., Provo, Utah)  
In: Synthetic fuels processing: Comparative economics: Proceedings of the Symposium, New York, N.Y., April 4-9, 1976. (A77-36326 16-44) New York, Marcel Dekker, Inc., 1977, p. 397-417.

MAJS: /\*AUTOMOBILE ENGINES/\*COAL UTILIZATION/\*ECONOMIC FACTORS/\*GASOLINE/\*HYDROGEN FUELS/\*URBAN TRANSPORTATION

MINS: / AIR POLLUTION/ COAL GASIFICATION/ ENERGY STORAGE/ HYDROGEN-BASED ENERGY/ METAL HYDRIDES/ POLLUTION CONTROL/ SAFETY DEVICES/ THERMODYNAMIC EFFICIENCY G.R.

ABA: G.R.

ABS: An investigation is conducted concerning the vehicle operational costs for a 350-vehicle taxi fleet and a 100-vehicle bus fleet. The historical background regarding hydrogen engines is reviewed. Problems of hydrogen storage are examined, taking into account the possibility to make use of metal hydrides. Attention is given to engine efficiency, aspects of air pollution, the efficiency of existing energy resource utilization, economics, and safety. The investigation shows that coal-generated hydrogen does have potential as a vehicular fuel for transportation. The best area for early implementation of the fuel is in fleet vehicles.

77N28324# ISSUE 19 PAGE 2516 CATEGORY 28 RPT#:  
TREE-1036 CNT#: EY-76-C-07-1570 77/01/00 31 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Guide for the conversion to and maintenance of hydrogen-fueled, spark-ignited engines

AUTH: A/SIMPSON, F. B.; B/LOFTHOUSE, J. H.; C/SWOPE, D. R.; D/HENRIKSEN, D. L.

CORP: Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho. AVAIL NTIS SAP: HC A03/MF A01

MAJS: /\*HYDROGEN FUELS/\*INTERNAL COMBUSTION ENGINES/\*SPARK IGNITION

MINS: / COMBUSTION CHAMBERS/ ENERGY CONVERSION/ FUEL COMBUSTION/ HYDROGEN-BASED ENERGY

ABA: ERA

ABS: A guide to one approach to the conversion of an internal combustion engine to hydrogen fuel is presented. Safety aspects, conversion, operation and maintenance of the engine are also included.

77A48709 ISSUE 23 PAGE 3929 CATEGORY 28  
77/00/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Alternate fuels for future aircraft

AUTH: A/BREWER, G. D. PAA: A/(Lockheed-California Co., Burbank, Calif.)  
In: Intersociety Energy Conversion Engineering Conference, 12th, Washington, D.C., August 28-September 2, 1977, Proceedings, Volume 1. (A77-48701 23-44) La Grange Park, Ill., American Nuclear Society, Inc., 1977, p. 62-68.

MAJS: /\*AIRCRAFT FUELS/\*HYDROGEN FUELS/\*JET ENGINE FUELS/\*SYNTHETIC FUELS

MINS: / COMMERCIAL AIRCRAFT/ LIQUID HYDROGEN/ METHANE/ PASSENGER AIRCRAFT/ SUBSONIC AIRCRAFT/ SUPERSONIC TRANSPORTS/ TECHNOLOGICAL FORECASTING

ABA: P.T.H.

ABS: The paper mentions some results of comparisons of the applicability of liquid hydrogen-fueled aircraft of the future and equivalent aircraft fueled with Jet A. Liquid hydrogen-fueled aircraft show clear superiority stemming from better lift-to-drag ratio in cruise and the specific fuel consumption realized during cruise. These advantages are retained when supersonic transport aircraft are considered as well. At the moment, studies indicate that it would cost more to build and operate a hydrogen-fueled fleet than a fleet fueled with synthetic Jet A, but if one takes into account projected improvements in the production process for liquid hydrogen (hydrogen gasification) and for synthetic Jet A, the LH2-fueled aircraft comes out ahead.

#### The Liquid Hydrogen Option for the Subsonic Transport: A Status Report.

P. F. Korycinski.

National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va. Sep 77, 28p  
NASA-TM-74089

N78-10306/6WE Price code: PC A03/MF A01

Continued subsonic air transport design studies include the option for a liquid hydrogen fuel system as an aircraft fuel conservation measure. Elements of this option discussed include: (1) economical production of hydrogen; (2) efficient liquefaction of hydrogen; (3) materials for long service life LH2 fuel tanks; (4) insulation materials; (5) LH2 fuel service and installations at major air terminals; (6) assessment of LH2 hazards; and (7) the engineering definition of an LH2 fuel system for a large subsonic passenger air transport.

TP	Dickson, Edward M.	
.360	The hydrogen energy economy : a	
.D5	realistic appraisal of prospects and	
	Impacts / Edward M. Dickson, John A.	
	Ryan, Marilyn H. Smulyan. New York :	
	Praeger, 1977.	213
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COMBUSTION IMPROVEMENT IN A HYDROGEN FUELED ENGINE  
 S. Furuhashi, K. Yamane, and I. Yamaguchi  
 International Journal of Hydrogen Energy  
 Vol. 2, no. 3, 1977,  
 p. 329-340.

## PERFORMANCE OF A HYDROGEN-POWERED TRANSIT VEHICLE

Roger E. Billings  
 Hydrogen Progress  
 2nd Quarter 1977  
 p. 16-21

Hydrogen's application to mass transit systems is considered. A 21 passenger bus is converted to hydrogen using a Dodge engine which has been modified for high compression operation. Back-firing and nitric oxide pollution formation are controlled by a water injection technique.

Hydrogen fuel storage for the experimental prototype is accomplished by two metal hydride containers using an iron-titanium alloy. Data are presented regarding equipment conversion and design, energy resource utilization, economics, and safety.

77A48819\* ISSUE 23 PAGE 3902 CATEGORY 5  
 77/00/00 9 PAGES UNCLASSIFIED DOCUMENT  
 UTTL: The liquid hydrogen option for the subsonic transport - A status report  
 AUTH: A/KORYCINSKI, P. F. PAA: A/(NASA, Langley Research Center, Hampton, Va.)  
 CORP: National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.  
 In: Intersociety Energy Conversion Engineering Conference, 12th, Washington, D.C., August 28-September 2, 1977, Proceedings, Volume 1, (A77-48701 23-44) La Grange Park, Ill., American Nuclear Society, Inc., 1977, p. 964-972.  
 ABA: J. M. B.  
 ABS: Studies dealing with the use of liquid hydrogen for fuel in subsonic air transport systems are reviewed. Topics of the studies include the possibility for economical production of hydrogen, the problems associated with the efficient liquefaction of the gas, the development of insulation materials and materials for long-lasting liquid hydrogen fuel tanks, the difficulties related to fueling processes and the installation of liquid hydrogen fuel stations at major air terminals, an assessment of the hazards connected with liquid hydrogen fuels, and the engineering and design problems involved in incorporating liquid

hydrogen fuel systems into large subsonic passenger aircraft.

## A HYDROGEN-POWERED MASS TRANSIT SYSTEM

R. L. Woolley  
Hydrogen Progress  
2nd Quarter 1977  
p. 22-27

In-service test data for a 19-passenger, hydrogen-powered bus is presented. Included is a description of the engine as modified for hydrogen operation, the metal hydride storage system, and the control system. Performance characteristics are described for vehicle operation over an established service route. Also included is a description of two safety demonstrations involving metal hydride storage of hydrogen.

77A48240\* ISSUE 23 PAGE 3904 CATEGORY 7  
77/00/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Direct-connect tests of hydrogen-fueled supersonic combustors

AUTH: A/WALTRUP, P. J.; B/DUGGER, G. L.; C/BILLIG, F. S.;  
D/ORTH, R. C. PAA: D/(Johns Hopkins University,  
Laurel, Md.)

CORP: Johns Hopkins Univ., Laurel, Md.  
In: Symposium on Combustion (International), 16th,  
Cambridge, Mass., August 15-20, 1976. Proceedings.  
(A77-48158 23-25) Pittsburgh, Pa., Combustion  
Institute, 1977, p. 1619-1629. NASA-supported  
research.

ABA: M.L.

ABS: Direct-connect tests of hydrogen-fueled supersonic combustors were performed using arc-heated air at combustor inlet Mach numbers of 2.9 to 3.2. Various axisymmetric combustor geometries of 5.89 and 6.96 cm (inner diameter) inlet were investigated; the fuel was injected from the wall either from a ring of equally spaced holes normal to the air stream, or from a circumferential slot oriented 45 deg downstream. The hole-type injectors consistently gave better results. The effects of various parameters are examined, and the performance comparison procedure is described. A theoretical model of the supersonic combustion process which includes a precombustion shock-compression is used to explain the character of the observed pressure distributions and to assess the effects of the measured heat transfer rates, deduced wall shear, and combustor geometry on performance.

78A28434 ISSUE 10 PAGE 1773 CATEGORY 37 RPT#:  
ASLE PREPRINT 77-LC-58-1 77/10/00 8 PAGES

UNCLASSIFIED DOCUMENT  
UTTL: Some characteristics of oil consumption measured by  
hydrogen fueled engine

AUTH: A/FURUHAMA, S.; B/HIRUMA, M. PAA: B/(Musashi  
Institute of Technology, Tokyo, Japan)  
American Society of Lubrication Engineers and American  
Society of Mechanical Engineers, Joint Lubrication  
Conference, Kansas City, Mo., 1977

ABA: S.D.

ABS: Although a number of studies have been conducted, the mechanism of oil consumption in a hydrogen-fueled engine is as yet not clear because of the lack of a suitable method for measuring consumption continuously and accurately. In this paper, a new measuring method is developed for easy continuous accurate measurement of oil consumption in a short period of time. An experimental apparatus is described and experiments are carried out, based on the concept that the carbon compounds - except for those in the ambient air - in the exhaust gas of a hydrogen-fueled spark-ignition engine are all attributable to the burning of lubricating oil. The oil consumption can therefore be measured continuously in a short period of time when the carbon compounds are oxidized to CO2 and the concentration of CO2 is continuously measured. Major conclusions are that the oil consumption is almost equivalent to that of gasoline engines if the combustion pressure and cylinder-wall temperature are equivalent, that oil consumption increases with a decrease in oil viscosity, and that about 10% of the total lubricating oil consumed in a four-stroke engine turns to HC while the remaining consumed oil is burnt completely.

TK  
2896  
.I55  
1977

Intersociety Energy Conversion Engineering  
Conference, 12th, Washington, 1977.  
Proceedings ...c1977

(Card 2)

1. Direct energy conversion—Congresses.
  2. Energy conservation—Congresses.
- I. American Nuclear Society.

779149 — The Liquid Hydrogen Option for the  
Subsonic Air Transport—A Status Report, P. F.  
Koryncinski, NASA/Langley, Hampton, Va. .... 964

78A14254\*# ISSUE 3 PAGE 342 CATEGORY 7  
77/08/00 18 PAGES UNCLASSIFIED DOCUMENT

UTTL: Direct-connect test of a hydrogen-fueled three-strut injector for an integrated modular scramjet engine  
AUTH: A/MCCLELLIN, C. R.; B/GOODERUM, P. B. PAA: B/(NASA, Langley Research Center, High-Speed Aerodynamics Div., Hampton, Va.)  
CORP: National Aeronautics and Space Administration, Langley Research Center, Hampton, Va  
Joint Army-Navy-NASA-Air Force Interagency Propulsion Committee, Combustion Meeting, 14th, U.S. Air Force Academy, Colorado Springs, Colo., Aug. 15-17, 1977. Paper, 18 p.

ABA: S.D.  
ABS: The study aims at illustrating the effects of strut and injector interactions and strut wakes not totally simulated in previous less complex, direct-connect hardware. In addition, the influence of the relative location of the injectors on opposite sides of each strut and the effect of injector spacing are evaluated. It is shown that better mixing efficiency is attained by locating the fuel injectors on opposite sides of a strut so that the jets come together, rather than being staggered. In the strut wake, it is not possible to determine the combustion efficiency by means of a one-dimensional analysis of the wall pressure.

78A16050 ISSUE 4 PAGE 560 CATEGORY 25 77/10/27  
12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Combustion Improvement in a hydrogen fueled engine  
AUTH: A/FURUHAMA, S.; B/YAMANE, K.; C/YAMAGUCHI, I. PAA: A/(Mitsubishi Institute of Technology, Tokyo, Japan); B/(Nissan Motor Co., Ltd., Tokyo, Japan); C/(Japan Automobile Research Institute, Ibaraki, Japan)  
International Journal of Hydrogen Energy, vol. 2, Oct. 27, 1977, p. 329-340.

ABA: (Author)  
ABS: Experimental testing of hydrogen-fueled engines has verified that hydrogen can be used safely and easily, and is a promising fuel for automobiles. However, there are problems with abnormal combustion and NO(x) formation. This paper discusses the phenomenon of abnormal combustion and presents a correlation between the abnormal combustion and NO(x) formation. Elimination of these problems was accomplished after

several engine modifications and by an experimentally-developed 'combined combustion process'. The characteristics of a hydrogen-oxygen engine with a hydrogen-rich fuel mixture were also studied. This engine was found to have an unexpectedly narrower range of operation than a hydrogen-air engine.

78A18843\*# ISSUE 6 PAGE 956 CATEGORY 28  
77/00/00 31 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen fueled subsonic aircraft - A prospective  
AUTH: A/WITCOFSKI, R. D. PAA: A/(NASA, Langley Research Center, Hampton, Va.)  
CORP: National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.  
In: International Workshop on Hydrogen and its Perspectives, Liege, Belgium, November 15-18, 1976. Proceedings, Volume 1. (A78-18826-06-44) Liege, Association des Ingenieurs Electriciens sortis de l'Institut Electrotechnique Montefiore, 1977, 31 p. J.M.B.

ABA:  
ABS: The performance characteristics of hydrogen-fueled subsonic transport aircraft are compared with those of aircraft using conventional aviation kerosene. Results of the Cryogenically Fueled Aircraft Technology Program sponsored by NASA indicate that liquid hydrogen may be particularly efficient for subsonic transport craft when ranges of 4000 km or more are involved; however, development of advanced cryogenic tanks for liquid hydrogen fuel is required. The NASA-sponsored program also found no major technical obstacles for international airports converting the liquid hydrogen fueling systems. Resource utilization efficiency and fuel production costs for hydrogen produced by coal gasification or for liquid methane or synthetic aviation kerosene are also assessed.

MASS TRANSIT IN A HYDROGEN ECONOMY  
Jim Dangerfield  
Hydrogen Progress  
2nd Quarter 1977  
p. 7-13

"The energy crisis has not yet overwhelmed us, but it will if we do not act quickly..."

IP	<b>Dickson, Edward M.</b>	
360	The hydrogen energy economy : a	
.D5	realistic appraisal of prospects and	
	Impacts / Edward M. Dickson, John W.	
	Ryan, Marilyn H. Smulyan. New York :	
	Praeger, 1977.	
11	<b>IMPACTS OF HYDROGEN-FUELED PRIVATE AND</b>	
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77N28124\*# ISSUE 19 PAGE 2488 CATEGORY 7 RPT#:  
 NASA-TN-D-8454 L-11050 77/08/00 65 PAGES  
 UNCLASSIFIED DOCUMENT

UTTL: Experimental investigation of a swept-strut  
 fuel-injector concept for scramjet application  
 AUTH: A/ANDERSON, G. Y.; B/REAGON, P. G.; C/GOODERUM, P.  
 B.; D/RUSSIN, W. R.  
 CORP: National Aeronautics and Space Administration, Langley  
 Research Center, Hampton, Va. AVAIL:NTIS SAP: HC  
 A04/MF A01  
 Washington

ABA: Author  
 ABS: Results are presented of an experiment to investigate  
 the behavior at Mach 4 flight conditions of the  
 swept-strut fuel-injector concept employed in the  
 Langley integrated modular scramjet engine design.  
 Autoignition of the hydrogen fuel was not achieved at  
 stagnation temperatures corresponding to a flight Mach  
 number of 4; however, once ignition was achieved,  
 stable combustion was maintained. Pressure  
 disturbances upstream of the injector location, which  
 were caused by fuel injection and combustion, were  
 generally not observed; this indicates the absence of  
 serious adverse combustor-inlet interactions. Mixing  
 performance and reaction performance determined from  
 probe surveys and wall pressure data indicate that  
 high combustion efficiency should be obtained with the  
 combustor length provided in the scramjet engine  
 design. No adverse interaction between the  
 perpendicular and parallel fuel-injection modes was  
 observed.

79A11806 ISSUE 2 PAGE 203 CATEGORY 26 CNT\*  
E(20-1)-4952 77/00/00 8 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: New alloy systems for hydrogen storage  
AUTH: A/ADKINS, C. M.; B/TAYLOR, E. J. PAA: B/(Virginia,  
University, Charlottesville, Va.)  
In: Symposium on Electrode Materials and Processes for  
Energy Conversion and Storage, Philadelphia, Pa., May  
9-12, 1977. Proceedings. (A79-11776 02-25) Princeton,  
N.J., Electrochemical Society, Inc., 1977. p. 497-504.  
MAJS: /\*ENERGY STORAGE/\*HYDROGEN-BASED ENERGY/\*IRON ALLOYS/\*  
METAL HYDRIDES/\*ROOM TEMPERATURE/\*TITANIUM ALLOYS  
MINS: / COBALT ALLOYS/ COPPER ALLOYS/ HYDROGEN FUELS/ NICKEL  
ALLOYS/ OPERATING TEMPERATURE

ABA: G.R.

ABS: The reported investigation is related to the objective  
to develop alloys which would form hydrides with a  
maximum amount of available hydrogen per unit weight  
and unit volume at room temperature. It was found that  
in accordance with the predictions of the Engel-Brewer  
theory the Ti<sub>2</sub>M phase was formed. M in this case  
denotes a mixture of Fe and one of either Cr, Ni, or  
Cu. The considered alloys formed TiH<sub>2</sub> and TiM and an  
undetermined constituent upon hydriding and extraction  
at room temperature. Since Ti<sub>2</sub>M was stable to about  
750 C the available hydrogen at room temperature was  
mostly from the TiM phase. No improvements in the  
hydriding characteristics of Ti<sub>2</sub>M as compared to TiFe  
were observed at room temperature. The one sample that  
was hydrided and extracted at 400 C showed no  
unexpected peaks. The extraction remains consisted of  
TiM, TiH<sub>2</sub>, Ti<sub>2</sub>M, and Ti.

77N25345\* ISSUE 16 PAGE 2112 CATEGORY 28  
RPT#: NASA-TM-X-3551 E-9070 77/06/00 33 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Thermal stability of some aircraft turbine fuels  
derived from oil shale and coal  
AUTH: A/REYNOLDS, T. W.  
CORP: National Aeronautics and Space Administration, Lewis  
Research Center, Cleveland, Ohio. AVAIL:NTIS SAP:

HC A03/MF A01

Washington  
Author

ABA: Author  
ABS: Thermal stability breakpoint temperatures are shown  
for 32 jet fuels prepared from oil shale and coal  
syncrudes by various degrees of hydrogenation. Low  
severity hydrotreated shale oils, with nitrogen  
contents of 0.1 to 0.24 weight percent, had breakpoint  
temperatures in the 477 to 505 K (400 to 450 F) range.  
Higher severity treatment, lowering nitrogen levels to  
0.009 to 0.017 weight percent, resulted in breakpoint  
temperatures in the 505 to 533 K (450 to 500 F) range.  
Coal derived fuels showed generally increasing  
breakpoint temperatures with increasing weight percent  
hydrogen. Fuels below 13 weight percent hydrogen  
having breakpoints below 533 K (500 F). Comparisons  
are shown with similar literature data.

79A14138\* ISSUE 3 PAGE 356 CATEGORY 28  
77/00/00 45 PAGES UNCLASSIFIED DOCUMENT

JTTL: Alternate aircraft fuel prospects and operational  
implications  
AUTH: A/WITCOFSKI, R. D. PAA: A/(NASA, Langley Research  
Center, Hampton, Va.)  
CORP: National Aeronautics and Space Administration, Langley  
Research Center, Hampton, Va.  
In: International Air Transportation Conference,  
Washington, D.C., April 4-6, 1977. Proceedings.  
(A79-14126 03-03) New York, American Society of Civil  
Engineers, 1977. p. 197-241.  
MAJS: /\*AIR TRANSPORTATION/\*AIRCRAFT FUELS/\*CIVIL AVIATION/\*  
COMMERCIAL AIRCRAFT/\*LIQUID HYDROGEN/\*SYNTHETIC FUELS  
MINS: / COAL GASIFICATION/ ENERGY CONSUMPTION/ ENERGY  
REQUIREMENTS/ FUEL CONSUMPTION/ HYDROCARBON FUEL  
PRODUCTION/ HYDROGEN FUELS/ HYDROGEN PRODUCTION/  
KEROSENE/ LIQUEFIED NATURAL GAS/ METHANE  
ABA: M.L.

ABS: The paper discusses NASA studies of the potentials of  
coal-derived aviation fuels, specifically synthetic  
aviation kerosene, liquid methane, and liquid  
hydrogen. Topics include areas of fuel production, air  
terminal requirements for aircraft fueling (for liquid  
hydrogen only), and the performance characteristics of  
aircraft designed to utilize alternate fuels. Energy  
requirements associated with the production of each of  
the three selected fuels are determined, and fuel  
prices are estimated. Subsonic commercial air  
transports using liquid hydrogen fuel have been  
analyzed, and their performance and the performance of  
aircraft which use commercial aviation kerosene are  
compared. Environmental and safety issues are  
considered.

77N23114\*# ISSUE 14 PAGE 1810 CATEGORY 7 RPT#:  
NASA-TN-D-8487 E-9105 77/05/00 38 PAGES

UNCLASSIFIED DOCUMENT

UTTL: Emissions and total energy consumption of a multicylinder piston engine running on gasoline and a hydrogen-gasoline mixture

AUTH: A/CASSIDY, J. F.

CORP: National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio. AVAIL. NTIS SAP: HC A03/MF A01 Washington

ABA: Author

ABS: A multicylinder reciprocating engine was used to extend the efficient lean operating range of gasoline by adding hydrogen. Both bottled hydrogen and hydrogen produced by a research methanol steam reformer were used. These results were compared with results for all gasoline. A high-compression-ratio, displacement production engine was used. Apparent flame speed was used to describe the differences in emissions and performance. Therefore, engine emissions and performance, including apparent flame speed and energy lost to the cooling system and the exhaust gas, were measured over a range of equivalence ratios for each fuel. All emission levels decreased at the leaner conditions. Adding hydrogen significantly increased flame speed over all equivalence ratios.

77A14982# ISSUE 4 PAGE 495 CATEGORY 25  
76/08/00 6 PAGES In RUSSIAN UNCLASSIFIED DOCUMENT

UTTL: Lifetime of the intermediate combustion products of a reacting system composed of hydrogen and air

AUTH: A/BASHUROVA, V. S.; B/BUNEV, V. A.; C/BABUSHOK, V. I.; D/BABKIN, V. S. PAA: D/(Akademiya Nauk SSSR, Institut Khimicheskoi Kinetiki i Goreniya, Novosibirsk, USSR)

Fizika Goreniya i Vzryva, vol. 12, July-Aug. 1976, p. 530-535. In Russian.

MAJS: /\*CHEMICAL REACTIONS/\*COMBUSTION PRODUCTS/\*FUEL-AIR RATIO/\*HYDROGEN FUELS

MINS: / LIFE (DURABILITY)/ PHYSICAL CHEMISTRY/ REACTION KINETICS/ THERMOCHEMISTRY

ABA: V.P.

ABS: Data on the lifetimes of intermediate products of the oxidation of hydrogen in air, obtained from a solution of the system of kinetic equations, are analyzed. The lifetime of all of these products is shown to depend on the initial conditions and the details of the reaction process. The application of lifetime data to the study and determination of the characteristics of a complex chemical process is demonstrated by examples.

78A42860\* ISSUE 18 PAGE 3228 CATEGORY 9  
78/06/30 20 PAGES UNCLASSIFIED DOCUMENT

UTTL: Air terminals and liquid hydrogen commercial air transports

AUTH: A/KORYCINSKI, P. F. PAA: A/(NASA, Langley Research Center, Hampton, Va.)

CORP: National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.

International Journal of Hydrogen Energy, vol. 3, June 30, 1978, p. 231-250.

ABA: (Author)

ABS: An initial appraisal is made of results of two studies of the ground requirements of liquid hydrogen (LH2) air transports. Each hypothesized the use of a 400-passenger 5500 nautical mile range subsonic commercial LH2 transport. Two of the world's busiest commercial airports, Chicago O'Hare International and San Francisco International, were selected for study. The current and predicted wide-body traffic at these airports was assumed to simulate the LH2 transport traffic at these airports in the 1990-1995 time period. Both studies produced conceptual designs for facilities to generate the required quantities of fuel from pipeline gaseous hydrogen and to deliver liquid hydrogen to the airplanes. Although the LH2 and jet fuel facilities were kept apart, both study teams found it practical to converge the fuel supply lines so that with proper safety and operational procedures and specialized LH2 equipment both LH2 and jet fuel transports can use common ramp and gate facilities.

77A12781 ISSUE 2 PAGE 285 CATEGORY 85 76/00/00  
5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Performance of a hydrogen-powered transit vehicle  
AUTH: A/WOOLLEY, R. L. PAA: A/(Billings Energy Corp., Provo, Utah)

In: Intersociety Energy Conversion Engineering Conference, 11th, State Line, Nev., September 12-17, 1976, Proceedings, Volume 1. (A77-12662 02-44) New York, American Institute of Chemical Engineers, 1976, p. 992-996.

MAJS: /\*AUTOMOBILE FUELS/\*ENGINE DESIGN/\*HYDROGEN-BASED ENERGY/\*METAL HYDRIDES/\*SURFACE VEHICLES/\*URBAN TRANSPORTATION

MINS: / ENERGY STORAGE/ FUEL CONSUMPTION/ SAFETY MANAGEMENT

ABA: (Author)

ABS: In-service test data for a 19-passenger, hydrogen-powered bus is presented. Included is a description of the engine as modified for hydrogen operation, the metal hydride storage system, and the control system. Performance characteristics are described for vehicle operation over an established service route. Also included is a description of two safety demonstrations involving metal hydride storage of hydrogen.

77A12663\* ISSUE 2 PAGE 231 CATEGORY 44 CNT#:  
NAS7-100 76/00/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Onboard hydrogen generation for automobiles

AUTH: A/HOUSEMAN, J.; B/CEPINI, D. J. PAA: B/(California  
Institute of Technology, Jet Propulsion Laboratory,  
Pasadena, Calif.)

CORP: Jet Propulsion Lab., California Inst. of Tech.,  
Pasadena.

In: Intersociety Energy Conversion Engineering  
Conference, 11th, State Line, Nev., September 12-17,  
1976, Proceedings, Volume 1. (A77-12662 02-44) New  
York, American Institute of Chemical Engineers, 1976,  
p. 6-16.

MAJS: /\*AUTOMOBILE FUELS/\*GAS GENERATORS/\*HYDROGEN FUELS/\*  
INTERNAL COMBUSTION ENGINES

MINS: / CARBON DIOXIDE/ ENERGY TECHNOLOGY/ HYDROCARBON FUELS  
/ HYDROGEN-BASED ENERGY/ LIQUEFIED GASES/ METHYL  
ALCOHOLS/ ONBOARD EQUIPMENT/ REACTION KINETICS

AEA: G.R.

ABS: Problems concerning the use of hydrogen as a fuel for  
motor vehicles are related to the storage of the  
hydrogen onboard a vehicle. The feasibility is  
investigated to use an approach based on onboard  
hydrogen generation as a means to avoid these storage  
difficulties. Two major chemical processes can be used  
to produce hydrogen from liquid hydrocarbons and  
methanol. In steam reforming, the fuel reacts with  
water on a catalytic surface to produce a mixture of  
hydrogen and carbon monoxide. In partial oxidation,  
the fuel reacts with air, either on a catalytic  
surface or in a flame front, to yield a mixture of  
hydrogen and carbon monoxide. There are many  
trade-offs in onboard hydrogen generation, both in the  
choice of fuels as well as in the choice of a chemical  
process. Attention is given to these alternatives, the  
results of some experimental work in this area, and  
the combustion of various hydrogen-rich gases in an  
internal combustion engine.

76/09/00  
BON70471# CATEGORY 28 RPT#: CONS/4707-1  
230 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen-fueled railroad motive power systems: A  
feasibility study

AUTH: A/FOSTER, R. W.; B/ESCHER, W. J. D.  
CORP: Escher Technology Associates, St. Johns, Mich.

MAJS: /\*ENERGY POLICY/\*HYDROGEN FUELS/\*RAIL TRANSPORTATION/\*  
TRANSPORTATION ENERGY

MINS: / DIESEL ENGINES/ ENERGY CONVERSION/ ENERGY TECHNOLOGY  
/ ENVIRONMENT EFFECTS

77A12780 ISSUE 2 PAGE 215 CATEGORY 37 CNT#:  
N00014-75-C-0220 76/00/00 7 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: The performance of hydrogen-injected reciprocating  
engines

AUTH: A/MCALEVY, R. F., III PAA: A/(Stevens Institute of  
Technology, Hoboken, N.J.)

In: Intersociety Energy Conversion Engineering  
Conference, 11th, State Line, Nev., September 12-17,  
1976, Proceedings, Volume 1. (A77-12662 02-44) New  
York, American Institute of Chemical Engineers, 1976,  
p. 985-991.

MAJS: /\*AUTOMOBILE FUELS/\*DIESEL ENGINES/\*FUEL INJECTION/\*  
HYDROGEN FUELS/\*PISTON ENGINES

MINS: / GASOLINE/ INTERNAL COMBUSTION ENGINES/ OTTO CYCLE/  
THERMODYNAMIC EFFICIENCY

ABA: (Author)

ABS: Due to economic and operational problems demonstrated  
with H<sub>2</sub>-fueled, naturally-aspirated gasoline engines,  
and the inability of unmodified diesel engines to run  
successfully on H<sub>2</sub> it appears that a hybrid engine,  
called the CFI engine, will have to be developed if H<sub>2</sub>  
is to become an alternative automotive fuel of  
significance. The CFI-cycle is analyzed on the basis  
of the air-standard-cycle approximation, and its  
performance characteristics are predicted. Published  
data from an experimental, single-cylinder, laboratory  
version of a CFI engine support the prediction.  
Considering the promise of the CFI engine for  
advancing the penetration of H<sub>2</sub> into the automotive  
fuel market, development of a practical H<sub>2</sub> CFI engine  
should start immediately.

78A25637# ISSUE 9 PAGE 1584 CATEGORY 37  
76/00/00 8 PAGES In RUSSIAN UNCLASSIFIED DOCUMENT

UTTL: Some problems in the operational analysis of a  
hydrogen-fueled gas turbine

AUTH: A/VARSHAVSKII, I. L.; B/KANILO, P. M.;  
C/AMBROZHEVICH, A. V. PAA: C/(Akademiya Nauk  
Ukrainskoi SSR, Institut Problem Mashinostroeniya,  
Kharkov, Ukrainian SSR)  
Problemy Mashinostroeniya, no. 3, 1976, p. 85-92. In  
Russian.

MAJS: /\*ENGINE CONTROL/\*GAS TURBINE ENGINES/\*HYDROGEN FUELS  
/\*THERMODYNAMIC EFFICIENCY

MINS: / AUTOMATIC CONTROL/ BLOCK DIAGRAMS/ KEROSENE

ABA: B.J.

ABS: An analysis is presented of the thermodynamic  
efficiency and operating characteristics of a  
hydrogen-fueled gas turbine engine. A method of fuel  
supply and automatic control for the engine are  
proposed. A hydrogen-fueled gas turbine is compared  
with a kerosene-fueled turbine in terms of efficiency.

TP World Hydrogen Energy Conference, 1st, Miami  
360 Beach, 1976.  
.W67 Conference proceedings...1976. (Card 2)  
1976 Coral Gables, Fla. : University of Miami,  
V.2 1976.

3 v . 411 . 26 -

ORAGE - IN VEHICLES (Session 3B)

HYDROGEN STORAGE ON HIGHWAY VEHICLES: UPDATE '76  
E.E. Ecklund, F.L. Kester, Energy Research and  
Development Administration, Washington, D.C. U.S.

HYDROGEN VEHICULAR FUEL STORAGE AS A STEP IN A W/  
SPLITTING CYCLE  
P.S. Rudman, Department of Physics, Technion - Is  
Institute of Technology, Haifa, Israel

HYDROGEN-POWERED HIGHWAY VEHICLES: APPLICATIONS  
OPTIMUM FORM OF FUEL STORAGE  
R.L. Whitelaw, Virginia Polytechnic Institute and  
State University, Blacksburg, Virginia U.S.A.

METHODS OF ON-BOARD GENERATION OF HYDROGEN FOR  
VEHICULAR USE  
A.Z. Ullman, W.D. Van Vorst, School of Engineering  
and Applied Science, University of California at  
Los Angeles, Los Angeles, California U.S.A.

AUTOMOTIVE FUEL-SAVING SYSTEM WITH ON-BOARD HYDRO  
GENERATION AND INJECTION INTO I.C. ENGINES  
D.A. Kelly, Technidyne, Inc., Maspeth, New York

ORIGINAL PAGE IS  
OF POOR QUALITY

77A33377\*# ISSUE 14 PAGE 2374 CATEGORY 44  
CNT#: NAS1-13395 76/00/00 25 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: A study of the efficiency of hydrogen liquefaction ---  
jet aircraft applications  
AUTH: A/BAKER, C. R.; B/SHANER, R. L. PAA: B/(Union  
Carbide Corp., Linde Div., Tonawanda, N.Y.)  
CORP: Union Carbide Corp., Tonawanda, N.Y.  
In: World Hydrogen Energy Conference, 1st, Miami  
Beach, Fla., March 1-3, 1976. Proceedings, Volume 2.  
(A77-33326 14-44) Coral Gables, Fla., University of  
Miami; New York, Pergamon Press, 1976, p. 2B-17 to  
2B-41.  
MAJS: /\*CONDENSING/\*HYDROGEN FUELS/\*JET ENGINE FUELS/\*LIQUID  
HYDROGEN/\*ORTHO PARA CONVERSION  
MINS: / CARNOT CYCLE/ CRYOGENIC STORAGE/ IRREVERSIBLE  
PROCESSES/ JOULE-THOMSON EFFECT/ LIQUEFACTION/  
THERMODYNAMIC PROPERTIES  
ABA: S.D.  
ABS: The search for an environmentally acceptable fuel to  
eventually replace petroleum-based fuels for  
long-range jet aircraft has singled out liquid  
hydrogen as an outstanding candidate. Hydrogen  
liquefaction is discussed, along with the effect of  
several operating parameters on process efficiency. A  
feasible large-scale commercial hydrogen liquefaction  
facility based on the results of the efficiency study  
is described. Potential future improvements in  
hydrogen liquefaction are noted.

77A25881# ISSUE 10 PAGE 1588 CATEGORY 25  
76/12/00 9 PAGES In RUSSIAN UNCLASSIFIED DOCUMENT

UTTL: Calculation of conditions for combustion separation  
behind a flat projection and in a recess in the  
supersonic flow of a hydrogen-air fuel mixture  
AUTH: A/MESHCHERIAKOV, E. A.; B/MAKASHEVA, O. V. PAA:  
B/(Tsentrallyy Aerogidrodinamicheskii Institut,  
Moscow, USSR)  
Fizika Goreniya i Vzryva, vol. 12, Nov.-Dec. 1976, p.  
871-879. In Russian.  
ABA: P.T.H.  
ABS: Theory of isothermal reactors in combination with  
elements of theory of turbulent jets is applied to  
calculate the flow parameters in separated combustion  
in the recirculation zones behind a flat projection

and in a recess situated in the supersonic flow of a  
homogeneous hydrogen-air fuel mixture. Fairly complete  
kinetics of hydrogen combustion in air is used in the  
calculations, including eight reactions for seven  
components. By the method it is possible to trace the  
effect of various geometric and regime parameters on  
the stability limits of the operation of combustion  
stabilizers of a given type.

TP World Hydrogen Energy Conference, 1st, Miami  
360 Beach, 1976.

.W67 Conference proceedings 1976 (Conf. 1)  
1976 (Session 5C) AIRCRAFT

V.3

THE THERMAL EFFICIENCY AND COST OF PRODUCING  
HYDROGEN AND OTHER SYNTHETIC AIRCRAFT FUELS  
FROM COAL

R.D. Witcofski, NASA Langley Research Center  
Hampton, Virginia U.S.A.

THE POTENTIAL OF LIQUID HYDROGEN AS A MILITARY  
AIRCRAFT FUEL\*

W.T. Mikolowsky, L.W. Noggle, The Rand Corporation  
Washington, D.C. U.S.A.

SOME EARLY PERSPECTIVES ON GROUND REQUIREMENTS OF  
LIQUID HYDROGEN AIR TRANSPORTS

P.F. Korycinski, NASA Langley Research Center  
Hampton, Virginia U.S.A.

VULNERABILITY OF ADVANCED FUEL SYSTEMS FOR AIRCRAFT  
J.R. Lippert, Wright-Patterson Air Force Base,  
Ohio, U.S.A.

NEW POTENTIALS FOR CONVENTIONAL AIRCRAFT WHEN  
POWERED BY HYDROGEN-ENRICHED GASOLINE

W.A. Menard, P. I. Moynihan, J.H. Rupe, Jet  
Propulsion Laboratory, Pasadena, California U.S.

FUEL SUBSYSTEM CHARACTERISTICS FOR LH<sub>2</sub> AIRCRAFT  
A.M. Momeny, Boeing Commercial Aircraft Company  
Seattle, Washington U.S.A.

77A18932# ISSUE 6 PAGE 864 CATEGORY 44  
76/00/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen as a fuel in compression ignition engines  
AUTH: A/KARIM, G. A. PAA: A/(Calgary, University, Calgary,  
Alberta, Canada)  
Archiwum Termodynamiki i Spalania, vol. 7, no. 1,  
1976, p. 89-100.

ABA: (Author)

ABS: Review is made of some of the main operational  
features associated with the use of hydrogen as a fuel  
in engines. The paper presents some findings of an  
investigation into the performance of a compression  
ignition engine fueled with hydrogen. Most of the  
experimental work reported relates to a laboratory  
dual fuel engine where hydrogen was introduced just  
outside the engine cylinder, mixed with the necessary  
air, compressed and then ignited by the injection of a  
small quantity of liquid fuel near the end of  
compression. Moreover, the role of various operating  
parameters on the onset of autoignition in a motor  
engine in the absence of a deliberate source of  
ignition was established analytically. The paper then  
concludes with the examination of the prospects of  
using hydrogen-oxygen mixtures in engines.

TP Advances in cryogenic engineering, v. 21 /  
490 edited by K. D. Timmerhaus and D. H. Weitzel.  
.A3 -- New York : Plenum Press, [1976]  
v.21 xv, 549 p. : ill. ; 26 cm.  
"A Cryogenic Engineering Conference  
Publication."  
ISBN 0-306-38021-8

1. Low temperature engineering--Con-  
gresses. I. Timmerhaus, K. D., ed. II.  
Weitzel, D. H., ed. III. Cryogenic Engi-  
Dispersion of Hydrogen or Methane Fuels Released into an  
Automobile Interior, J. M. ARVIDSON, J. HORD, and D. B. MANN,  
Cryogenics Division, Institute for Basic Standards ..... 387

77A12779 ISSUE 2 PAGE 215 CATEGORY 37 76/00/00  
7 PAGES UNCLASSIFIED DOCUMENT

UTTL: A guide for the conversion to and maintenance of hydrogen-fueled, spark-ignited engines

AUTH: A/SIMPSON, F. B.; B/SWOPE, D. R.; C/LOFTHOUSE, J. H.; D/HENRIKSEN, D. L. PAA: C/(Idaho National Engineering Laboratory, Idaho Falls, Idaho); D/(Billings Energy Research Corp., Provo, Utah) In: Intersociety Energy Conversion Engineering Conference, 11th, State Line, Nev., September 12-17, 1976, Proceedings, Volume 1. (A77-12662 02-44) New York, American Institute of Chemical Engineers, 1976, p. 978-984.

ABA: R.D.V.

ABS: An outline for the design and maintenance of engines burning hydrogen fuel, and for conversion of engines to hydrogen fuel, is presented. Properties of hydrogen as engine fuel are examined (low ignition energy, high ignition temperature, high heating value, and air displacement) and the behavior of H<sub>2</sub> in engine systems are analyzed, along with efficient forms of H<sub>2</sub> storage (compressed gas, liquefied cryo medium, and metallic hydride pellets) and H<sub>2</sub> engine processes. Ways of

preventing oxygen in-leakage and H<sub>2</sub> out-leakage, seal design, and prevention of hydrogen embrittlement of engine materials are mentioned. Use of lean mixtures, exhaust gas recirculation, and water induction (injection) are techniques described. Backflash suppression and other aspects of hydrogen engine operation are outlined, along with engine break-in, engine tuning and ignition timing, and maintenance (periodic preventive and trouble shooting).

77N21632# ISSUE 12 PAGE 1617 CATEGORY 44  
76/03/00 3 VOLS 32 PAGES UNCLASSIFIED DOCUMENT

UTTL: Development of a liquid hydrogen car

AUTH: A/FURUHAMA, S.; B/HIRUMA, M.; C/ENOMOTO, Y.  
CORP: Musashi Inst. of Tech., Tokyo (Japan). AVAIL.NTIS  
SAP: HC A99/MF A01  
In Miami Univ. First World Hydrogen Energy Conf.  
Proc., Vol 3 32 p (SEE N77-21626 12-44)

ABA: Author

ABS: A liquid hydrogen tank with a capacity of 230 liters (61 gal.) at 5 atm/g (71 psi.g) pressure was installed in a Datsun B210 passenger car having a 1.4 liter displacement engine. Because the lower temperature hydrogen gas introduces better performance in the engine, fuel was lead from the rear tank to the front engine through a vacuum insulated pipe and injected

into the intake port by a mechanical valve. The performance of the car in a 2,800 km (1730 mi) rally is evaluated as regards energy economy, emission, and safety.

77N15045\*# ISSUE 6 PAGE 706 CATEGORY 7 RPT#:  
NASA-TM-X-73931 76/00/00 83 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Thermal design and analysis of a hydrogen-burning wind tunnel model of an airframe-integrated scramjet

AUTH: A/GUY, R. W.; B/MUELLER, J. N.; C/PINCKNEY, S. Z.; D/LEE, L. P.

CORP: National Aeronautics and Space Administration, Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A05/MF A01

MAJS: /\*AERODYNAMIC CONFIGURATIONS/\*AIRFRAMES/\*HYDROGEN FUELS/\*SUPERSONIC COMBUSTION RAMJET ENGINES/\*WIND TUNNEL MODELS

MINS: / FLOW CHARACTERISTICS/ HEAT TRANSFER/ SURFACE TEMPERATURE

ABA: Author

ABS: An aerodynamic model of a hydrogen burning, airframe integrated scramjet engine has been designed, fabricated, and instrumented. This model is to be tested in an electric arc heated wind tunnel at an altitude of 35.39 km (116,094 ft.) but with an inlet Mach number of 6 simulating precompression on an aircraft undersurface. The scramjet model is constructed from oxygen free, high conductivity copper and is a heat sink design except for water cooling in some critical locations. The model is instrumented for pressure, surface temperature, heat transfer rate, and thrust measurements. Calculated flow properties, heat transfer rates, and surface temperature distributions along the various engine components are included for the conditions stated above. For some components, estimates of thermal strain are presented which indicate significant reductions in plastic strain by

selective cooling of the model. These results show that the 100 thermal cycle life of the engine was met with minimum distortion while staying within the 2669 N (600 lbf) engine weight limitation and while cooling the engine only in critical locations.

TP World Hydrogen Energy Conference, 1st, Miami  
360 Beach, 1976.  
.W67 Conference proceedings: 1st World Hydro-  
1976 gen Energy Conference, 1-3 March 1976, Miami  
V.3 Beach, Florida; presented by International

PROTOTYPE HYDROGEN AUTOMOBILE USING A METAL HYDRIDE  
D.L. Henriksen, D.B. Mackay, V.R. Anderson,  
Billings Energy Research Corporation, Provo,  
Utah U.S.A.

AUTOMOTIVE HYDRIDE TANK DESIGN  
D.B. Mackay, Billings Energy Research Corporation  
Provo, Utah U.S.A.

ENGINEERING STUDY OF HYDROGEN-FUELED BUS OPERATION  
T. Wall, R. Feeney, J. Hollenberg, R.F. McAlevy I.  
Stevens Institute of Technology, Hoboken, New  
Jersey U.S.A.

A HYDROGEN-POWERED MASS TRANSIT SYSTEM  
R.E. Billings, Billings Energy Research Corporation  
Provo, Utah U.S.A.

HYDROGEN FUEL FOR THE RAILROADS: A PROPOSAL\*  
H.L. Gier, Beech Aircraft Corporation, Boulder,  
Colorado U.S.A.

METHANOL-GASOLINE BLEND FUELED ENGINE - PERFORMANCE  
AND EMISSIONS\*  
R.R. Adt, Jr., K. Chester, J. Pappas, M. Swain,  
University of Miami, Coral Gables, Florida U.S.A.

77N21634# ISSUE 12 PAGE 1617 CATEGORY 44  
76/03/00 21 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Modification techniques and performance  
characteristics of hydrogen-powered IC engines: State  
of the art, 1975  
AUTH: A/SIMPSON, F. B.; B/LOFTHOUSE, J. H.; C/SWOPE, D. W.  
; D/WOOLLEY, R. L. PAA: D/Billings Energy Research  
Corp.)  
CORP: Idaho National Engineering Lab., Idaho Falls.  
AVAIL.NTIS SAP: HC A99/MF A01  
In Miami Univ. First World Hydrogen Energy Conf  
Proc., Vol. 3 22 p (SEE N77-21625 12-44)  
HYDRIDES/ PROPULSIVE EFFICIENCY/ THERMODYNAMIC  
EFFICIENCY  
ABA: Author  
ABS: Developments in hydrogen-powered engine technology are  
summarized. Topics reviewed include: engine  
parameters, modifications, operating conditions,  
running characteristics, and performance. The cost for  
manpower and materials associated with the  
modification of one engine is discussed.

77A14530 ISSUE 3 PAGE 389 CATEGORY 44 76/08/00  
2 PAGES UNCLASSIFIED DOCUMENT  
JTTL: An alternative fuel for cars --- hydrogen production  
and storage  
AUTH: A/CHATTERJEE, J. S.; B/SOM, P. PAA: B/Jadavpur  
University, Calcutta, India)  
Electronics and Power, vol. 22, Aug. 1976, p. 528,  
529.  
ABA: Author  
ABS: The paper is concerned with an effective solution of  
easy and inexpensive production and safe storage of  
hydrogen for use as a fuel for automobiles. The  
discussion covers raw materials and chemistry, total  
power requirements, payload comparisons, and system  
layout, with particular reference to electrolysis of  
sodium hydroxide and sodium chloride. The hydrogen  
tank at 2 atm serves only as a buffer to start the  
engine and maintain the engine cycle until the  
generation of hydrogen from the reaction chamber  
reaches the engine. The reaction chamber will  
ultimately be filled with sodium hydroxide, which can  
be recovered for the recycling process. The total  
electrical energy required for running the car by  
recycling sodium hydroxide is 24,000,000 Mwh

TP World Hydrogen Energy Conference, 1st, Miami  
360 Beach, 1976.  
.W67 Conference proceedings: 1st World Hydro-  
1976 gen Energy Conference, 1-2 March 1976, Miami  
V.3 (Sessions 6C and 7C) **AUTOMOBILES**

WATER INDUCTION IN HYDROGEN-POWERED IC ENGINES  
R.L. Woolley, D.C. Henriksen, Billings Energy  
Research Corporation, Provo, Utah U.S.A.

FUEL CELL DEVELOPMENT FOR USE AS A POWER SOURCE  
IN TRACTION\*  
A. Blanchart, C. De Brandt, C. Spaepen, Belgian  
Nuclear Research Center, Mol, Belgium

DEVELOPMENT OF A LIQUID HYDROGEN CAR  
S. Furuhashi, M. Hiruma, Y. Enomoto, Musashi  
Institute of Technology, Tokyo, Japan

DYNAMIC TESTS OF HYDROGEN-POWERED IC ENGINES  
R.L. Woolley, G.J. Germane, Billings Energy Resea  
Corporation, Provo, Utah U.S.A.

MODIFICATION TECHNIQUES AND PERFORMANCE CHARACTER  
OF HYDROGEN-POWERED IC ENGINES - STATE OF THE ART  
1975  
F.B. Simpson, J.H. Lofthouse, D.R. Swope, R.L. Wo  
Idaho National Engineering Laboratory, Idaho Fall  
Idaho U.S.A.

CRASH TEST OF A LIQUID HYDROGEN AUTOMOBILE

77A16534# ISSUE 5 PAGE 661 CATEGORY 28 RPT#:  
DGLR PAPER 76-188 76/09/00 29 PAGES In GERMAN  
UNCLASSIFIED DOCUMENT  
UTTL: Liquid hydrogen as propellant for commercial aircraft  
AUTH: A/QUAST, A. PAA: A/(Deutsche Forschungs- und  
Versuchsanstalt fuer Luft- und Raumfahrt, Institut  
fuer Aerodynamik, Braunschweig, West Germany)  
Deutsche Gesellschaft fuer Luft- und Raumfahrt,  
Jahrestagung, 9th, Munich, West Germany, Sept. 14-16,  
1976, 29 p. In German.

ABA: G.R.

ABS: An investigation is conducted concerning the  
feasibility to use liquid hydrogen as fuel for  
commercial aircraft. Effects related to lower fuel  
weight and larger tank volume compensate each other.  
The energy consumption in the case of an aircraft  
using hydrogen is, therefore, about the same as in the  
case of a corresponding conventional aircraft.  
However, a considerable amount of electrical energy is  
required to transform gaseous hydrogen into the liquid  
state. Liquid hydrogen is consequently significantly

more expensive than synthetic hydrocarbons. As much as  
40% of the operational costs of commercial aircraft  
can be related to fuel costs. It is concluded that a  
use of hydrogen in commercial aviation on the basis of  
the current status of technology is not economic.

77N21639# ISSUE 12 PAGE 1618 CATEGORY 44  
76/03/00 25 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Use of hydrogen in automotive engines  
AUTH: A/GUPTA, C. P.  
CORP: Roorkee Univ. (India). AVAIL:NTIS SAP: HC A99/MF  
A01  
In Miami Univ. First World Hydrogen Energy Conf.  
Proc., Vol. 3 25 p (SEE N77-21626 12-44)

ABA: Author

ABS: The case of hydrogen as automotive engine fuel is  
discussed in the context of environment pollution and  
scarcity of hydrocarbon fuels. The development of the  
air-breathing, hydrogen IC engine is reviewed. The  
hydrogen-oxygen high temperature cycle power plant for  
automotive applications is also examined. Various  
methods of storing hydrogen on automotive vehicles are  
discussed and the resulting vehicle weights and ranges  
compared. The production, transportation, storage and  
distribution of hydrogen are briefly considered.

77A14584 ISSUE 3 PAGE 390 CATEGORY 44 76/11/00  
8 PAGES In GERMAN UNCLASSIFIED DOCUMENT

UTTL: Alternate fuels for road vehicles of the future

AUTH: A/GWINNER, D. PAA: A/(Daimler-Benz AG, Stuttgart, West Germany)  
VDI-Z, vol. 118, no. 22, Nov. 1976, p. 1053-1060. In German.

ABA: G.R.

ABS: An evaluation of fuels shows that presently only methanol and hydrogen can be considered as possible substitutes for gasoline and Diesel oil as motor-vehicle fuels. Questions related to a use of methanol and hydrogen for the propulsion of road vehicles are investigated, taking into account the availability of the raw materials for a production of the two fuels, problems of fuel storage on board the vehicle, and aspects of motor operation. It is pointed

out that the use of either fuel as a substitute for the currently used fuels for motor vehicles would lead to a significant reduction of air pollution problems. An introduction of methanol as fuel on a relatively short-term basis is possible. A use of hydrogen, however, requires the solution of a number of problems mainly related to the economic production of the gas and its storage on board the vehicle.

77N21630# ISSUE 12 PAGE 1617 CATEGORY 44  
76/03/00 3 VOLS 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fuel subsystem characteristics for LH2 aircraft

AUTH: A/MOMENTHY, A. M.

CORP: Boeing Commercial Airplane Co., Seattle, Wash.  
AVAIL. NTIS SAP: HC A99/MF A01  
In Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 3 16 p (SEE N77-21626 12-44)

MAJS: /\*AIRCRAFT FUEL SYSTEMS/\*ENERGY POLICY/\*HYDROGEN FUELS  
/\*LIQUID HYDROGEN/\*TRANSPORTATION ENERGY

MINS: / AIRCRAFT SAFETY/ COMMERCIAL AIRCRAFT/ CRYOGENICS/  
ENERGY TECHNOLOGY/ FUEL PUMPS/ FUEL TANKS

ABA: Author

ABS: Design characteristics of the fuel subsystem for subsonic LH2 fueled commercial aircraft are discussed

in terms of requirements and technology availability. Some of the differences between LH2 systems developed for space vehicles and those required for commercial aircraft are pointed out. Significant areas of technology requiring advancement and long lead time development testing are identified. Results obtained from a Boeing study covering the development of a candidate fuel subsystem for a 3,000 nautical mile range LH2 fueled commercial airplane are included.

77A33382# ISSUE 14 PAGE 2327 CATEGORY 31  
76/00/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen-powered highway vehicles - Applications and optimum form of fuel storage

AUTH: A/WHITELAW, R. L. PAA: A/(Virginia Polytechnic Institute and State University, Blacksburg, Va.)  
In: World Hydrogen Energy Conference, 1st, Miami Beach, Fla., March 1-3, 1976, Proceedings, Volume 2, (A77-33326 14-44) Coral Gables, Fla., University of Miami; New York, Pergamon Press, 1976, p. 3B-41 to 3B-51.

ABA: (Author)

ABS: Twelve different vehicle applications are considered for the future era of hydrogen as fuel. It is shown that seven different stored energy quantities, from 100,000 to 8,000,000 Btu will accommodate all. Optimum tank sizes and weights for each are then determined, both for liquid hydrogen at 2 atm, 23 K, and for pressurized hydrogen at 102 atm, 288 K. Liquid hydrogen storage, in well-insulated tankage, is shown to be 1/50th the weight and 1/15th the cost of pressurized gas storage, for the same energy, besides being much safer. The use of liquefied natural gas (LNG), so long as available, enjoys a 50% weight and cost advantage over liquid hydrogen for tankage alone. Two million Btu of liquid hydrogen, sufficient for a 400-mile family car trip, may be stored in two 43-in. long by 8 in. diam. insulated tanks for a total tank weight of 70 lb and cost of \$263.

77N21616# ISSUE 12 PAGE 1615 CATEGORY 44  
76/03/00 3 VOLS 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen-powered highway vehicles: Applications and optimum form of fuel storage

AUTH: A/WHITELAW, R. L.

CORP: Virginia Polytechnic Inst. and State Univ., Blacksburg. AVAIL. NTIS SAP: HC A99/MF A01  
In Miami Univ. 1st World Hydrogen Energy Conf. Proc., Vol. 2 11 p (SEE N77-21591 12-44)

MAJS: /\*ENERGY STORAGE/\*HYDROGEN FUELS/\*MOTOR VEHICLES

MINS: / HIGH PRESSURE/ LIQUID HYDROGEN/ STORAGE TANKS

ABA: Author

ABS: Twelve different vehicle applications are considered for the future era of hydrogen as fuel. It is shown that seven different stored energy quantities, from 100,000 to 8,000,000 Btu, will accommodate all. Optimum tank sizes and weights for each are then determined, both for liquid hydrogen at 2 atmos., 23K, and for pressurized hydrogen at 102 atmos., 288K. Liquid hydrogen storage, in well-insulated tankage, is shown to be 1/50th the weight and 1/15th the cost of pressurized gas storage, for the same energy, besides being much safer.

77A33391\*# ISSUE 14 PAGE 2305 CATEGORY 9  
76/00/00 24 PAGES UNCLASSIFIED DOCUMENT

UTTL: Some early perspectives on ground requirements of liquid hydrogen air transports  
AUTH: A/KORYCINSKI, P. F. PAA: A/(NASA, Langley Research Center, Hampton, Va.)  
CORP: National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.  
In: World Hydrogen Energy Conference, 1st, Miami Beach, Fla., March 1-3, 1976, Proceedings, Volume 3, (A77-33326 14-44) Coral Gables, Fla., University of Miami; New York, Pergamon Press, 1976, p. 5C-33 to 5C-56.

ABA: S.D.  
ABS: The paper examines the problem of liquid-hydrogen (LH2) subsonic long-range air transport from the perspectives of airplane manufacturers, the airline operator, the air terminal authority and the LH2 supplier. Emphasis is placed on identifying common problems and interfaces that are likely to occur in preparing for commercial airline operations of LH2 subsonic air transport in the 1990-1995 period.

General considerations are discussed relative to sources and cost of gaseous hydrogen, hydrogen liquefaction, and LH2 availability. The fact that hydrogen sustains combustion at altitudes substantially higher than hydrocarbon fuels suggests that air transport can be designed to operate at higher enroute air traffic flight levels. This can be an advantage if only to relieve traffic congestion on heavily traveled routes. Pertinent interfaces in planning for the use of LH2 in air transportation are identified, including productivity and profitability, passenger-fuel compatibility, and lightning and electrical discharges.

77A33393# ISSUE 14 PAGE 2304 CATEGORY 7  
76/00/00 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fuel subsystem characteristics for LH2 aircraft  
AUTH: A/MOMENTHY, A. M. PAA: A/(Boeing Commercial Airplane Co., Seattle, Wash.)  
In: World Hydrogen Energy Conference, 1st, Miami Beach, Fla., March 1-3, 1976, Proceedings, Volume 3, (A77-33326 14-44) Coral Gables, Fla., University of Miami; New York, Pergamon Press, 1976, p. 5C-87 to 5C-102.  
ABA: (Author)  
ABS: Design characteristics of the fuel subsystem for subsonic LH2 (liquid hydrogen) fueled commercial aircraft are discussed in terms of requirements and technology availability. Some of the differences between LH2 systems developed for space vehicles and those required for commercial aircraft are pointed out. Significant areas of technology requiring advancement and long lead time development testing are identified. The material presented reflects the results obtained from a Boeing study covering the development of a candidate fuel subsystem for a 3000 nautical mile range LH2 fueled commercial airplane.

77N22131# ISSUE 13 PAGE 1682 CATEGORY 7  
76/00/00 30 PAGES UNCLASSIFIED DOCUMENT

UTTL: Performance characteristics of turbo-rockets and turbo-ramjets using high energy fuel  
AUTH: A/DINI, D.  
CORP: Pisa Univ. (Italy). AVAIL. NTIS SAP: HC A20/MF A01  
In AGARD Variable Geometry and Multicycle Eng. 30 p (SEE N77-22112 13-07)  
MAJS: /\*HYDROGEN FUELS/\*JET ENGINE FUELS/\*TURBORAMJET ENGINES/\*TURBOROCKET ENGINES  
MINS: / AERODYNAMIC CHARACTERISTICS/ ENGINE DESIGN/ SUPERSONIC AIRCRAFT/ THERMODYNAMICS/ VARIABLE GEOMETRY STRUCTURES  
ABA: Author  
ABS: The aerodynamic and thermodynamic behavior of turbo-rockets and turbo-ramjets is considered. By means of variable engine geometry, multicycle engines meet aircraft requirements for takeoff, climb, cruise, maneuver, loiter, and landing. Performance characteristics are evaluated for these conditions, taking into account variable geometry in some intake and exhaust configurations. Problems arising from future high energy fuels, particularly hydrogen, impose changes in interface components, geometry, and control. Preliminary designs of turbo-rockets and turbo-ramjets for military and civil applications are discussed.

ORIGINAL PAGE  
OF POOR QUALITY

77N21638# ISSUE 12 PAGE 1617 CATEGORY 44  
76/03/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: A hydrogen-powered mass transit system

AUTH: A/BILLINGS, R. E.

CORP: Billings Energy Research Corp., Provo, Utah.  
AVAIL.NTIS SAP: HC A99/MF A01

In Miami Univ. First World Hydrogen Energy Conf  
Proc., Vol. 3 14 p (SEE N77-21626 12-44)

MAJS: /\*ENERGY POLICY/\*HYDROGEN FUELS/\*INTERNAL COMBUSTION  
ENGINES/\*TRANSPORTATION ENERGY/\*URBAN TRANSPORTATION

MINS: / ENGINE DESIGN/ EXHAUST GASES/ FUEL SYSTEMS/ METAL  
HYDRIDES/ MOTOR VEHICLES/ SAFETY MANAGEMENT

ABA: Author

ABS: Hydrogen's application to mass transit systems is  
considered. A 21-passenger bus is converted to  
hydrogen using a Dodge engine which has been modified  
for high compression operation. Backfiring and nitric  
oxide pollution formation are controlled by a water  
injection technique. Hydrogen fuel storage for the  
experimental prototype is accomplished by two metal  
hydride containers using an iron-titanium alloy. Data  
are presented regarding equipment conversion and  
design, energy resource utilization, economics, and  
safety.

77N21636# ISSUE 12 PAGE 1617 CATEGORY 44  
76/03/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Prototype hydrogen automobile using a metal hydride

AUTH: A/HENRIKSEN, D. L.; B/MACKAY, D. B.; C/ANDERSON, V.  
R.

CORP: Billings Energy Research Corp., Provo, Utah.  
AVAIL.NTIS SAP: HC A99/MF A01

In Miami Univ. First World Hydrogen Energy Conf.  
Proc., Vol. 3 12 p (SEE N77-21626 12-44)

ABA: Author

ABS: A 1975 Pontiac Grand Ville was converted to run on  
hydrogen. Engine conversion, the design of the  
iron-titanium storage system, and the design of  
related controls and safety equipment are discussed.  
Engine modifications include increase in compression  
ratio, conversion of the carburetor for water  
induction, and changes in the ignition system. Power  
control is obtained by throttling the air-hydrogen  
mixture. Waste heat from the engine exhaust is  
circulated through the hydride tank to drive off  
hydrogen. Controls are provided for regulating waste  
heat and hydrogen pressure. The method for recharging  
the system is also described.

77N10033\*# ISSUE 1 PAGE 6 CATEGORY 3 RPT#:  
NASA-CR-2699 D6-75775 CNT#: NAS1-14159 76/09/00  
176 PAGES UNCLASSIFIED DOCUMENT

UTTL: An exploratory study to determine the integrated  
technological air transportation system ground  
requirements of liquid-hydrogen-fueled subsonic,  
long-haul civil air transports TLSP: Final Report

CORP: Boeing Commercial Airplane Co., Seattle, Wash.;  
United Air Lines, Inc., Chicago, Ill.; Air Products  
and Chemicals, Inc., Allentown, Pa. CSS: (Dept. of  
Preliminary Design.) AVAIL.NTIS SAP: HC A09/MF  
A01

Washington NASA Prepared in cooperation with United  
Airlines and Air Products and Chemicals, Inc.

MAJS: /\*AIRLINE OPERATIONS/\*CRYOGENIC FLUID STORAGE/\*  
HYDROGEN FUELS/\*JET ENGINE FUELS/\*LIQUID HYDROGEN

MINS: / AIRPORTS/ CIVIL AVIATION/ COST ANALYSIS/ TECHNOLOGY  
ASSESSMENT

ABA: Author

ABS: A baseline air terminal concept was developed which  
permitted airlines and the airport to operate JP- or  
LH2-fueled aircraft at common terminal gates. The  
concept included installation of a hydrogen  
liquefaction and storage facility on airport property,  
as well as the fuel distribution system. The capital  
investment and hydrogen-related operating costs to the  
airlines were estimated.

77N10372\*# ISSUE 1 PAGE 52 CATEGORY 7 76/00/00  
11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen-fueled scramjets: Potential for detailed  
combustor analysis

AUTH: A/BEACH, H. L., JR.

CORP: National Aeronautics and Space Administration, Langley  
Research Center, Hampton, Va. AVAIL.NTIS SAP: HC  
A22/MF A01

In Its Advan. in Eng. Sci., Vol. 4 p 1629-1639 (SEE  
N77-10345 01-31)

SINGLE-PHASE FLOW/ TURBULENT FLOW

ABA: Author

ABS: Combustion research related to hypersonic scramjet  
(supersonic combustion ramjet) propulsion is discussed  
from the analytical point of view. Because the fuel is  
gaseous hydrogen, mixing is single phase and the  
chemical kinetics are well known; therefore, the  
potential for analysis is good relative to  
hydro-carbon fueled engines. Recent progress in  
applying two and three dimensional analytical  
techniques to mixing and reacting flows indicates  
cause for optimism, and identifies several areas for  
continuing effort.

77A33394# ISSUE 14 PAGE 2420 CATEGORY 85  
76/00/00 32 PAGES UNCLASSIFIED DOCUMENT

UTTL: Development of a liquid hydrogen car  
AUTH: A/FURUHAMA, S.; B/HIRUMA, M.; C/ENOMOTO, Y. PAA:  
C/(Musashi Institute of Technology, Tokyo, Japan)  
In: World Hydrogen Energy Conference, 1st, Miami  
Beach, Fla., March 1-3, 1976. Proceedings, Volume 3.  
(A77-33326 14-44) Coral Gables, Fla., University of  
Miami; New York, Pergamon Press, 1976. p. 6C-27 to  
6C-58.

ABA:

ABS: The design concept and efficiency of a car provided  
with liquid hydrogen as the vehicular fuel are  
described. A Datsun B210 930 kg weight small passenger  
car was modified into a vehicle with a liquid hydrogen  
tank. The modifications were made relative to  
introduction of cold hydrogen gas, mechanical fuel  
injection into intake port, a two-step fuel control  
device, control of mixture ratio, improvement of  
compression ratio, piston ring performance, spark plug  
and timing, and backfire caused by intake valve seat  
made of copper alloy. Test results of the modified  
engine on the bench are discussed. As a result of the  
complete running of the car on the public road  
together with usual cars in long distance such as 2800  
km, it is demonstrated that liquid hydrogen has a  
bright future as a carrying medium of automobiles. An  
ideal system of the liquid-hydrogen car should have a  
cassette type liquid-hydrogen tank, from which liquid  
hydrogen is fed to the small-volume high-pressure gas  
reservoir, and high-pressure hydrogen gas is to be  
injected into the combustion chamber of the engine.

77N10344# ISSUE 1 PAGE 48 CATEGORY 28  
76/00/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen-fueled subsonic aircraft: A perspective  
AUTH: A/WITCOFSKI, R. D.  
CORP: National Aeronautics and Space Administration, Langley  
Research Center, Hampton, Va. AVAIL:NTIS SAP: HC  
A20/MF A01  
In: Its Advan. In Eng. Sci., Vol. 3 p 1265-1278 (SEE  
N77-10305 01-31)

ABS: The performance characteristics of hydrogen-fueled  
subsonic transport aircraft are compared to those  
using conventional aviation kerosene. Additional  
aspects discussed include potential improvements in  
the exhaust emissions characteristics of aircraft jet  
engines, problems associated with onboard fuel  
containment, results of recent studies of the impact  
of hydrogen-fueled aircraft on the airport and  
associated ground support equipment, and estimates of  
the cost and thermal efficiency of producing synthetic  
aviation fuels from coal.

77A33392# ISSUE 14 PAGE 2304 CATEGORY 7 CNT#:  
NAS7-100 76/00/00 28 PAGES UNCLASSIFIED DOCUMENT

UTTL: New potentials for conventional aircraft when powered  
by hydrogen-enriched gasoline  
AUTH: A/MENARD, W. A.; B/MOYNIHAN, P. I.; C/RUPE, J. H.  
PAA: C/(California Institute of Technology, Jet  
Propulsion Laboratory, Pasadena, Calif.)  
CORP: Jet Propulsion Lab., California Inst. of Tech.,  
Pasadena.

In: World Hydrogen Energy Conference, 1st, Miami  
Beach, Fla., March 1-3, 1976. Proceedings, Volume 3.  
(A77-33326 14-44) Coral Gables, Fla., University of  
Miami; New York, Pergamon Press, 1976. p. 5C-59 to  
5C-86.

ABA: (Author)

ABS: Hydrogen enrichment for aircraft piston engines is  
under study in a new NASA program. The objective of  
the program is to determine the feasibility of  
inflight injection of hydrogen in general aviation  
aircraft engines to reduce fuel consumption and to  
lower emission levels. A catalytic hydrogen generator  
will be incorporated as part of the air induction  
system of a Lycoming turbocharged engine and will  
generate hydrogen by breaking down small amounts of  
the aviation gasoline used in the normal propulsion  
system. This hydrogen will then be mixed with gasoline  
and compressed air from the turbocharger before  
entering the engine combustion chamber. The paper  
summarizes the results of a systems analysis study.  
Calculations assuming a Beech Duke aircraft indicate  
that fuel savings on the order of 20% are possible. An  
estimate of the potential for the utilization of  
hydrogen enrichment to control exhaust emissions

indicates that it may be possible to meet the 1979  
Federal emission standards.

**Modification Techniques and Performance Characteristics of Hydrogen (Powered IC Engines) State of the ART, 1975.**

F. B. Simpson, J. H. Lofthouse, D. R. Swope, and R. L. Wooley.

Idaho National Engineering Lab., Idaho Falls. Sep 76, 26p  
ANCR-1302 Price code: PC A03/MF A01

Over the past quarter of a century there has been a significant amount of work on modification of internal combustion (IC) engines to operate on hydrogen. However, comparisons are difficult because of large variation in designs, engine parameters, and test conditions. A comparative summary of the recent work on hydrogen-powered engines is presented under a unifying format. This summary includes material extracted from published reports and obtained by private communication. It is intended that this survey be of value to those beginning work in the field, and will provide some guidance in determining the direction of future research. Included are the following: engine parameters, modifications, operating conditions, running characteristics, performance, and related comments. More detailed discussion is included on the manpower and material costs associated with the modification of one of the engines listed. (ERA citation 02:022793)

**NASA CR-2534**

**ADVANCED SUPERSONIC TECHNOLOGY CONCEPT STUDY - HYDROGEN FUELED CONFIGURATION. G. D. Brewer and R. E. Morris. (Summary Rpt.). Apr. 1975.**

**Lockheed-California Co., Burbank, Calif. LR 26322  
NASA NAS2-7732**

Conceptual designs of hydrogen fueled supersonic transport configurations for period were developed and compared with equivalent technology Jet A-1 fueled determine the economic and performance potential of liquid hydrogen as an alternative.

Parametric evaluations of supersonic cruise vehicles with varying design and mission characteristics established the basis for selecting a preferred configuration which was then studied in greater detail.

An assessment was made of the general viability of the selected concept including evaluation of costs and environmental considerations, i.e., exhaust emissions and boom characteristics. Technology development requirements and suggested implementation schedules are presented.

79N33207\*# ISSUE 24 PAGE 3178 CATEGORY 7 RPT#:  
NASA-CR-132558 LR-26752-1 CNT#: NAS1-12972  
75/01/00 56 PAGES UNCLASSIFIED DOCUMENT

UTTL: Study of the application of hydrogen fuel to long-range subsonic transport aircraft. Volume 1: Summary TLSP: Final Report

AUTH: A/BREWER, G. D.; B/MORRIS, R. E.; C/LANGE, R. H.; D/MOORE, J. W.

CORP: Lockheed-California Co., Burbank. AVAIL.NTIS SAP: HC A04/MF A01

ADR: For vol. 2 see N75-30163

ABS: The feasibility of using liquid hydrogen as fuel in advanced designs of long range, subsonic transport aircraft is assessed. Both passenger and cargo type aircraft are investigated. Comparisons of physical, performance, and economic parameters of the LH2 fueled designs with conventionally fueled aircraft are presented. Design studies are conducted to determine appropriate characteristics for the hydrogen related systems required on board the aircraft. These studies included consideration of material, structural, and thermodynamic requirements of the cryogenic fuel tanks and fuel systems with the structural support and thermal protection systems.

75V37449 1974 ISS: 00 TL704.7.U53 1974 629.134351 LC-75-600784

UTTL: Hydrogen as an aviation fuel : TLSP: report / prepared by the Subcommittee on Aeronautics and Space Technology of the Committee on Science and Astronautics, U.S. House of Representatives, Ninety-third Congress, second session, United States, Congress, House, Committee on Science and Astronautics, Subcommittee on Aeronautics and Space Technology.

U.S. Govt. Print. Off., Washington : v. 26 p. : 23 cm.

At head of title: Committee print. "Serial DD."

LC: Airplanes -- Fuel. Hydrogen as fuel.

NASA: / AIRCRAFT FUELS/ HYDROGEN FUELS

AM-ATL: / TL704.7.U532 1974 JPL: / TL704.7.U5B 1974

MAIN-CORP TRACE-TITL\* CATLG BY-LC

/ / AVAIL: / AMES-ATL/ JPL

78N74313# CATEGORY 28 RPT#: SLL-73-0053 73/08/00  
49 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hydrogen as vehicular fuel

AUTH: A/BAUER, W.; B/KEETON, S. C.; C/TALLERICO, L. N.; D/LANDRAM, C. S.

CORP: Sandia Labs., Albuquerque, N. Mex. AVAIL.NTIS

MAJS: /\*AUTOMOBILE FUELS/\*FUEL CONSUMPTION/\*HYDROGEN FUELS

MINS: / DESIGN ANALYSIS/ HEAT EXCHANGERS/ HYDRIDES/ SAFETY FACTORS/ TRANSITION METALS

74V16504 1967 ISS: 00 QD516.B26 541.361 LC-74-520931  
AUTH: A/Banes, B.; B/McIntyre, R. W.; C/Sims, J. A.  
UTTL: Properties of air and combustion products with  
kerosine and hydrogen fuels; TLSP: equilibrium  
composition and thermodynamic properties for air and  
systems C(subscript n)H b2 s(subscript n)/air and  
H b2 s/air including second virial corrections, by B.  
Banes, R. W. McIntyre and J. A. Sims.  
Published by Bristol Siddeley Engines on behalf of the  
Propulsion and Energetics Panel of the Advisory Group  
for Aerospace Research and Development Filton, Eng.,  
13 vols. illus., tables 22 cm.  
In English, French English and French; summaries in  
English and French. Includes bibliographical  
references.  
LC: Air -- Tables, calculations, etc. Combustion gases  
-- Tables, calculations, etc. Hydrocarbons -- Tables,  
etc. Thermodynamics -- Tables, calculations, etc.  
Chemical equilibrium -- Tables, etc. Combustion gases.  
Gases, Air--Analysis. Air--Pollution--Research.  
Kerosene.  
ADDED: McIntyre, R. W., joint author. Sims, J. A.,  
joint author. North Atlantic Treaty Organization,  
Advisory Group for Aerospace Research and Development,  
Propulsion and Energetics Panel.  
NASA: / AIR/ AIR POLLUTION/ COMBUSTION/ COMBUSTION  
PRODUCTS/ DYNAMIC CHARACTERISTICS/ GASES/ HYDROGEN  
FUELS/ KEROSENE/ NORTH ATLANTIC TREATY ORGANIZATION  
(NATO)/ RESEARCH/ THERMODYNAMIC PROPERTIES  
JSC: / QD516.B21  
MAIN-AUTH TRACE-CORP\*TITL\*AUTH\* CATLG BY-LC  
/ / Publ In UNITED KINGDOM AVAIL: / JOHNSON

79N74877# CATEGORY 2B RPT#: PB-287999/7 PAPER-74-6  
74/10/00 33 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Energy carriers in space conditioning and automotive  
applications: A comparison of hydrogen, methane,  
methanol and electricity  
AUTH: A/DAVITIAN, H.  
CORP: Cornell Univ., Ithaca, N. Y. CSS: (Energy Proj.)  
AVAIL.NTIS  
Sponsored by NSF  
MAJS: /\*AIR CONDITIONING/\*AUTOMOBILE FUELS/\*ELECTRIC CURRENT  
/\*HYDROGEN FUELS/\*METHANE/\*METHYL ALCOHOLS  
MINS: / COSTS/ PETROLEUM PRODUCTS/ THERMODYNAMIC EFFICIENCY

77N76374# CATEGORY 2B RPT#: AD-A028224  
SSS-R-74-2345 AFFDL-TR-74-102 CNT#: F33615-72-C-2193  
AF PROJ. 4363 75/09/00 59 PAGES UNCLASSIFIED  
DOCUMENT  
UTTL: Military applications of liquid hydrogen fueled  
aircraft TLSP: Technical Report, Mar. - Jul. 1974  
AUTH: A/SCHALIT, L. M.; B/READ, H. E.  
CORP: Systems Science and Software, La Jolla, Calif.  
AVAIL.NTIS  
MAJS: /\*HYDROGEN FUELS/\*MILITARY AIRCRAFT  
MINS: / FUEL TANKS/ LIQUID HYDROGEN/ VULNERABILITY

ETHANOL

79N33346# ISSUE 24 PAGE 3197 CATEGORY 28 RPT#:  
PB-295645/6 79/00/00 34 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Ethanollic fuels from renewable resources in the solar  
age  
AUTH: A/GREGOR, H. P.; B/JEFFRIES, T. W.  
CORP: Columbia Univ., New York. CSS: (Dept. of Chemical  
Engineering and Applied Chemistry.) AVAIL.NTIS  
SAP: HC A03/MF A01  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ETHYL ALCOHOL/\*FUELS/\*  
ORGANIC COMPOUNDS/\*SOLID WASTES/\*SYNTHETIC FUELS  
MINS: / CELLULOSE/ COST ANALYSIS/ FERMENTATION/ FILTRATION/  
HYDROLYSIS/ OSMOSIS  
ABA: GRA  
ABS: Production of ethanol, other liquid fuels, and organic  
chemicals from cellulosic biomass at prices that can  
compete with those of petroleum derived materials by  
employing presently available or soon to be developed  
membrane technologies is described. Contemporary  
membrane technologies can already effect major savings  
in process costs for the conventional fermentation of  
grains or molasses to produce ethanol; developing  
membrane technologies could employ cheap cellulosic  
substrates for ethanol production.

79N32384# ISSUE 23 PAGE 3070 CATEGORY 28 RPT#:  
SAN-0115-T3 79/01/00 179 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Mission analysis for the federal fuels from biomass  
program. Volume 4: Thermochemical conversion of  
biomass to fuels and chemicals TLSP: Final Report  
AUTH: A/KOHAN, S. M.; B/BARKHORDAR, P. M.  
CORP: SRI International Corp., Menlo Park, Calif.  
AVAIL.NTIS SAP: HC A09/MF A01  
ABA: DOE  
ABS: The selection of the feedstock used in the analysis of  
thermochemical conversion technologies is discussed.  
Detailed technical and economic evaluation are  
presented of biomass conversion to electricity and  
steam by combustion, SNG by gasification and  
methanation, methanol by gasification and synthesis,  
oil by catalytic liquefaction, oil and char by  
pyrolysis, and ammonia by gasification and synthesis.

79N26233# ISSUE 17 PAGE 2247 CATEGORY 28 RPT#:  
PB-292552/7 CAEC-28 79/01/00 31 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: The production of ethanol from agricultural waste: An  
economic evaluation TLSP: Final Report  
AUTH: A/PAIGE, D.; B/BOULTON, R.  
CORP: California Univ., Davis. AVAIL.NTIS SAP: HC  
A03/MF A01  
Sponsored by Calif. Energy Commission  
MAJS: /\*ECONOMIC ANALYSIS/\*ETHYL ALCOHOL/\*FOOD/\*  
MANUFACTURING/\*SOLID WASTES/\*SYNTHETIC FUELS  
MINS: / CALIFORNIA/ DISTILLATION/ HYDROLYSIS/ PRODUCTION  
ENGINEERING  
ABA: GRA  
ABS: The quantities of wet waste and dry waste available in  
California are estimated. Economic analyses based on  
investment rate of return are developed for four  
alternate process schemes, varying in complexity from  
a simple pretreatment, fermentation, and distillation  
process to a process involving pretreatment, enzymatic  
hydrolysis, concentration, aerobic ethanol  
fermentation, and distillation. The hypothesized  
schemes use tomato and peach cannery wastes and/or  
rice straw as feedstocks. The economic sensitivity to  
plant size, ethanol market price, and waste treatment  
credit is shown. Annual investment rates of return of  
from 7 to 12 percent are calculated.

ETHANOL FROM AGRICULTURAL RESIDUES. O. C. Stton,  
J. L. Gaddy.

Chemical Engineering Progress, vol 75, no 12, 1979  
December, p. 52-57.

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OF POOR QUALITY

79A40745# ISSUE 17 PAGE 3236 CATEGORY 44  
79/00/00 19 PAGES UNCLASSIFIED DOCUMENT

UTTL: Material and energy balances in the production of ethanol from wood

AUTH: A/WAYMAN, M.; B/LORA, J. H.; C/GULBINAS, E. PAA: C/(Toronto, University, Toronto, Canada)  
In: Chemistry for energy: Proceedings of the Symposium, Winnipeg, Manitoba, Canada, June 5-7, 1978. (A79-40736 17-44) Washington, D.C., American Chemical Society, 1979, p. 183-201. Research supported by the National Research Council of Canada and University of Toronto.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENZYMES/\*ETHYL ALCOHOL/\*HYDROLYSIS/\*SULFURIC ACID/\*WOOD

MINS: / CELLULOSE/ ENERGY TECHNOLOGY/ FERMENTATION/ FLOW CHARTS/ GRAPHS (CHARTS)/ HYDROCARBON FUEL PRODUCTION

ABA: S.D.

ABS: Processes for ethanol production from wood are examined in an effort to obtain data on material and energy balances, and possibly on the economics involved. The discussion covers pretreatment of wood, acid hydrolysis, enzyme hydrolysis, fermentation, material and energy balances for acid and enzyme hydrolysis following autohydrolysis and caustic extraction, and the economics of these two processes. Gross energy recoveries (ethanol + lignin) by the two processes are found to be 52.4% and 58.0% respectively, with net energy recoveries of 36.1% and 42.3%. Economic estimates show a significant advantage in investment and operating costs for the enzyme hydrolysis process.

79A28439 ISSUE 11 PAGE 2055 CATEGORY 44  
79/02/00 7 PAGES In FRENCH UNCLASSIFIED DOCUMENT

UTTL: On future carburants, II --- alternative fuels from alcohols and hydrogen

AUTH: A/GRENON, M.  
Revue de l'Energie, vol. 30, Feb. 1979, p. 118-124. In French.

MAJS: /\*ELECTRIC BATTERIES/\*ETHYL ALCOHOL/\*HYDROCARBON FUELS /\*METHYL ALCOHOLS

MINS: / ALLOYS/ ELECTRIC AUTOMOBILES/ ENERGY CONSUMPTION/ ENERGY REQUIREMENTS/ HYDROGEN-BASED ENERGY/ METAL HYDRIDES

ABA: (Author)

ABS: As was noted in the first part of this article, there is widespread incertitude concerning both possible future conception levels and future fuel needs over the next few decades. Although research on substitute fuels is not being carried-out with great vigor, methanol, ethanol and hydrogen must be mentioned as being the most promising solutions, or at least the solutions which are being most actively studied. This article deals with these fuels of the 'future'.

79A47813 ISSUE 21 PAGE 3982 CATEGORY 44  
79/08/31 3 PAGES UNCLASSIFIED DOCUMENT

UTTL: Dehydration of ethanol - New approach gives positive energy balance

AUTH: A/LADISCH, M. R.; B/DYCK, K. PAA: B/(Purdue University, West Lafayette, Indiana)  
Science, vol. 205, Aug. 31, 1979, p. 898-900.

MAJS: /\*CELLULOSE/\*CHEMICAL ENERGY/\*DEHYDRATION/\*ETHYL ALCOHOL

MINS: / CALCIUM OXIDES/ DISTILLATION/ ENERGY REQUIREMENTS/ PH FACTOR/ SODIUM HYDROXIDES/ TEMPERATURE EFFECTS

ABA: C.F.W.

ABS: A method of dehydrating ethanol in which the combustion energy of the ethanol product exceeds the energy needed to carry out the dehydration by a factor of 10 is presented. This involves removing water from aqueous ethanol by using cellulosic materials, starch, corn, and other agents. Column temperature was found to have a significant effect on dehydration: at 1 equal to 91 C, corn easily dehydrates alcohol and at 79.5 C this capacity is diminished. The advantage of using organic rather than inorganic dehydration agents is that the temperature of regeneration is lower for starch or cellulose (60 to 110 C) than for CaO (160 to 170 C), thus utilizing lower temperature energy for regenerating a dehydrating agent such as cellulose or starch.

79A49425 ISSUE 22 PAGE 4181 CATEGORY 44  
79/09/24 3 PAGES UNCLASSIFIED DOCUMENT

UTTL: Biomass - The self-replacing energy resource

AUTH: A/BYLINSKY, G.  
Fortune, vol. 100, Sept. 24, 1979, p. 78, 79, 81.

MAJS: /\*ALCOHOLS/\*BIOMASS ENERGY PRODUCTION/\*COST EFFECTIVENESS/\*ENERGY SOURCES/\*FORESTS/\*WOOD

MINS: / CORN/ DOMESTIC ENERGY/ ELECTRIC POWER PLANTS/ ENERGY CONVERSION EFFICIENCY/ ENERGY TECHNOLOGY/ TIMBER VIGOR

ABA: C.F.W.

ABS: The paper discusses the use of biomass as an alternative energy source, focusing mainly on coal and wood. The advantages of employing coal burning for ethanol distillation plants are discussed as well as methods of ethanol extraction from corn. Other energy sources are also discussed which include utilizing unharvested, new-grown hardwood that accounts for 55% of the total wood growth. It was determined that forest growth could be doubled if the problem of inadequate harvesting equipment could be overcome. Attention is given to wood-chip-burning house-heating systems and also to fast growing water plants, that can be harvested and converted into methane and fertilizer.

79A51774 ISSUE 22 PAGE 4372 CATEGORY 44  
79/00/00 6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Which alcohol fuel for Brazil - Methanol or ethanol  
AUTH: A/CARVALHO, A. V., JR.; B/YANG, V.; C/TRINDADE, S.  
C. PAA: C/(Centro de Tecnologia Promon, Rio de  
Janeiro, Brazil)

In: Intersociety Energy Conversion Engineering  
Conference, 14th, Boston, Mass., August 5-10, 1979.  
Proceedings, Volume 1. (A79-51726 23-44) Washington,  
D.C., American Chemical Society, 1979, p. 295-300.

MAJS: /\*ENERGY REQUIREMENTS/\*ETHYL ALCOHOL/ HYDROCARBON FUEL  
PRODUCTION/\*METHYL ALCOHOLS

MINS: / BRAZIL/ COST ANALYSIS/ ETHYLENE/ FUEL CONSUMPTION/  
GASOLINE/ WOOD

ABA: (Author)

ABS: This paper is an updated account of the achievements  
of the Brazilian National Alcohol Program and of the  
recently proposed program on methanol from wood  
(eucalyptus). Both programs aim at production and  
utilization of alcohol fuels. Production, utilization  
and process considerations of both methanol and  
ethanol are presented. Alcohols are still more  
expensive than petroleum fuels but provide more social  
benefits than imported energy.

78A36443 ISSUE 15 PAGE 2679 CATEGORY 23  
78/05/00 2 PAGES UNCLASSIFIED DOCUMENT

UTTL: Enzymes show promise for biomass conversion

AUTH: A/PYE, E. K. PAA: A/(Pennsylvania, University,  
Philadelphia, Pa.)

Energy, vol. 3, Spring 1978, p. 23, 24.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*CELLULOSE/\*ENZYME  
ACTIVITY/\*ETHYL ALCOHOL/\*ORGANIC WASTES (FUEL  
CONVERSION)

MINS: / BRAZIL/ COST ANALYSIS/ ENERGY TECHNOLOGY/ GLUCOSE

ABA: M.L.

ABS: Enzymatic procedures for converting cellulose into  
glucose which can be fermented to ethanol are  
considered. Current research projects involve the use  
of *Thermoactinomyces* cellulase and hemicellulase to  
convert beef cattle wastes into sugars, the use of  
*Trichoderma reesei* cellulase to convert a variety of  
cellulosic materials, the use of amyloglucosidase to  
transform plant starch, and the use of *Trichoderma*  
*viride* enzymes to break down cellulose from paper mill  
pulp, corn cobs, and cotton gin trash. An advantage of  
enzymatic processes is that they proceed under  
moderate conditions (30-50 C, neutral pH) and do not  
require the high temperature and pressure and low pH  
that are necessary for acid decomposition of  
cellulose. The cost of obtaining ethanol from  
cellulose is discussed and is shown to be competitive  
with alternative fuel costs in some parts of the  
world.

79A45231 ISSUE 19 PAGE 3627 CATEGORY 44  
78/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Biomass conversion potential in the Southeast  
AUTH: A/SAHA, H. PAA: A/(Alabama A & M University,  
Huntsville, Ala.)

In: Application of solar energy: Proceedings of the  
Third Southeastern Conference, Huntsville, Ala., April  
17-19, 1978. (A79-45201 19-44) Huntsville, Ala., UAH  
Press, 1978, p. 481-488.

ABA: C.F.W.

ABS: The biomass production and conversion potential of the  
southeastern U.S., with its large forest land and wood  
residue, long coastal areas, abundance of water, large  
amounts of readily collectable agricultural, urban and  
industrial waste materials, longer rainfall and  
fertile soil, is examined. Various types of biomass  
production and conversion methods, including  
terrestrial and silvicultural biomass as well as  
herbaceous, aquatic and organic waste biomass, are  
evaluated. A result of a silvicultural biomass  
production found that its productivity under  
closed-space, short-rotation conditions could yield  
annual dry-ton-equivalents of 5 to 13 tons per acre.  
It was also determined that the most promising  
production of large quantities of biomass in the SE  
U.S. would be the establishment of intensively-managed  
energy farms, using woody and herbaceous species,  
including forest and crop residues, high-yield crops,  
and animal manure. Special attention is given to  
diagrams that describe biomass conversions, such as  
terrestrial biomass and domestic residue, and to a  
description of the basic steps in ethanol production  
from farm products.

79N29652# ISSUE 20 PAGE 2697 CATEGORY 44 RPT#:  
LBL-8658 CNT#: W-7405-ENG-48 78/12/00 55 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Process development studies on the bioconversion of  
cellulose and production of ethanol

AUTH: A/WILKE, C. R.; B/BLANCH, H. W.

CORP: California Univ., Berkeley, Lawrence Berkeley Lab.  
AVAIL:NTIS SAP: HC A04/MF A01

MAJS: /\*CELLULOSE/\*ETHYL ALCOHOL/\*PRODUCTION ENGINEERING

MINS: / ENZYME ACTIVITY/ FERMENTATION/ HYDROLYSIS

ABA: Author (DOE)

ABS: Progress is reported in the following areas: raw  
materials and process evaluation, enzyme fermentation  
studies, ethanol fermentation studies, hydrolysis  
reactor development, and utilization of hemicellulose  
sugars.

79N27338# ISSUE 18 PAGE 2391 CATEGORY 28 RPT#:  
CONF-7806139-1 78/00/00 19 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Material and energy balances in the production of ethanol from wood --- conferences

AUTH: A/WAYMAN, M.; B/LORA, J. H.; C/GULBINAS, E.  
CORP: Toronto Univ. (Ontario). CSS: (Dept. of Chemical Engineering and Applied Chemistry.) AVAIL.NTIS  
SAP: HC A02/MF A01

Presented at Symp. on Chem. for Energy, Winnipeg, Canada, Jun. 1978

MAJS: /\*CONFERENCES/\*ETHYL ALCOHOL/\*HYDROLYSIS/\*PRODUCTION  
ENGINEERING/\*SYNTHETIC FUELS/\*WOOD

MINS: / COST ESTIMATES/ ENZYMES/ MATERIALS RECOVERY

ABA: DOE

ABS: Experimental production of ethanol from aspen wood gave yields of 70.7% or 83.4% when acid hydrolysis or enzymatic hydrolysis were used after autohydrolysis and extraction of lignin. These were, respectively, 58.4 and 68.9 gallons of 95% ethanol per ton of aspen wood (dry basis). In addition 426 lb of lignin with heat of combustion 11,100 Btu/lb were obtained per ton of wood. Multi-stage hydrolysis was beneficial for both acid and enzymatic hydrolysis, 80% and over 99% of theoretical yields of sugar being obtained by the two processes. Economic estimates show a significant advantage in investment and operating costs for the enzymatic process. The price of 95% ethanol, including a reasonable return on investment by this process is estimated at \$1.34/gallon.

78N30404# ISSUE 21 PAGE 2797 CATEGORY 28  
78/02/00 6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Alcohols and gaseous fuels from biomass

AUTH: A/MCCALLUM, P. W.

CORP: Mueller Associates, Inc., Baltimore, Md. AVAIL.NTIS  
SAP: HC A22/MF A01

In NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 p 789-795 (SEE N78-30370 21-31)

MAJS: /\*ALCOHOLS/\*BIOMASS ENERGY PRODUCTION/\*GASEOUS FUELS/\*  
WASTE UTILIZATION

MINS: / ENERGY CONVERSION/ ENERGY TECHNOLOGY/ FERMENTATION/  
METHANE/ TRANSPORTATION ENERGY/ WASTE ENERGY  
UTILIZATION

ABA: G. Y.

ABS: Bioconversion processes for the production of alcohols and gaseous fuels from biomass or organic plant and animal matter are discussed. An anaerobic digestion (fermentation) scheme is presented for the production of methane and ethanol from complex organics and organic starches, respectively. The implications of the utilization of alcohols and gaseous fuels for transportation are discussed.

79N32389# ISSUE 23 PAGE 3070 CATEGORY 28 RPT#:  
TID-29400-2 CNT#: W-7405-ENG-92 78/08/31 315  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Sugar crops as a source of fuels. Volume 2:  
Processing and conversion research

AUTH: A/LIPINSKY, E. S.; B/BIRKETT, H. S.; C/POLACK, J. A.;  
D/ATCHISON, J. E.; E/KRESOVICH, S.; F/MCCLURE, T. A.;  
G/LAWHON, W. T.

CORP: Battelle Columbus Labs., Ohio. AVAIL.NTIS SAP: HC  
A14/MF A01

MAJS: /\*DISTILLATION/\*ETHYL ALCOHOL/\*FERMENTATION/\*  
HYDROCARBON FUEL PRODUCTION/\*SUGAR CANE

MINS: / CELLULOSE/ COST ESTIMATES/ KETONES/ LIGNIN

ABA: DOE

ABS: Topics discussed include processing of sugar crops for the manufacture of fermentable sugars; conversion of fermentable sugars into ethanol considered from both a technical and economic viewpoint; and research and development implications of the technical and economic results. Appendices provide equipment lists, materials and energy balances, and costs for the manufacture of ethanol from sugarcane and from molasses, using state-of-the-art technology. Ethanol from sugarcane or sweet sorghum is unlikely to be available in large quantities for less than \$1.00 per gallon because improvements in sugar crop production and processing are needed to hold the raw material costs for ethanol to \$0.70 per gallon. When reasonable provisions are made for fermentation, distillation and return on investments, the target of \$1.00 per gallon appears appropriate. There are opportunities to manufacture liquid motor fuels other than ethanol from sugar crop juice and/or associated lignocellulosic fractions. Typical alternatives are 2,3-butanediol, ketones derived from short-chain fatty acids, and microbial oils.

A79-40745 # Material and energy balances in the production of ethanol from wood. M. Wayman, J. H. Lora, and E. Gulbinas (Toronto, University, Toronto, Canada). In: Chemistry for energy: Proceedings of the Symposium, Winnipeg, Manitoba, Canada, June 5-7, 1978. (A79-40736 17-44) Washington, D.C., American Chemical Society, 1979, p. 183-201. 23 refs. Research supported by the National Research Council of Canada and University of Toronto.

Processes for ethanol production from wood are examined in an effort to obtain data on material and energy balances, and possibly on the economics involved. The discussion covers pretreatment of wood, acid hydrolysis, enzyme hydrolysis, fermentation, material and energy balances for acid and enzyme hydrolysis following autohydrolysis and caustic extraction, and the economics of these two processes. Gross energy recoveries (ethanol + lignin) by the two processes are found to be 52.4% and 58.0%, respectively, with net energy recoveries of 36.1% and 42.3%. Economic estimates show a significant advantage in investment and operating costs for the enzyme hydrolysis process. S.D.

## ELECTRO-CHEMICAL ELECTRICITY FROM ETHANOL

Gary Garriott

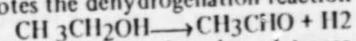
Alternative Sources

Vol. no. 30 February 1978

p. 22-26

One such project, submitted jointly by the University of Wisconsin-Green Bay and Armstrong Senior High School, Neenah, Wisc., a winner of a major award for organic innovation, proposed the production of low-power electricity from ethanol, a fermentable alcohol distilled from a wide variety of starch and sugar plants and crops. Its conception was inspired by conditions existing in many isolated areas of the world; particularly underdeveloped countries; where low-power electricity is required for emergency communications; educational radio, television, and cinema; and a host of other special and miscellaneous needs. Among many factors, the project design specifically attempted to eliminate the weight and maintenance problems of large moving parts associated with motor-generator technology as well as promoting the utilization of indigenous, non-polluting alcohol fuel as a renewable alternative to gasoline. Difficulties related to these and other factors (see Table I) severely restrict the availability and reliability of transported electricity in isolated regions.

The system operates in this fashion: feed alcohol is first vaporized and passed over a catalyst heated to 275°C. which promotes the dehydrogenation reaction



Acetaldehyde, unreacted ethanol, and traces of other impurities are condensed from the gas stream by a series of scrubbers, leaving nearly pure hydrogen for introduction into a fuel cell which combines oxygen from the air and hydrogen electrochemically to produce direct current electricity. Energy can be utilized directly or stored in a suitable battery bank. Recovered alcohol and acetaldehyde can be combusted to provide heat for vaporization and the dehydrogenation reaction.

N79-29652# California Univ., Berkeley. Lawrence Berkeley Lab

PROCESS DEVELOPMENT STUDIES ON THE BIOCONVERSION OF CELLULOSE AND PRODUCTION OF ETHANOL

Charles R. Wilke and H. W. Blanch Dec. 1978 55 p refs (Contract W-7405-eng 48)

(LBL-8658) Avail. NTIS HC A04/MF A01

Progress is reported in the following areas: raw materials and process evaluation, enzyme fermentation studies, ethanol fermentation studies, hydrolysis reactor development, and utilization of hemicellulose sugars. Author (DOE)

BIOCHEMICAL ENGINEERING: RENEWABLE SOURCES OF ENERGY AND CHEMICAL FEEDSTOCKS. John M. Nystrom and Stanley H. Barnett, eds. (Papers presented at Symposium on Biochemical Sources of Energy held at 2nd Pacific Chemical Engineering Congress, Denver, Colo., Aug. 1977 and Symposium on Biological Sources of Energy & Chemical Feedstocks held at 84th National AIChE Meeting, Atlanta, Ga., Feb. 1978)

BIOCONVERSION OF PLANT BIOMASS TO ETHANOL.....

American Institute of Chemical Engineers

Symposium on Biochemical Sources of Energy

Symposium on Biological Sources of Energy & Chemical Feedstocks

Aug. 1977  
Feb. 1978

p. 75

79N28361# ISSUE 19 PAGE 2530 CATEGORY 28 RPT#:  
TID-29093-VOL-5 CNT# EY-76-C-03-0015-131 78/12/00  
203 PAGES UNCLASSIFIED DOCUMENT

UTTL: Mission analysis for the federal fuels from biomass program. Volume 5: Biochemical conversion of biomass to fuels and chemicals

AUTH: A/JONES, J. L.; B/FONG, W. S.; C/SCHOOLEY, F. A.; D/DICKENSON, R. L.

CORP: SRI International Corp., Menlo Park, Calif.  
AVAIL. NTIS SAP: HC A10/MF A01

MAJS: /\*BIOCHEMISTRY/\*BIOMASS ENERGY PRODUCTION

MINS: / ALCOHOLS/ ENERGY TECHNOLOGY/ FERMENTATION/ SUGARS

ABA: DOE

ABS: In the analysis of the anaerobic digestion options, specific feedstocks, including animal manure, wheat straw, and marine algae (giant kelp), are considered on a case basis. The processes are described, investment and operating costs estimated, and the availability and reliability of the technology and environmental considerations briefly discussed. The analysis of the fermentation of biomass feedstocks to ethanol from sugars and the actual production of the sugars are described. After describing the process for fermentation of sugars to alcohol, estimating investment and operating costs, and commenting on the availability and reliability of the technology and environmental considerations, a number of alternative feedstocks and processes for producing the fermentable sugar solutions are examined. These processes for producing the sugar solutions are examined in a manner comparable with that mentioned above. The feedstocks included in the analysis are sugar cane, wheat straw, and aquatic biomass.

## ENERGY BALANCE FOR ETHYL ALCOHOL PRODUCTION FROM CROPS.

Jose Gomes da Silva, et al.

Science, v.201, Sept.8,1978, p.903-906.

Abstract. Energy requirements to produce ethyl alcohol from three different crops in Brazil (sugarcane, cassava, and sweet sorghum) were calculated. Figures are presented for the agricultural and industrial phases. The industrial phase is always more energy-intensive, consuming from 60 to 75 percent of the total energy. Sugarcane is the more efficient crop for ethyl alcohol production, followed by sweet sorghum and cassava from a net energy viewpoint. The utilization of sweet sorghum stems might increase the total energy gain from this crop to almost the same level as sugarcane. Cassava has a lower energy gain at the present state of agriculture in Brazil.

9903 Process design and economic studies of alternative fermentation methods for the production of ethanol. Cysewski, G.R.; Wilke, C.R. (Lawrence Berkeley Lab., CA). *Biotechnol. Bioeng.*; 20: No. 9, 1421-1444(Sep 1978).

Cell recycle and vacuum fermentation processes are described for the continuous production of ethanol. Preliminary process design studies are employed to make an economic comparison of these alternative fermentation schemes with continuous and batch fermentation technologies. Designs are based on a production capacity of 78,000 gal 95% ethanol (EtOH)/day employing molasses as the fermentation substrate. The studies indicate that a 57% reduction in fixed capital investment is realized by continuous rather than batch operation. Further decreases in required capital investment of 68 and 71% over batch fermentation were obtained for cell recycle and vacuum operation, respectively. However, ethanol production costs were dominated by the cost of molasses, representing over 75% of the total manufacturing cost. But, when a reasonable yeast by-product credit was assumed, the net production cost for 95% ethanol was estimated at 82.3 and 80.6 cent/gal, for the cell recycle and vacuum processes, respectively.

32757 (COO-5007-1) Technology and economics of conversion of cellulose (wood) and corn starch to sugars, alcohol and yeast. Final report. Wolnak, B. (Wolnak (Bernard) and Associates, Chicago, IL (USA)). Aug 1978. Contract ET-78-X-02-5007. 253p. Dep. NTIS, PC A12/MF A01.

The present status of the technology and economics for the production of glucose, alcohol, and yeast from cellulose (wood), corn starch, and molasses is analyzed. The basic processes for producing glucose and the factors affecting the economics of its production are reviewed. The costs of producing ethanol and yeast from the glucose are derived. Market availability of glucose, ethanol, and yeast is surveyed. (JSR)

78N30391# ISSUE 21 PAGE 2796 CATEGORY 28  
78/02/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: Recent progress in automotive alcohol fuel application

AUTH: A/MENRAD, H. K.

CORP: Volkswagen A.G., Wolfsburg (West Germany).

AVAIL.NTIS SAP: HC A22/MF A01

In NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 p 712-727 (SEE N78-30370 21-31)

MAJS: /\*AUTOMOBILE FUELS/\*ENERGY TECHNOLOGY/\*ETHYL ALCOHOL/\* METHYL ALCOHOLS/\*TECHNOLOGY ASSESSMENT/\*TRANSPORTATION ENERGY

MINS: / AUTOMOBILE ENGINES/ BIOMASS ENERGY PRODUCTION/ EXHAUST GASES/ OCTANE NUMBER/ SYNTHETIC FUELS

ABA: A.R.H.

ABS: Topics covered include: (1) biomass energy production of ethanol; (2) methanol synthesis; (3) fleet tests of Volkswagen vehicles using 15 volume % methanol mixture; (4) fleet tests using straight methanol or straight ethanol; (5) improved performance of spark ignition engines during bench tests using alcohols as fuel or components; (6) emissions; (7) prototype vehicles using pure methanol fuels; (8) properties of methanol/gasoline blends; and (9) the costs and energy values of methanol and ethanol fuels.

79N27335# ISSUE 18 PAGE 2390 CATEGORY 28 RPT#:  
HCP/ET-2854 CNT#: ET-78-C-01-2854 78/09/00 140

PAGES UNCLASSIFIED DOCUMENT

UTTL: Comparative economic assessment of ethanol from biomass

CORP: Mitre Corp., McLean, Va. CSS: (METREK Div.)

AVAIL.NTIS SAP: HC A07/MF A01

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ECONOMIC ANALYSIS/\*ETHYL ALCOHOL/\*LIFE CYCLE COSTS

MINS: / INDUSTRIAL PLANTS/ MATHEMATICAL MODELS/ PRODUCTION ENGINEERING

ABA: DOE

ABS: Fourteen studies and reports in which the economic aspects of producing ethanol from various biomass feedstocks were evaluated. These studies presented 28 ethanol plant configurations. The major assumptions made and the financial and cost/performance parameters used for each configuration were identified. This information was used to compute life cycle costs of ethanol production using the full life cycle cost model and the systems to project the utilization of renewable resources model. The differences between ethanol selling prices given in the studies reviewed and those obtained with the models are discussed. Life cycle costs were also calculated using a common set of financial parameters for all ethanol configurations.

79N27327# ISSUE 18 PAGE 2389 CATEGORY 28 RPT#:  
CCNF-7809125-1 CNT#: EY-76-C-06-1830 78/00/00 34  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Investigation of gasification of biomass in the  
presence of catalysts

AUTH: A/MUDGE, L. K.; B/SEALOCK, L. J., JR.; C/ROBERTUS,  
R. J.; D/MITCHELL, D. H.; E/BAKER, E. G.; F/WALKUP,  
P. C.

CORP: Battelle Pacific Northwest Labs., Richland, Wash.  
AVAIL.NTIS SAP: HC A03/MF A01  
Presented at 5th Biomass Thermochem. Conversion  
Coordination Meeting, Richland, Wash., 19-20 Sep. 1978

ABA: DOE

ABS: The technical and economic feasibility of catalyzed  
biomass gasification to produce the specific products  
methane, hydrogen, carbon monoxide, or synthesis gas  
for generation of ammonia, methanol, or hydrocarbons  
are reported. The work in the current reporting period  
was centered on laboratory studies to determine the  
relative activity of Na2CO3 and iron and 3 1/2 times  
as much as Borax or uncatalyzed wood at both 550 and  
650 C. The effect of biomass composition on gas  
production was determined by gasifying wood, bark, and  
cellulose. In all cases bark samples produced more gas  
than their respective woods. The use of combined  
catalysts to optimize methane production was studied.  
Initial screening of catalysts was begun. The design,  
procurement, and installation of the process  
development unit is described.

78N33260# ISSUE 24 PAGE 3198 CATEGORY 28 RPT#:  
LBL-6881 CNT#: W-7405-ENG-48 78/02/01 20 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Process development studies on the bioconversion of  
cellulose and production of ethanol

AUTH: A/WILKE, C. R.

CORP: California Univ., Berkeley, Lawrence Berkeley Lab.  
AVAIL.NTIS SAP: HC A02/MF A01

MAJS: /\*ALCOHOLS/\*CELLULOSE/\*ETHANE

MINS: / ENZYMES/ HYDROLYSIS/ NITROGEN OXIDES/ OXYGEN

ABA: ERA

ABS: The No-02 pretreatment of wheat straw prior to  
enzymatic hydrolysis was investigated. Studies of the  
conversion of xylose to ethanol by *Fusarium oxysporum*  
were continued. Progress is also reported on pilot  
plant process development and design studies on  
continuous cellulase production, enzyme recovery,  
batch cellulase enzyme production from *Trichoderma*  
*viride*, and kinetic modeling of the enzymatic  
hydrolysis of 5 percent newsprint.

79N11242# ISSUE 2 PAGE 167 CATEGORY 28 RPT#:  
DOE/US-0001/2 78/03/00 59 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Alcohol fuels program plan

CORP: Department of Energy, Washington, D. C. CSS: ( Alcohol Fuels Program.) AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /\*ALCOHOLS/\*FUELS

MINS: / COST ESTIMATES/ ECONOMICS/ ENVIRONMENT EFFECTS/  
ETHANE/ METHANE/ SOCIAL FACTORS

ABA: DOE

ABS: The Department of Energy has considered the production  
and use of ethanol and methanol as liquid fuels. The  
task force on alcohol fuels has reviewed the status of  
alcohol-related activities within DOE and elsewhere  
and has formulated a plan of action to (1) help  
resolve uncertainties, and (2) provide options  
supportive of potential national decisions in this  
area. DOE is currently conducting a fuels Supply  
Strategy Study which will consider all candidate  
alternative fuels and emphasize contingency planning  
to ensure an acceptable balance between supply and  
demand under future contingency cases. The special  
studies included in the immediate action element will  
provide analyses of key-issue areas for alcohol fuels  
to support the fuels supply strategy study. These  
special studies will examine the following aspects of  
alcohol fuels use: (1) resource availability, (2)  
economic, environmental, and social impacts, (3)  
end-use applications, (4) Federal fiscal  
consequences, (5) industry incentives, and (6) policy  
instruments for price control, market assurance, and  
import control.

79N13190# ISSUE 4 PAGE 437 CATEGORY 28 RPT#:  
HCP/M2923-01 CNT#: EC-77-X-01-2923 78/06/00 159  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Status of alcohol fuels utilization technology for  
highway transportation

CORP: Mueller Associates, Inc., Baltimore, Md. AVAIL.NTIS  
SAP: HC A08/MF A01

ABA: DOE

ABS: The current status of the technology(ies) of alcohol utilization in highway transportation is reviewed. Methanol, ethanol, and certain of their derivatives are treated. The results of engine, vehicle, and fuels testing are summarized. The topics of exhaust emissions, performance, and fuel economy, vehicle drive-ability, fuel systems materials compatibility, engine and vehicle design, fuels characterization, and environmental consideration are discussed in depth, based upon the most recent data available at the time of this writing. The status of the technology at the time of the last comprehensive surveys (1974) is summarized and discussed in greater detail in an appendix to this report. Significant advances made since that time are delineated, as are remaining information gaps and areas in which more extensive investigation is still needed. An appendix is provided which describes the salient properties of selected alcohols and alcohol-derived fuels.

79N13189# ISSUE 4 PAGE 437 CATEGORY 28 RPT#:  
HCP/W1737-01 CNT#: EC-70-C-03-1737 EY-76-S-05-5216  
78/05/00 59 PAGES UNCLASSIFIED DOCUMENT

UTTL: Comparative automotive engine operation when fueled with ethanol and methanol

AUTH: A/ECKLUND, E. E.

CORP: Department of Energy, Washington, D. C.; Santa Clara Univ., Calif.; Miami Univ., Coral Gables, Fla.

AVAIL.NTIS SAP: HC A04/MF A01

Prepared in cooperation with Santa Clara Univ. and Miami Univ., Coral Gables

MAJS: /\*ETHANE/\*FUEL SYSTEMS/\*METHANE/\*MULTIENGINE VEHICLES  
/\*PERFORMANCE TESTS

MINS: / COST ANALYSIS/ ECONOMIC FACTORS/ EMISSION/ EXHAUST  
SYSTEMS/ OPERATIONS RESEARCH/ STEADY STATE

ABA: DOE

ABS: An experimental investigation of Q spark ignition multicylinder engine operation on pure ethanol was undertaken to contrast the engine performance and exhaust emissions with indolene and pure methanol. Equivalence ratio (normalized F/A ratio) was chosen as the principal independent variable. Fuel economy, the regulated exhaust emissions and exhaust aldehydes, and maldistribution were taken as dependent variables. Both steady state engine results and simulated driving cycle (the Federal Emission Test Procedure-FIP and the Highway Fuel Economy Test Procedure-HFETP) results are presented and discussed. The findings show, in general, that ethanol gives results in fuel economy on the basis of miles per millions Btu which lie between the results obtained using gasoline and methanol, i.e., better fuel economy than gasoline and poorer fuel economy than methanol.

ORIGINAL PAGE IS  
OF POOR QUALITY

78A14025 ISSUE 3 PAGE 425 CATEGORY 44 77/08/00  
5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Materials and energy from the sun

AUTH: A/CALVIN, M. PAA: A/(California, University,  
Berkeley, Calif.)  
Sunworld, Aug. 1977, p. 2-6.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*HYDROCARBONS/\*LATEX/\*  
SOLAR ENERGY CONVERSION

MINS: / ACETONE/ BENZENE/ BRAZIL/ ENERGY CONSERVATION/  
RUBBER/ SUGAR CANE

ABA: S.C.S.

ABS: Attention is given to using the green plant as a solar energy collector device noting various types of plants having such potential. A Brazilian project producing ethanol from sugar cane is discussed along with the hydrocarbon storage capacities of such rubber-producing plants as Hevea brasiliensis and guayule. Latex-producing plants (including Euphorbia tirucalli, Asclepias, and Euphorbia trigona) are described in terms of their possible cultivation under arid or semiarid conditions. Methods for latex hydrocarbon analysis are presented along with the preliminary results of an experimental planting project. Practical approaches for the use of hydrocarbon as a crude oil are identified, including refining processes and the utilization of the plants as both collectors of sunlight and producers of compounds.

78A11121 ISSUE 1 PAGE 62 CATEGORY 44 77/00/00  
28 PAGES UNCLASSIFIED DOCUMENT

UTTL: Biomass and wastes as energy resources - Update

AUTH: A/KLASS, D. L. PAA: A/(Institute of Gas Technology,  
Chicago, Ill.)

In: Clean fuels from biomass and wastes; Proceedings  
of the Second Symposium, Orlando, Fla., January 25-28,  
1977. (A78-11120 01-44) Chicago, Ill., Institute of  
Gas Technology, 1977, p. 1-28.

ABA: J.M.B.

ABS: Technological developments facilitating the conversion of biomass to fuels and chemicals in desirable forms are reviewed. Topics considered include the design of an ideal synthetic fuel plantation, methods for calculating the net energy production of hypothetical biomass plantations, the economics of substitute natural gas, and the competition between agriculture and biomass plantations for available land. Various conversion processes, such as incineration, pyrolysis, hydrogenation, chemical and enzyme hydrolysis and fermentation, are mentioned. Comparisons are made between the heating values of biomass, wastes and coal, and the conversion efficiencies of several types of municipal refuse-to-steam systems are considered. The use of wood as fuel for electric power generation and for the production of ethanol, furfural and phenol is also discussed.

78A11128 ISSUE 1 PAGE 63 CATEGORY 44 77/00/00  
16 PAGES UNCLASSIFIED DOCUMENT

UTTL: The use of ethanol-gasoline mixtures for automotive fuel

AUTH: A/SCHELLER, W. A. PAA: A/(Nebraska, University,  
Lincoln, Neb.)

In: Clean fuels from biomass and wastes; Proceedings  
of the Second Symposium, Orlando, Fla., January 25-28,  
1977. (A78-11120 01-44) Chicago, Ill., Institute of  
Gas Technology, 1977, p. 185-200.

MAJS: /\*AUTOMOBILE FUELS/\*BIOMASS ENERGY PRODUCTION/\*ENERGY  
CONSERVATION/\*ETHYL ALCOHOL/\*GASOLINE

MINS: / ECONOMIC FACTORS/ ENERGY TECHNOLOGY/ FUEL  
CONSUMPTION/ FUEL TESTS/ GRAINS (FOOD)

ABA: J.M.B.

ABS: The use of mixtures of grain alcohol (ethanol) and gasoline for automotive fuel is discussed. A mixture containing 10 liquid volume percent ethanol in unleaded gasoline is found to undergo a volume increase on mixing, to be compatible with a relatively low octane fuel, and to reduce fuel consumption to about 95% of that for unleaded gasoline. In addition, the ethanol-gasoline combination provides improved starting and better performance of the automobile during winter months, due to more efficient carburation and more complete vaporization of the fuel. The economics of producing the mixture and a net energy analysis of grain alcohol production also favor introduction of the combination fuel.

77A48713 ISSUE 23 PAGE 3980 CATEGORY 44  
77/00/00 6 PAGES UNCLASSIFIED DOCUMENT

UTTL: The prospects for fuels from biomass

AUTH: A/LIPINSKY, E. S. PAA: A/(Battelle Columbus  
Laboratories, Columbus, Ohio)

In: Intersociety Energy Conversion Engineering  
Conference, 12th, Washington, D.C., August  
28-September 2, 1977, Proceedings, Volume 1,  
(A77-48701 23-44) La Grange Park, Ill., American

Nuclear Society, Inc., 1977, p. 94-99. ERDA-supported  
research.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY TECHNOLOGY/\*  
FEASIBILITY ANALYSIS/\*SYNTHETIC FUELS

MINS: / AUTOMOBILE FUELS/ COST ANALYSIS/ ENERGY CONVERSION/  
ETHYL ALCOHOL/ SUGAR CANE

ABA: P.T.H.

ABS: The prospects for making fuels from biomass are investigated by considering the process of converting sugarcane to ethanol and studying the economics of ethanol as a motor fuel. A cost analysis is made for a large ethanol distilling plant, and it is found that the cost of anhydrous ethanol would be about \$0.31 per liter. Adding anhydrous ethanol in a suitable gasoline blend would increase the selling price of gasoline \$0.015 to \$0.021 per liter.

77A48707 ISSUE 23 PAGE 3980 CATEGORY 44  
77/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Cassava fuel alcohol in Brazil  
AUTH: A/YANG, V.; B/MILFONT, W. N., JR.; C/SCIGLIANO, A.;  
D/MASSA, C. O.; E/SRESNEWSKY, S.; F/TRINDADE, S. C.  
PAA: F/(Centre de Tecnologia Promon, Rio de Janeiro,  
Brazil)

In: Intersociety Energy Conversion Engineering  
Conference, 12th, Washington, D.C., August  
28-September 2, 1977, Proceedings, Volume 1,  
(A77-48701 23-44) La Grange Park, Ill., American  
Nuclear Society, Inc., 1977, p. 44-53.

ABA: (Author)  
ABS: Energetics and economics of ethanol production from  
cassava under Brazilian conditions were analyzed. A  
150 cu m/day alcohol distillery based on batch  
conversion and fermentation steps and employing a  
totally enzymatic process was the base distillery  
chosen. Comparison with alcohol production from sugar  
cane juice was made. Prospects for process energy  
improvements and effects on alcohol production costs  
are discussed and compared to base-distillery results.  
Net energy/ratio concept was used as basis for process  
energetics analysis. Sharp increase in cassava  
agriculture productivity is expected to considerably  
improve cassava fuel alcohol economics.

77A38673 ISSUE 17 PAGE 2910 CATEGORY 44  
77/09/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fuels from biomass - Energy outlay versus energy  
returns: A critical appraisal  
AUTH: A/LEWIS, C. W. PAA: A/(Strathclyde, University,  
Glasgow, Scotland)

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY TECHNOLOGY/\*FUELS  
/\*PHOTOSYNTHESIS/\*VEGETATION GROWTH  
MINS: / ALCOHOLS/ ENERGY SOURCES/ ENERGY STORAGE/  
FERMENTATION/ METHANE/ PRODUCTION ENGINEERING

ABA: (Author)  
ABS: The concept of fuel production by the microbial  
conversion of biomass is discussed with particular  
emphasis upon the energy implications involved. Both  
the energy requirements and energy returns for a  
number of selected systems are assessed in the light  
of current technology, while areas for future  
improvements are also mentioned. The general trend of  
such biological energy systems is that energy gains  
made via plant photosynthesis using intensive systems  
are subsequently more than lost in the conversion of  
biomass energy content into storable, high-energy  
fuels such as ethanol and methane. Of the operations  
under investigation, the growth of sugarcane and its  
fermentation to ethanol is considered to be the most  
favorable as a marginal net energy production process.

77A48708 ISSUE 23 PAGE 4024 CATEGORY 45  
77/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Exhaust and evaporative emission from a Brazilian  
Chevrolet fueled with ethanol-gasoline blends  
AUTH: A/FUREY, R. L.; B/JACKSON, M. W. PAA: B/(General  
Motors Corp., Warren, Mich.)  
In: Intersociety Energy Conversion Engineering  
Conference, 12th, Washington, D.C., August  
28-September 2, 1977, Proceedings, Volume 1,  
(A77-48701 23-44) La Grange Park, Ill., American  
Nuclear Society, Inc., 1977, p. 54-61.

MAJS: /\*AIR POLLUTION/\*AUTOMOBILE FUELS/\*ETHYL ALCOHOL/\*  
EXHAUST GASES  
MINS: / ALDEHYDES/ CARBON MONOXIDE/ EVAPORATION/ FUEL-AIR  
RATIO/ HYDROCARBONS/ NITROGEN OXIDES

ABA: (Author)  
ABS: Exhaust and evaporative emissions from a 1974  
Brazilian Chevrolet Opala were measured using gasoline  
and various ethanol-gasoline mixtures. For this car,  
which was designed to operate with rich air-fuel  
mixtures, addition of up to 20 percent ethanol to  
gasoline reduced exhaust hydrocarbon and carbon  
monoxide emissions, but increased exhaust aldehyde and  
nitrogen oxide emissions. The leaning of the air-fuel  
mixture, due to ethanol addition, was the primary  
cause of the exhaust emission changes. Evaporative  
emissions were slightly higher with 10 percent ethanol  
in gasoline, than with gasoline alone.

7 78N28266# ISSUE 19 PAGE 2510 CATEGORY 28 RPT#:  
LBL-6861 CNT#: W-7405-ENG-48 77/09/30 15 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Pilot plant studies of the bioconversion of cellulose  
and production of ethanol  
AUTH: A/WILKE, C. R.  
CORP: California Univ., Berkeley, Lawrence Berkeley Lab.  
AVAIL.NTIS SAP: HC A02/MF A01  
MAJS: /\*BIODEGRADATION/\*CELLULOSE/\*ETHYL ALCOHOL/\*PILOT  
PLANTS

MINS: / CHEMICAL ANALYSIS/ ECONOMIC ANALYSIS/ FERMENTATION/  
HYDROLYSIS  
ABA: Author (ERA)  
ABS: Results of the following studies are reported:  
analysis and evaluation of potential raw  
materials--chemical analysis of the Kudzu plant and  
effect of NO/sub x/pretreatments on the hydrolysis of  
wheat straw; utilization of hemicellulose sugars;  
process design and economic studies--hydrolysis  
process and ethanol fermentation; pilot plant process  
development and design studies--enhanced cellulase  
production and continuous hydrolysis.

78N25247# ISSUE 16 PAGE 2098 CATEGORY 28 RPT#:  
LBL-6860 CNT#: W-7405-ENG-48 77/06/30 40 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Pilot studies of the bioconversion of cellulose and  
production of ethanol  
AUTH: A/WILKE, C. R.  
CORP: California Univ., Berkeley. Lawrence Berkeley Lab.  
CSS: (Energy and Environment Div.) AVAIL.NTIS  
SAP: HC A03/MF A01  
MAJS: /\*BIOCHEMISTRY/\*CELLULOSE/\*ETHYL ALCOHOL/\*PROCESS  
CONTROL (INDUSTRY)  
MINS: / FERMENTATION/ HYDROLYSIS/ SOLVENT EXTRACTION/ SUGARS  
/ WOOD  
ABA: ERA  
ABS: Progress is reported in the following studies on  
analysis and evaluation of potential raw materials:  
preliminary pretreatment studies using wheat straw;  
extraction of wheat straw with alcohol and water at  
elevated temperatures; extraction of ground wood with  
alcohol and water at elevated temperatures; and,  
delignification of newsprint with ethylene glycol.  
Other research in progress includes studies on:  
utilization of hemicellulose sugars; process design  
and economics of hydrolysis processes and ethanol  
fermentation; and pilot plant process development and  
design, including cell-recycle systems for cellulase  
production, continuous hydrolysis, countercurrent  
hydrolysis, and ethanol fermentation studies.

79N77529# CATEGORY 28 RPT#: NZERDC-28  
ISSU-0110-1692 77/00/00 39 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Ethanol from agricultural crops: A literature survey  
AUTH: A/KARDOS, N.; B/MULCOCK, A. P.  
CORP: New Zealand Energy Research and Development Committee,  
Auckland. AVAIL.NTIS  
MAJS: /\*AGRICULTURE/\*CROPS/\*ETHANE  
MINS: / COST ANALYSIS/ ECONOMIC ANALYSIS/ GASOLINE/  
PRODUCTION MANAGEMENT/ SUBSTITUTES/ SUGAR BEETS

78N75383# CATEGORY 28 RPT#: COO-4147-1 OR-1  
CNT#: EG-77-C-02-4147 77/00/00 5 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Bioconversion of plant biomass to ethanol  
CORP: General Electric Co., Schenectady, N. Y. AVAIL.NTIS  
MAJS: /\*ALCOHOLS/\*ENERGY CONVERSION/\*ETHANE/\*PLANTS (BOTANY)  
MINS: / CELLULOSE/ LIGNIN/ MOLD

77N28593# ISSUE 19 PAGE 2552 CATEGORY 44 RPT#:  
UCRL-52208 CNT#: W-7405-ENG-48 77/01/17 17 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Biosolar synfuels for transportation  
AUTH: A/ANDERSON, C. J.  
CORP: California Univ., Livermore. Lawrence Livermore Lab.  
AVAIL.NTIS SAP: HC A02/MF A01  
MAJS: /\*ENERGY POLICY/\*ENERGY SOURCES/\*SYNTHETIC FUELS  
MINS: / COSTS/ RECYCLING/ TRANSPORTATION ENERGY  
ABA: ERA  
ABS: A short review is given of biosolar sources of  
synthetic liquid fuels (synfuels) for transportation.  
There are a variety of ways to convert potentially  
large energy crops into fuels suitable for  
transportation use; e.g., liquid fuels such as  
methanol, ethanol, and pyrolytic oils. In addition,  
organic wastes are widely produced, and although they  
are still generally not considered a resource, there  
is little doubt that they will increasingly be  
recycled for their material and energy value. Major  
technical, social, economic, environmental, and  
political questions remain, and although the potential  
for biosolar transportation synfuels is large, it is  
still small compared to transportation energy demand.  
Because of their costs, early implementation of  
biosolar conversion schemes will likely not be in the  
area of transportation synfuels.

GASOLINE DOES, TOO, MIX WITH ALCOHOL.  
W.A. Scheller and B.J. Mohr.  
Chemtech, v.7, no.10, Oct.1977, p.616-623.

With gasoline selling in the U.S. near 60 cents/gal—  
taxes and all—is there any sense in planning to use etha-  
nol—currently quoted at over one dollar/gal—to replace  
it? We in Nebraska think there is. This paper explains  
why. First it will discuss the performance in state-owned  
vehicles of a 10 volume % solution of ethanol in gasoline—  
what we call GASOHOL. Then it will review how ethanol  
is made from grain. Finally, it will look at overall econom-  
ics, which we find encouraging enough to be planning a  
60 000 gal/day fuel operation. But let's start at the begin-  
ning.

77A490B0 ISSUE 23 PAGE 4014 CATEGORY 44  
76/00/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Field crops as a future source of fuels and chemical feedstocks

AUTH: A/LIPINSKY, E. S. PAA: A/(Battelle Columbus Laboratories, Columbus, Ohio)  
In: Sharing the sun: Solar technology in the seventies; Proceedings of the Joint Conference, Winnipeg, Canada, August 15-20, 1976. Volume 7. (A77-48910 23-44) Cape Canaveral, Fla., International Solar Energy Society, 1976, p. 104-117.  
ERDA-supported research.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY SOURCES/\*FARM CROPS/\*SYNTHETIC FUELS

MINS: / ALCOHOLS/ AMMONIA/ CORN/ COST EFFECTIVENESS/ ENERGY TECHNOLOGY/ SUGAR CANE/ WHEAT

ABA: (Author)

ABS: Such field crops as sugarcane, sorghums, sugar beets, wheat, and corn are under investigation as sources of fuels and commodity chemicals. Ethanol and methanol appear more attractive for industrial use than for fuel usage. Thermochemical production of fertilizer ammonia appears especially attractive. Genetic optimization, agronomic improvements, whole-plant harvesting, and hauling cost reductions may all be needed to fulfill the economic promise of this approach to ameliorating the hydrocarbon crisis.

77A12240 ISSUE 2 PAGE 229 CATEGORY 44 76/10/00  
5 PAGES UNCLASSIFIED DOCUMENT

UTTL: The long-range prospects for solar-derived fuels

AUTH: A/POLLARD, W. G.  
American Scientist, vol. 64, Sept.-Oct. 1976, p. 509-513.

ABA: S.D.

ABS: Solar-derived fuels are considered to be those produced annually by photosynthesis in currently growing plant material. The paper examines the potential of fuels derived from the sun through photosynthesis from the standpoint of their commercial conversion as an integral part of the world energy system in the long-range future when reserves of fossil fuels, especially petroleum and natural gas, have been depleted. Attention is focused on the pyrolysis of biomass to produce solid fuel and methanol, as well as on the production of liquid and gaseous fuels by appropriate techniques. It is shown that the long-range prospect for the use of solar energy through photosynthesis to produce solid, liquid, and gaseous fuel seems reasonably well assured. The technology for such fuels is already well developed and their extensive use awaits a favorable price level for delivered biomass and a major shift in agricultural and silvicultural practice.

77N23599 ISSUE 14 PAGE 1875 CATEGORY 44  
76/00/00 294 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fermentation kinetics and process economics for the production of ethanol TLSP: Ph.D. Thesis

AUTH: A/CYSEWSKI, G. R.

CORP: California Univ., Berkeley. SAP: Avail: Univ. Microfilms Order No. 77-4428

ABA: Dissert. Abstr.

ABS: Fermentation technology for the production of ethanol was optimized. Using glucose as the fermentable substrate, optimal fermentation parameters of pH, temperature, oxygen tension and sugar concentration were determined in both batch and continuous culture. The experimental results indicate that although ethanol fermentation is an anaerobic process, trace amounts of oxygen are required for maximal ethanol production. Continuous ethanol production by the adapted yeast was found to be 43% higher than for the unadapted yeast under conditions of complete substrate utilization. The pH of the broth had only a slight effect on fermentation rates between 3.5 and 5.5. However, the sugar concentration did affect ethanol productivities in continuous culture, with the optimal concentration being 10 wt% sugar. A cell recycle system employing an external settler to increase the biomass concentration was increased fourfold in the recycle system over conventional continuous operations. This produced a corresponding fourfold increase in ethanol productivity.

77N26324# ISSUE 17 PAGE 2245 CATEGORY 28 RPT#:  
T10-27336 QR-4 CNT#: W-7405-ENG-92 76/06/30 95  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Systems study of fuels from sugarcane, sweet sorghum, sugar beets, and corn TLSP: Quarterly Report for period ending 15 Jun. 1976

AUTH: A/LIPINSKY, E. S.; B/MCCURE, T. A.; C/SHEPPARD, W. J.; D/OTIS, J. L.; E/LAWHON, W. T.; F/NATHAN, R. A.  
CORP: Battelle Columbus Labs., Ohio. AVAIL:NTIS SAP: HC A05/MF A01

MAJS: /\*AGRICULTURE/\*CORN/\*ECONOMICS/\*FUELS/\*SUGAR BEETS/\*SUGAR CANE

MINS: / ALCOHOLS/ AMMONIA/ ETHANE/ METHANE

ABA: ERA

ABS: Preliminary results are presented of an economic analysis of the agricultural and conversion aspects of producing fuel and ammonia from sugar beets, sweet sorghum, and corn. Ethanol would be produced by fermentation of cane juice and methanol and ammonia from the synthesis of gas obtained from the partial oxidation of the combustible organics using the Purox process.

77N23277# ISSUE 14 PAGE 1833 CATEGORY 2B RPT#:  
AD-A033483 MAT-75-20 76/09/00 14 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: An evaluation of methanol, ethanol, the propanols, and the butanols as ship propulsion fuels  
AUTH: A. NEWTON, D. O.  
CORP: Naval Ship Research and Development Center, Annapolis, Md. CSS: (Materials Dept.) AVAIL. NTIS SAP: HC A02/MF A01

ABA: GRA  
ABS: This report evaluates the alkyl monohydric alcohols from methanol through the butanols (C-1 to C-4) as Navy ship propulsion fuels. Properties of the alcohols from the technical literature are compared with the properties of Navy ship propulsion hydrocarbon fuels (Diesel fuel Marine and JP-5). None of these alcohols is suitable as a direct substitute or as an extender for the currently used ship propulsion fuels. The use of methanol with its low volumetric energy content would entail over a 50 percent reduction in range between refuelings; the use of the other alcohols would result in roughly 25 percent to 40 percent loss of range. All the C-1 to C-4 alcohols have flash points below the 60 C minimum considered safe for shipboard fuels. Also, all have low cetane numbers, high water solubility, and problems with toxicity. However, methanol and mixtures of low-boiling alcohols are potentially usable as fuels for new ships specifically designed for their use.

77N18573# ISSUE 9 PAGE 1196 CATEGORY 44 RPT#:  
✓ LBL-4480 CNT#: W-7405-ENG-48 76/03/00 293 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Fermentation kinetics and process economics for the production of ethanol  
AUTH: A/CYSEWSKI, G. R.; B/WILKE, C. R.  
CORP: California Univ., Berkeley, Lawrence Berkeley Lab. AVAIL. NTIS SAP: HC A13/MF A01  
ABA: ERA  
ABS: A cell recycle system employing an external settler to increase the biomass concentration in continuous fermentations was examined. In addition, a novel vacuum fermentation scheme was developed whereby ethanol is boiled away from the fermentation broth as it is produced. By combining the vacuum fermentation with cell recycle, yeast cell densities of 124 g dry wt/l were achieved resulting in a 14-fold increase in ethanol productivity over simple continuous operation. From the experimental results obtained industrial size ethanol fermentation plants were designed and an economic evaluation conducted. The process design studies indicated that over a 50 percent reduction in capital expenditure may be obtained by continuous rather than batch operation. Further reductions in processing costs were achieved by both cell recycle and vacuum operation. However, the cost of fermentable substrate, either molasses or enzymatic hydrolysate sugars, dominates the economics of ethanol production.

(LBL-4480) Fermentation kinetics and process economics for the production of ethanol. Cysewski, G.R.; Wilke, C.R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1976. Contract W-7405-Eng-48. 293p. Dep. NTIS \$9.25.

The aim of this study was to develop and optimize fermentation technology for the production of ethanol. Using glucose as the fermentable substrate, optimal fermentation parameters of pH, temperature, oxygen tension, and sugar concentration were determined in both batch and continuous culture. The experimental results indicate that although ethanol fermentation is an anaerobic process, trace amounts of oxygen are required for maximal ethanol production. The ethanol productivity of the initial culture of *Saccharomyces cerevisiae* (ATCC No. 4126) was optimal at an oxygen tension of 0.7 mmHg and a temperature of 35°C. However, when long term continuous culture was maintained the yeast "adapted" after 3 weeks of operation, requiring an oxygen tension of only 0.07 mmHg for optimal ethanol production, 43 percent higher than for unadapted yeast. A cell recycle system employing an external settler to increase the biomass concentration in continuous fermentations was examined. In addition, a novel vacuum fermentation scheme was developed whereby ethanol is boiled away from the fermentation broth as it is produced. By combining the vacuum fermentation with cell recycle, yeast cell densities of 124 g dry wt/l were achieved resulting in a 14-fold increase in ethanol productivity over simple continuous operation. From the experimental results obtained industrial size ethanol fermentation plants were designed and an economic evaluation conducted. The process design studies indicated that over a 50 percent reduction in capital expenditure may be obtained by continuous rather than batch operation. Further reductions in processing costs were achieved by both cell recycle and vacuum operation. However, the cost of fermentable substrate, either molasses or enzymatic hydrolysate sugars, dominates the economics of ethanol production.

DEHYDRATION OF AQUEOUS ETHANOL MIXTURES BY EXTRACTIVE DISTILLATION. C. Black and D. E. Ditsler. p. 1-15 See Subject Reference for this.

DESIGN OF A TWO-BUSHEL PER DAY CONTINUOUS ALCOHOL UNIT. W. B. Altsheler, H. W. Mollet, E. H. C. Brown.

Chemical Engineering Progress, vol 43, no 9, September 1947, p. 467-472. 5-620

**BIOCHEMICAL ENGINEERING--ENERGY, RENEWABLE  
RESOURCES AND NEW FOODS.**

**S.M. Barnett, J.P. Clark, and J.M. Nystron, eds.  
AIChE Symposium Series, v.72, no.158, 1976.**

**BIOCHEMICAL CONVERSION OF REFUSE TO ETHYL ALCOHOL .....**

**Gary S. Santini and Walter G. Vaux 99**

**GROW ALCOHOL AS A REPLACEMENT FOR GASOLINE.** A plan is presented whereby a sufficient quantity of safe combustible liquid fuel could be produced annually to satisfy all of our automotive needs. The annual production of as much as 100 billion gallons of ethyl alcohol could be achieved if the already available arable land were planted for just this purpose. Initially, all of the special plantings would be converted directly into alcohol by the well known fermentation process. However, later, when knowledge gained from research now in progress permits the more economical conversion of raw agricultural products to other possibly more useful liquid fuels, the crops needed would be on hand for immediate use. The cost of the alcohol produced is considered to be competitive with gasoline at today's prices, would eliminate the need for rationing, and should be cheaper in the future as crude oil supplies dwindle. Also, a substantial reduction in automotive exhaust pollutants should be experienced since no lead additives for antiknock quality are needed, and in addition, researchers at Stanford University recently found substantial decreases in emissions using methyl alcohol as a reference alcohol. 6 refs.

McCloskey, J.P. Electron Group Rockwell Int, Anaheim, Calif. *Energy Sources* v 2 n 1 1975 p 53-60.

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(NP-20952) Production of ethanol from wood wastes and agricultural crop residues. Lewis, R. (Minnesota Univ., Minneapolis (USA). Center for Studies of the Physical Environment). 19 Apr 1974. 5p. Univ. of Minnesota, Minneapolis.

In this brief review, methods for ethanol production, by-products of ethanol production, energy and material requirements of methanol production from wood, and potential ethanol production and uses are considered. (JSR)

## METHANOL

79A40774\* ISSUE 17 PAGE 3216 CATEGORY 37 RPT#:  
SAE PAPER 790427 79/02/00 19 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Methanol decomposition bottoming cycle for IC engines  
AUTH: A/PUROHIT, G.; B/HOUSEMAN, J. PAA: B/(California  
Institute of Technology, Jet Propulsion Laboratory,  
Pasadena, Calif.)

CORP: Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.  
Society of Automotive Engineers, Congress and  
Exposition, Detroit, Mich., Feb. 26-Mar. 2, 1979. 19  
p.

MAJS: /\*AUTOMOBILE FUELS/\*EXHAUST GASES/\*INTERNAL COMBUSTION  
ENGINES/\*METHYL ALCOHOLS/\*THERMAL DECOMPOSITION/\*WASTE  
ENERGY UTILIZATION

MINS: / DIESEL ENGINES/ ENERGY REQUIREMENTS/ LOCOMOTIVES/  
LOW COST/ POWER EFFICIENCY/ PRESSURE EFFECTS/ SPARK  
IGNITION/ TRUCKS

ABA: (Author)

ABS: This paper presents the concept of methanol  
decomposition using engine exhaust heat, and examines  
its potential for use in the operation of passenger  
cars, diesel trucks, and diesel-electric locomotives.  
Energy economy improvements of 10-20% are calculated  
over the representative driving cycles without a net  
loss in power. Some reductions in exhaust emissions  
are also projected.

METHANOL DERIVATION FROM NORTH DAKOTA LIGNITE AND  
USE AS A FUEL. E. C. Galss, A. L. Freeman and T. J.  
Wentworth.

Industrial Engineering Chemistry, vol 18, no 4,  
December 1979. p. 288-290.

79A26404 ISSUE 9 PAGE 1617 CATEGORY 44  
79/01/00 6 PAGES In FRENCH UNCLASSIFIED DOCUMENT  
UTTL: Fuels of the future. I --- demand and proposed sources  
AUTH: A/GRENON, M.

Revue de l'Energie, vol. 30, Jan. 1979, p. 32-37. In  
French.

MAJS: /\*ENERGY POLICY/\*ENERGY SOURCES/\*FUEL CONSUMPTION/\*  
SYNTHETIC FUELS/\*TECHNOLOGICAL FORECASTING

MINS: / ACETYLENE/ AUTOMOBILE FUELS/ CRUDE OIL/ ELECTRIC  
AUTOMOBILES/ ENERGY TECHNOLOGY/ FUEL OILS/ GEOTHERMAL  
ENERGY CONVERSION/ METHYL ALCOHOLS/ NUCLEAR ENERGY/  
SOLAR ENERGY CONVERSION

ABA: B.J.

ABS: General problems of energy demand are examined along  
with such possible solutions as synthetic fuels and  
primary sources of energy (hydroelectric, geothermal,  
nuclear and solar). Special consideration is given to  
the development of methanol- and hydrogen-based fuels.

A79-45996 Vehicle evaluation of neat methanol - Com-  
promises among exhaust emissions, fuel economy and driveability. N.  
D. Brinkman (GM Research Laboratories, Warren, Mich.). *International Journal of Energy Research*, vol. 3, July-Sept. 1979, p.  
243-274, 28 refs.

Methanol as an alternative fuel in vehicles with spark-ignited,  
internal combustion engines is evaluated. A methanol-fueled model  
car, equipped with electronic fuel injection was modified to provide  
proper air-fuel ratios for methanol. Exhaust emissions and fuel  
economy, using an average equivalence air-fuel ratio of 0.96 and  
spark timing, designed for the production gasoline car, were com-  
pared. It was found that methanol fuelling with a 0.96 ratio using  
best-power rather than production spark timing increased fuel  
economy from 3 to 6% without significantly affecting emissions and  
driveability. Furthermore, with best-power spark timing and a  
maximum economy air-fuel ratio of 0.83, driveability was acceptable  
and the CO and NO emissions met the 1977 standard. Although  
feasibility and benefits of operating vehicles with neat methanol were  
demonstrated, not all problems of methanol fuelling (i.e., cold starts)  
were solved and other alternatives such as obtaining hydrocarbon  
liquids from coal should be considered.

C.F.W.

**METHYLNITRITE IN THE EXHAUST FROM A METHANOLGASOLINE FUELED AUTOMOBILE. A. Jonsson and S. Berg.**

**Chemosphere, vol 8, no 11/12, 1979, p. 835-841.**

Methanol is being considered and evaluated as an automotive fuel to supplement and replace gasoline. Methanol can be used as motor fuel either straight or as a fuel component in methanol-gasoline blends. Unburned methanol in the exhaust emissions from a methanol fueled engine may react with nitrogen oxides, which are present in the exhaust from internal combustion engines, to form methyl nitrite. Methyl nitrite was found to be mutagenic in *Salmonella typhimurium* (1). In this study methanol and methyl nitrite are measured in samples of exhaust emissions from a vehicle using gasoline and a methanol-gasoline blend.

**RADIATION FROM METHANOL FURNACE.**

**W.L. Grosshandler and R.F. Sawyer.**

**J. Heat Transfer, v.100, no.2, May 1978, p.247-252.**

*Monochromatic intensity measurements are taken in a water-cooled furnace, 20 cm in diameter, burning methanol and a methanol/coal slurry. The primary interest is to determine the contribution of particulate radiation to the total intensity. Temperature, carbon dioxide, carbon monoxide, water, methanol, and particulate concentration levels are quantitatively measured throughout the furnace chamber. A computer code is discussed which integrates the equation of transfer over a nonhomogeneous path containing combustion gases and particulates. This allows comparison of the measured intensity with a theoretical prediction based upon known concentration and temperature profiles. The intensity and emittance measurements from the methanol furnace are compared with measurements in other experimental furnaces burning oil and gas.*

**GASOHOL CONSUMPTION SKYROCKETS. Clare E. Wise**

**Machine Design, vol 51, no 24, October 25, 1979, p. 28-**

**VEHICLE EVALUATION OF NEAT METHANOL--COMPROMISES AMONG EXHAUST EMISSIONS, FUEL ECONOMY AND DRIVEABILITY.**  
Norman D. Brinkman

**International Journal of Energy Research. v. 3, no. 3, July--September 1979, p. 243-274.**

79A10035 ISSUE 1 PAGE 105 CATEGORY 44 78/00/00  
7 PAGES UNCLASSIFIED DOCUMENT

**UTTL:** The status of alcohol fuels utilization technology for highway transportation

**AUTH:** A/ECKLUND, E. E.; B/PARKER, A. J., JR.; C/TIMBARIO, T. J.; D/MCCALLUM, P. W. PAA: A/(U.S. Department of Energy, Washington, D.C.); D/(Mueller Associates, Inc., Baltimore, Md.)

In: Intersociety Energy Conversion Engineering Conference, 13th, San Diego, Calif., August 20-25, 1978. Proceedings, Volume 1. (A79-10001 01-44) Warrendale, Pa., Society of Automotive Engineers, Inc., 1978, p. 226-232.

**MAJS:** /\*ALCOHOLS/\*AUTOMOBILE FUELS/\*HYDROCARBON FUELS/\*SYNTHETIC FUELS/\*TECHNOLOGY ASSESSMENT

**MINS:** / AIR POLLUTION/ DESIGN ANALYSIS/ ENERGY TECHNOLOGY/ EXHAUST GASES/ FUEL CONSUMPTION

**ABA:** B.J.

**ABS:** The paper attempts to provide a 1977 picture of utilization technology readiness of automotive alcohol fuels (methanol and methanol/gasoline blends and ethanol and ethanol/gasoline blends) in anticipation of future demand. The utilization potential of alcohol fuels is discussed in terms of: (1) exhaust emissions, (2) performance and fuel economy, (3) vehicle driveability, (4) engine/vehicle design changes, (5) other environmental, health, and safety considerations, and (6) fuels characterization.

78A5254B ISSUE 24 PAGE 4361 CATEGORY 37 CNT#:  
DOT-OS-30113 78/00/00 8 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Performance and NOx emissions of spark ignited  
combustion engines using alternative fuels - Quasi  
one-dimensional modeling. II - Methanol fueled engines  
AUTH: A/RUBIN, M. B.; B/MCLEAN, W. J. PAA: B/(Cornell  
University, Ithaca, N.Y.)  
Combustion Science and Technology, vol. 18, no. 5-6,  
1978, p. 199-206. U.S. Department of Transportation  
MAJS: /\*COMBUSTION PRODUCTS/\*INTERNAL COMBUSTION ENGINES/\*  
METHYL ALCOHOLS/\*NITROGEN OXIDES/\*ONE DIMENSIONAL FLOW  
/\*PISTON ENGINES/\*SPARK IGNITION/\*THERMODYNAMIC  
EFFICIENCY  
MINS: / AUTOMOBILE FUELS/ COMBUSTION EFFICIENCY/ FLAME  
PROPAGATION/ FUEL CONSUMPTION/ FUEL INJECTION/ OCTANE  
NUMBER/ WATER

ABA: (Author)

ABS: A thermodynamic model employing a one-dimensional  
semi-empirical flame speed has been used to evaluate  
methanol as a reciprocating engine fuel. The empirical  
parameters in the flame speed were determined by  
matching computed combustion durations with  
experimental values reported in the literature.  
Satisfactory agreement was obtained between predicted  
and measured values for power, efficiency and NOx  
emissions. The model predicts maximum thermal  
efficiency of the methanol engine for equivalence  
ratios in the 0.7 to 0.8 range. This is within  
practical operating range, as experiments have shown  
the lean misfire limit to be near an equivalence ratio  
of 0.6. No emissions are predicted to reach a maximum  
near an equivalence ratio of 0.9 and are reduced by  
about two-thirds at an equivalence ratio of 0.75.  
Addition of water to methanol is shown to  
significantly reduce NOx emissions, although with some  
loss in thermal efficiency. Improved fuel economy  
without excessive NOx emissions can be obtained by  
employing methanol-water blends at high compression  
ratios.

79N70353# CATEGORY 28 RPT#: FE-2416-20 CNT#:  
EX-76-C-01-2416 78/01/04 14 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Conceptual designs of commercial plants: Coal to  
methanol and methanol to gasoline TLSP: Quarterly  
Technical Progress Report, 1 Aug. - 28 Oct. 1977  
CORP: Badger Plants, Inc., Cambridge, Mass. AVAIL.NTIS  
MAJS: /\*COAL GASIFICATION/\*GASOLINE/\*INDUSTRIAL PLANTS/\*  
METHYL ALCOHOLS  
MINS: / CARBON DIOXIDE/ LIQUEFIED GASES/ LIQUEFIED NATURAL  
GAS

78A50850 ISSUE 23 PAGE 4164 CATEGORY 28  
78/08/00 8 PAGES In GERMAN UNCLASSIFIED DOCUMENT  
UTTL: Alternative fuel methanol - Selection criteria and  
status of research

AUTH: A/KOENIG, A.; B/MENRAD, H.; C/LEE, W.; D/BERNHARDT,  
W. PAA: D/(Volkswagenwerk AG, Wolfsburg, West  
Germany)  
Erdoel und Kohle Erdgas Petrochemie vereinigt mit  
Brennstoff-Chemie, vol. 31, Aug. 1978, p. 360-367. In  
German. Research supported by the Bundesministerium  
 fuer Forschung und Technologie.

ABA: G.R.

ABS: A description is presented of the results of an  
investigation in which the possibilities and problems  
with respect to a use of methanol as alternative fuel  
for motor vehicles have been studied. It is pointed  
out that of all available fuel alternatives methanol  
appears to be most suited for a possible replacement  
of currently used fuels. Prototypes of vehicles for  
the use of methanol in undiluted form are being  
developed and optimized. The use of a 15%  
methanol-gasoline mixture as an intermediate step with  
respect to the introduction of methanol was  
investigated in a fleet test. Economic factors are of  
primary importance concerning the time of an  
introduction of methanol as fuel. On the basis of  
long-term considerations, a comparison of the costs  
involved in producing methanol and conventional fuels  
from coal appears vital. Such a comparison is in favor  
of methanol.

79N27619# ISSUE 18 PAGE 2426 CATEGORY 28  
78/08/15 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Methanol from coal  
AUTH: A/MILLER, D. R.  
CORP: Vulcan-Cincinnati, Inc., Ohio. AVAIL.NTIS SAP: HC  
A23/MF A01  
In JPL Proc. of the Conf. on Coal Use for California  
p 273-277 (SEE N79-27597 18-42)  
MAJS: /\*CATALYSIS/\*COAL GASIFICATION/\*ENERGY CONVERSION/\*  
METHYL ALCOHOLS/\*SYNTHETIC FUELS  
MINS: / CALIFORNIA/ COAL UTILIZATION/ ENERGY POLICY/ ENERGY  
TECHNOLOGY/ ENVIRONMENT PROTECTION  
ABA: J.M.S.  
ABS: Economic feasibility of methanol or methyl fuel  
produced from coal using existing technology is  
discussed. Other factors considered include  
environmental, safety, toxicity, transportation, so  
storage, ease of burning, and retrofitting of present  
boilers. Demonstrations of its uses as a boiler fuel  
and as a turbine fuel are cited.

78A32235 ISSUE 12 PAGE 2197 CATEGORY 44  
78/03/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: 25 years of fuel cell development /1951-1976/  
AUTH: A/KORDESCH, K. V. PAA: A/(Union Carbide Corp.,  
Battery Products Div., Parma, Ohio)  
Electrochemical Society, Journal, vol. 125, Mar. 1978,  
p. 77C-91C.

MAJS: /\*CHRONOLOGY/\*ELECTRIC BATTERIES/\*ELECTRODES/\*FUEL  
CELLS/\*TECHNOLOGY ASSESSMENT

MINS: / APOLLO PROJECT/ ELECTROLYTIC CELLS/ ENERGY  
TECHNOLOGY/ POROUS MATERIALS

ABA: W.L.

ABS: Areas of fuel cell research during the '50s are  
indicated and the recognition of the need for a stable  
large interface between electrode and electrolyte is  
credited with causing the sudden breakthrough in  
technology. A chronological survey of fuel cell  
systems is presented; fuel cells considered include  
high-temperature cells (molten carbonate cells),  
medium-temperature fuel cells (modifications of the  
Bacon cell), fuel cells with platinum black Teflon  
electrodes, fuel cells with porous metal electrodes,  
ion-exchange membrane cells, matrix (phosphoric acid)  
fuel cells, acidic methanol cells, alkaline cells with  
methanol or methanol-derived fuels, ammonia as fuel,  
sodium amalgam cells, regenerative H<sub>2</sub>-O<sub>2</sub> fuel cell  
systems, thermally regenerative systems, radioactive  
regenerative fuel cells, chemical redox systems, the  
nitric acid-oxygen redox electrode, biochemical cells,  
direct hydrocarbon cells, and indirect hydrocarbon  
cells.

79N29378# ISSUE 20 PAGE 2662 CATEGORY 28 RPT#:  
FE-2416-37 CNT#: EX-76-C-01-2416 78/00/00 11  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Coal-to-gasoline conceptual design and market  
evaluation of methanol fuel and methanol-derived  
gasoline TLSP: Quarterly Technical Progress Report,  
31 Jul. - 27 Oct. 1978

CORP: Badger Plants, Inc., Cambridge, Mass. AVAIL NTIS  
SAP: HC A02/MF A01

MAJS: /\*COAL UTILIZATION/\*ENERGY TECHNOLOGY/\*HYDROCARBON  
FUEL PRODUCTION/\*SYNTHANE

MINS: / ENERGY CONVERSION/ GASOLINE/ MARKETING/ PRODUCT  
DEVELOPMENT

ABA: DOE

ABS: Conceptual design work completed during the quarter on  
the conversion of coal to gasoline using the Mobil  
W-gasoline process is summarized. Preliminary work  
done on the marketing study for methanol is also  
summarized.

79N25391 ISSUE 16 PAGE 2132 CATEGORY 37  
78/00/00 190 PAGES UNCLASSIFIED DOCUMENT

UTTL: Computer controlled dynamic tests with motoring of an  
internal combustion engine with alternate fuels  
TLSP: Ph.D. Thesis

AUTH: A/GERMANE, G. J.

CORP: Brigham Young Univ., Provo, Utah. SAP: Avail: Univ.  
Microfilms Order No. 7911892

MAJS: /\*COMPUTER PROGRAMS/\*DYNAMIC TESTS/\*FUELS/\*INTERNAL  
COMBUSTION ENGINES

MINS: / DYNAMOMETERS/ ETHYL ALCOHOL/ GASOLINE/ METHYL  
ALCOHOLS/ MIXTURES

ABA: Dissert. Abstr.

ABS: A computer controlled and monitored internal  
combustion engine test cell with motoring is  
described. A control scheme for the engine and  
dynamometer for a simulated vehicle with gear shifting  
is presented. A comparison of dynamic and steady state  
engine tests is made. An evaluation of alternate fuels  
is made from the results of two different driving  
cycles, one with transmission shifting and motoring  
and the other with only gear shifting. Experimental  
data, from the dynamic tests, which show a difference  
in brake thermal efficiency and exhaust emissions for  
ethanol-gasoline and methanol-gasoline mixtures  
compared with straight gasoline, is presented.

78N30322# ISSUE 21 PAGE 2787 CATEGORY 28  
78/03/00 23 PAGES UNCLASSIFIED DOCUMENT

UTTL: Identification of probable automotive fuels  
composition: 1985 - 2000

AUTH: A/RUSSEL, J. A.

CORP: Southwest Research Inst., San Antonio, Tex.  
AVAIL NTIS SAP: HC A20/MF A01

In DOE Highway Vehicle Systems p 311-333 (SEE  
N78-30293 21-31)

ABA: L.S.

ABS: Methodology is presented to be utilized in projecting  
most probable compositions of hydrocarbon and methanol  
automotive fuels, using domestic nonpetroleum  
resources (oil shale and coal) in their manufacture.  
Compositional factors are critically contingent upon  
syncrude conversion process parameters which require  
further development and definition. If the emerging  
syncrudes-synfuels industry develops at currently  
foreseeable rates, such syncrudes will be blended with  
petroleum crudes in such a manner as to have no impact  
on conventional automotive fuels composition.

79N26149# ISSUE 17 PAGE 2235 CATEGORY 25 RPT#:  
COO-4191-1 CNT#: EY-77-S-02-4191 78/08/00 9 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Combustion optimization studies for stratified charge  
and diesel engines TLSP: Progress Report, 1 Oct.  
1977 - 30 Sep. 1978

AUTH: A/STEINBERGER, R. L.; B/BRACCO, F. V.  
CORP: Princeton Univ., N. J. AVAIL.NTIS SAP: HC A02/MF  
A01

MAJS: /\*COMBUSTION/\*DIESEL ENGINES/\*OPTIMIZATION  
MINS: / COMPRESSION LOADS/ INTERNAL COMBUSTION ENGINES/  
SPARK IGNITION

ABA: DOE

ABS: The objectives of the program are to assess the  
feasibility and operating characteristics of the  
following high compression, spark ignition (or self  
ignition), stratified charge (or diesel) engine  
configuration: compression ratio: 16; open chamber;  
direct fuel injection; unthrottled operation; 615  
cc/cylinder; explored speed range 1000 to 4000 rpm  
(expected practical range 600 to 6000 rpm); fuels:  
ethanol-diesel mixtures; and spark ignition  
(stratified charge) or self ignition (diesel), to  
continue the development and the testing of physical  
and numerical aspects of multidimensional combustion  
models in order to assess and improve their accuracy  
and to reduce their computation time, and to  
contribute to the achievement of a more fundamental  
and detailed understanding, characterization, and  
command of the processes which control efficiency and  
emissions in internal combustion engines.

78N30353# ISSUE 21 PAGE 2791 CATEGORY 37  
78/02/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Gaseous emissions control for heavy duty diesel  
engines.

AUTH: A/LOMBARDI, C.  
CORP: Fiat Research Center, Turin, Italy. AVAIL.NTIS  
SAP: HC A23/MF A01

In NATO Proc. of the 4th Intern. Symp. on Automotive  
Propulsion Systems, Vol. 1 p 319-329 (SEE N78-30332  
21-31)

ABA: G.Y.

ABS: Results are summarized from a study on heavy duty  
diesel engine emissions. The emission control methods  
reported are: (1) exhaust gas recirculation; (2)  
exhaust gas recirculation plus supercharging to the  
original power level; (3) variable compression ratio;  
and dual fuel (gasoline and methanol). The work was  
performed on different direct injection engines, both  
aspirated and turbocharged, whose characteristics are  
given.

79N24190# ISSUE 15 PAGE 1965 CATEGORY 28 RPT#:  
FE-2490-15 CNT#: EX-76-C-01-2490 78/04/00 264  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Fluid bed process studies on selective conversion of  
methanol to high octane gasoline TLSP: Final Report

AUTH: A/KAM, A. Y.

CORP: Mobil Research and Development Corp., Paulsboro, N. J.  
AVAIL.NTIS SAP: HC A12/MF A01

MAJS: /\*ANTI-KNOCK ADDITIVES/\*AUTOMOBILE FUELS/\*GASOLINE/\*  
METHYL ALCOHOLS/\*OCTANE NUMBER

MINS: / AIR POLLUTION/ ENERGY CONVERSION/ FLUIDIZED BED  
PROCESSORS/ LEAD (METAL)/ PILOT PLANTS/ POLLUTION  
CONTROL/ QUALITY CONTROL

ABA: DOE

ABS: The Mobil fluid bed methanol-to-gasoline process was  
successfully scaled-up to a 4 barrel-a-day pilot  
plant. Gasoline selectivity is higher than 88 wt% of  
hydrocarbons produced, and the octane rating is 96.  
Gasoline quality is excellent and exceeds all the  
requirements of unleaded regular gasoline. With this  
demonstration accomplished, the process is now ready  
for scale-up to a 100 B/D pilot plant, the final step  
before constructing commercial size facilities.  
Methanol was completely converted at design  
conditions. Steady state operations were demonstrated,  
and gasoline yield and quality were optimized. Process  
variable studies showed that durene yields increased  
with pressure and decreased with temperature. Several  
process concepts including light gas recycle,  
co-feeding liquid/vapor methanol, and heat removal  
from the fluid bed were evaluated. A process design  
basis for a large unit was developed.

78N26225# ISSUE 17 PAGE 2230 CATEGORY 28 RPT#:  
BERC/IPR-77/B 78/02/00 7 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Experiments with novel fuels for diesel engines

AUTH: A/MARSHALL, W. F.

CORP: Department of Energy, Bartlesville, Okla. CSS: (   
Energy Research Center.) AVAIL.NTIS SAP: HC  
A02/MF A01

ABA: ERA

ABS: Engine tests were conducted with two fuels that would  
be considered as novel for use in diesel engines. The  
fuels, methanol and a water/diesel fuel emulsion, were  
used because of their potential for reductions in  
exhaust emissions. The test results showed that these  
fuels yield no advantages over standard diesel fuel  
with respect to emissions of unburned hydrocarbons and  
oxides of nitrogen. Although smoke and carbon monoxide  
emissions were reduced with the use of the water/fuel  
emulsion, the same effect could also be achieved via  
engine adjustment.

78N30390# ISSUE 21 PAGE 2795 CATEGORY 26  
78/02/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Automotive materials compatibility with methanol fuel blends

AUTH: A/POTEAT, L. E.

CORP: Miami Univ., Fla. AVAIL.NTIS SAP: HC A22/MF A01  
In NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 p 707-711 (SEE N78-30370 21-31)

ABA: A.R.H.

ABS: The effects of methanol on the materials in automobile fuel systems were investigated using several methanol/gasoline blends including blends with water to simulate moisture pick-up by the methanol. The conditions included ambient and elevated temperatures and with and without agitation. Evaluation was based on weight loss due to uniform corrosion and indications of pitting corrosion, stress corrosion, cracking, and galvanic corrosion. Methanol and methanol/gasoline blends increase the corrosion rates of most metals over the rates found in straight gasoline. Two areas of potential corrosion problems were determined. The most severe problem was the attack of methanol and methanol blends on ferric plated steels. Methanol and methanol blends also produced severe pitting in aluminum. Agitation did not appear to have a marked effect on the rate of corrosion, and the difference in temperature from 70 F to 120 F did not make an appreciable difference in corrosion rates.

78N30389# ISSUE 21 PAGE 2795 CATEGORY 28  
78/02/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Flame speeds, performance, and emissions with methanol-indolene blends --- in an automobile engine

AUTH: A/HENEIN, N. I.

CORP: Wayne State Univ., Detroit, Mich. AVAIL.NTIS SAP:  
HC A22/MF A01

In NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 p 697-706 (SEE N78-30370 21-31)

ABA: Author

ABS: Methanol, added at different ratios to indolene, has various effects on combustion, performance, and emissions in a CFR-SI engine. Flame speed is measured by fixed ionization probes and by a newly developed travelling ionization probe. The resulting turbulent flame speeds, computed laminar flame speeds, and the equivalent spherical flame speeds are analyzed to detect the turbulence decay over the cycle. The following effects were noted: increased octane number and brake specific fuel consumption, improved thermal efficiency, increased flame speed, increased BSFC and BSHC and decreased BSNOx emissions.

79N30412# ISSUE 21 PAGE 2798 CATEGORY 28 RPT#:  
BMFT-FB-77-84 CNT#: BMFT-ETS-3057-A 78/12/00 357  
PAGES In GERMAN; ENGLISH summary UNCLASSIFIED  
DOCUMENT DCAF E002631

UTTL: Methane and methanol as alternative energy sources: A comparative profitability study TLSP: Final Report

AUTH: A/DEIPENAU, H.

CORP: Salzgitter A.G. (West Germany). AVAIL.NTIS SAP:  
HC A16/MF A01; ZLDI, Munich DM 74,35  
Bonn Bundesmin. fuer Forsch. u. Technol.

ABA: Author (ESA)

ABS: Elaborations of the economic and technical ways and means for the supply of LNG and methanol to industrial centers, using natural gas from the Iranian area as raw material, were compared. The classification of given possibilities for the preparation, transportation, and storage of potential sources of energy is discussed. Cost estimates of transportation, a comparative examination of economic and technical aspects, and a description of the use of LNG and methanol in Germany (motor cars, power plants, gas supply) are presented. It is concluded that energy costs for LNG in Wilhelmshaven are lower than those for methanol, and that large quantities of LNG and methanol from the Persian Gulf can be sold in the various sectors of the German energy market on the condition that crude gas prices on the Persian Gulf do not exceed 3-DM/Gcal.

78N27289# ISSUE 18 PAGE 2377 CATEGORY 28 RPT#:  
FE-2276-20 CNT#: EX-76-C-01-2276 78/03/00 37  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Development studies on selected conversion of synthesis gas from coal to high octane gasoline

CORP: Mobil Research and Development Corp., Paulsboro, N. J.  
AVAIL.NTIS SAP: HC A03/MF A01

ABA: ERA

ABS: Aging and regeneration studies of developmental catalysts SG-B-3 and SG-A-4 in the micro reactor units (10 cc catalyst capacity). Hydrogen regeneration of SG-B-3 at 700 F restores catalyst selectivity, however, catalyst activity is not completely restored by this treatment. High temperature oxidative regeneration of catalyst SG-A-4 was successful. Multiple regeneration studies are now being made. Aging data was obtained on five catalysts in the direct conversion of synthesis gas to dimethylether. All catalysts showed significant aging when compared with proven methanol synthesis catalysts. Flow studies with a spent catalyst in the plexiglass model indicate that slugging may occur in the bench-scale fluid unit (150 cc catalyst capacity). Catalysts recovered from the unit show that carbon formation is excessive and probably responsible for the slugging and the uncontrollable higher temperatures observed in the catalyst disengager zone.

78N30331# ISSUE 21 PAGE 2788 CATEGORY 28  
78/03/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Solving alcohol fuel problems by fuel modification  
AUTH: A/KELLER, J. L.  
CORP: Union Oil Co. of California, Los Angeles.  
AVAIL NTIS SAP: HC A20/MF A01  
In DOE Highway Vehicle Systems p 397-407 (SEE  
N78-30293 21-31)

ABA: L.S.

ABS: There are two basically different methods available for altering these properties so as to alleviate problems: (1) converting methanol itself into other chemical species with more favorable properties and (2) modifying fuel composition by adding or removing other components. Examples of the first are conversion to gasoline hydrocarbons by the Mobil process, conversion to t-alkyl methyl ethers by reaction with olefins, and effective conversion to high alcohols. The latter is taken to include the conversion of CO and H<sub>2</sub> partially to higher alcohols instead of to methanol during methanol synthesis. Possibilities for modification by means of additives and otherwise altering fuel composition are discussed.

78N28255 ISSUE 19 PAGE 2508 CATEGORY 28 RPT#:  
BLL-RIS-10951 78/07/00 23 PAGES UNCLASSIFIED  
DOCUMENT DCAF F002907

UTTL: Methanol as a fuel for self-moving parts used in closed environments

AUTH: A/SALVI, G.

CORP: British Library Lending Div., Boston Spa (England).  
SAP: Avail: British Library Lending Div., Boston Spa, Engl.  
Transl. into ENGLISH from Riv. del Combustibili (Italy), v. 30, nos. 5-6, 1976 p 147-155

ABA: Author

ABS: Methanol was used experimentally as a fuel in internal combustion engines operated in closed environments; thanks to the antiknock properties of the alcohol, with high air/fuel ratios, combustion gases are obtained containing 2-3% oxygen and very low concentration of pollutants. The absence of lead compounds in the exhausts allows a catalytic muffler to be fitted into the exhaust manifold so as to obtain practically nonpollutant exhausts under conditions of great efficiency and for long periods of time. In this way, it is possible to operate lift trucks, tractors, cleaning machines and other machines in stores, sheds and mines, with internal combustion engines, overcoming the serious problems of a health nature met with to date.

78N30330# ISSUE 21 PAGE 2788 CATEGORY 37  
78/03/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Solving alcohol fuel problems by engine modification  
AUTH: A/PATTERSON, D. J.  
CORP: Michigan Univ., Ann Arbor. AVAIL NTIS SAP: HC  
A20/MF A01  
In DOE Highway Vehicle Systems p 385-397 (SEE  
N78-30293 21-31)

ABA: L.S.

ABS: The approach used to identify problems and solutions for use of methanol and blends is two pronged. First a careful review of the literature made and pertinent references photocopied and abstracted for the project files. Because published papers often reflect work that is more than one year old and because the understanding of the problems of methanol use is rapidly changing, it was deemed essential to make a number of personal contacts with individuals and laboratories having on-going programs. For this effort, a questionnaire was prepared. This study of the problems and solutions for retrofitting older vehicles is expected to provide guidelines for the design and materials of future vehicles in order to facilitate their operation on methanol or blends should that become desirable.

78N30329# ISSUE 21 PAGE 2788 CATEGORY 37  
78/03/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Engine lubricants for use in methanol fueled highway vehicles

AUTH: A/OWENS, E. C.

CORP: Southwest Research Inst., San Antonio, Tex. CSS: ( Army Fuels and Lubricants Research Labs.)  
AVAIL NTIS SAP: HC A20/MF A01  
In DOE Highway Vehicle Systems p 377-395 (SEE  
N78-30293 21-31)

ABA: L.S.

ABS: In order to provide an initial screening for problems when methanol fuels are used in conjunction with present commercially available lubricants, a series of engine tests were conducted using the Coordinated Lubricants Research (CLR) single-cylinder engine. The initial test cycle was patterned after the ASTM Sequence II-C cycle normally used to evaluate the rusting and corrosion characteristics of motor oils. After these initial series of wear screening tests were completed, it became apparent that methanol produced additional wear, apparently of a corrosive nature. The CLR was fitted with a piston which allowed diversion and collection of blowby from the piston ring zone for analysis. Analysis of the liquid and gaseous phases of this blowby showed that methanol produced significant concentrations of formaldehyde. In addition, a significant concentration of formic acid was present.

78N30392# ISSUE 21 PAGE 2796 CATEGORY 28

78/02/00 3 PAGES UNCLASSIFIED DOCUMENT

UTTL: Alternative fuels with regard to LPG and methanol --- urban transportation

AUTH: A/VANDERWEIDE, J.

CORP: Research Inst. for Road Vehicles, TNO, Delft (Netherlands). AVAIL.NTIS SAP: HC A22/MF A01 In NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 p 727-730 (SEE N78-30370 21-31)

ABA: A.R.H.

ABS: The increased use of LPG in many Western European countries as an automotive fuel in cars, vans, and taxis results from the long term availability of LPG from the North Sea where it exists in the form of an associated gas. The exhaust emissions produced in seven European cars, each running on four different gasolines (lead-free low octane, lead-free high octane, premium, and regular), LPG and NG were compared. Favorable emission data obtained for LPG and NG are discussed. Strongly reduced exhaust emissions (which meet U.S. standards for 1978) and substantial noise reduction were obtained when LPG was used in city buses during demonstration projects in London, Vienna, and Amsterdam. Cost calculations for large-scale operations are comparable to those for diesel vehicles. Experience with methanol as a fuel or blending component is less extensive. Its use as an alternative fuel in the Netherlands is discussed.

PERFORMANCE AND NO<sub>x</sub> EMISSIONS OF SPARK IGNITED COMBUSTION ENGINES<sup>x</sup> USING ALTERNATIVE FUELS--QUASI ONE-DIMENSIONAL MODELING, II. METHANOL FUELED ENGINES, by M. B. Rubin and W. J. McLean. Combustion Science and Technology, vol. 18, nos. 5 & 6, 1978, p. 199-206.

**Abstract**—A thermodynamic model employing a one-dimensional semi-empirical flame speed has been used to evaluate methanol as a reciprocating engine fuel. The empirical parameters in the flame speed were determined by matching computed combustion durations with experimental values reported in the literature. Satisfactory agreement was obtained between predicted and measured values for power, efficiency and NO<sub>x</sub> emissions.

The model predicts maximum thermal efficiency of the methanol engine for equivalence ratios in the 0.7 to 0.8 range. This is within practical operating range, as experiments have shown the lean misfire limit to be near an equivalence ratio of 0.6. NO emissions are predicted to reach a maximum near an equivalence ratio of 0.9, and are reduced by about two-thirds at an equivalence ratio of 0.75. Addition of water to methanol is shown to significantly reduce NO<sub>x</sub> emissions, although with some loss in thermal efficiency. Improved fuel economy without excessive NO<sub>x</sub> emissions can be obtained by employing methanol-water blends at high compression ratios.

78N30378# ISSUE 21 PAGE 2794 CATEGORY 45

78/02/00 2 PAGES UNCLASSIFIED DOCUMENT

UTTL: The effect of methanol addition to gasoline on total and individual hydrocarbons, methanol, and formaldehyde emissions from a carburetted spark ignition engine

AUTH: A/DOEPKER, R. D.

CORP: Miami Univ., Fla. AVAIL.NTIS SAP: HC A22/MF A01 In NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 p 608-609 (SEE N78-30370 21-31)

ABA: A.R.H.

ABS: A four-cylinder, spark ignition carburetted engine was fueled with Indolene (gasoline) and 20 and 30 percent by volume blends of methanol-indolene. Reduced pressure sampling, followed by vapor phase chromatography techniques, were utilized to determine qualitatively and quantitatively the composition of the exhaust emissions, including specific hydrocarbon species, methanol, and formaldehyde. The light C sub 1 through C sub 5 hydrocarbons were also found to decrease with increasing blend level. Separation of these hydrocarbons into saturated and unsaturated hydrocarbons further demonstrate these observed decreases. These C sub 1 through C sub 5 hydrocarbons represent from 65 to 70 percent of the total hydrocarbon emissions on a gram/Hp-hr basis and over 85 percent on a moles/Hp-hr basis. Chemical composition of the C sub 1 through C sub 5 hydrocarbon fraction was independent of blend level, but dependent on equivalence ratio. The C sub 6 through C sub 16 hydrocarbon emissions followed similar trends.

78N30328# ISSUE 21 PAGE 2788 CATEGORY 28  
78/03/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Methanol utilization

AUTH: A/PEFLEY, R.

CORP: Santa Clara Univ., Calif. AVAIL.NTIS SAP: HC  
A20/MF A01

In DOE Highway Vehicle Systems p 365-376 (SEE  
N78-30293 21-31)

MAJS: /\*AUTOMOBILE ENGINES/\*EXHAUST GASES/\*GASOLINE/\*METHYL  
ALCOHOLS

MINS: / COMPARISON/ DYNAMOMETERS/ PERFORMANCE/ STEADY STATE

ABA: L.S.

ABS: The experimental phase of the program focused on the steady state mapping of performance and exhaust emissions of a dynamometer mounted, 2300cc, Ford Pinto engine. The Indolene and methanol baseline comparison with original equipment indicated that gains in thermal efficiency and reduced exhaust emissions (with the exception of aldehydes) are obtained while operating on methanol at the same engine speed, load, and equivalence ratio phi. All of the observed comparative performance and emissions characteristics were subject to the inherent cylinder-to-cylinder variations in phi of this particular 4-cylinder engine. Based on the observed maldistribution for both Indolene and methanol, it appears that additional relative gains for methanol ranging from 2 to 5 percent in thermal efficiency (and power) are possible if the maldistribution is eliminated in the range 0.8 less than phi less than 1.0. Individual exhaust cylinder measurements were recorded. From these measurements, the maldistribution effects on exhaust emissions of the NOx, UBF and CO were resolved.

78N30395# ISSUE 21 PAGE 2796 CATEGORY 28  
78/02/00 2 PAGES UNCLASSIFIED DOCUMENT

UTTL: Vehicle evaluation of neat methanol: Compromises  
among exhaust emissions, fuel economy, and  
driveability

AUTH: A/BRINKMAN, N. D.

CORP: General Motors Research Labs., Warren, Mich.

AVAIL.NTIS SAP: HC A22/MF A01

In NATO Proc. of the 4th Intern. Symp. on Automotive  
Propulsion Systems, Vol. 2 p 736-738 (SEE N78-30370  
21-31)

MAJS: /\*AUTOMOBILE FUELS/\*ENGINE TESTS/\*EXHAUST GASES/\*FUEL  
CONSUMPTION/\*FUEL TESTS/\*METHYL ALCOHOLS

MINS: / FUEL COMBUSTION/ FUEL INJECTION/ FUEL SYSTEMS/  
OCTANE NUMBER

ABA: Author

ABS: Two cars, one carbureted and the other fuel injected, were modified to burn neat methanol. Exhaust emissions, fuel economy, and driveability were measured and compared to those obtained with gasoline in the unmodified (production) cars. Because acceptable driveability and durability were obtained only with the fuel injected car, it was used to investigate the spark timing and equivalence ratio settings which would give an acceptable compromise among exhaust emissions, fuel economy, and driveability. Average equivalence ratios of 0.96 to 0.62 and spark timing from best power to 15 degrees retarded were studied. With spark timing set for best power and the average equivalence ratio for maximum fuel economy (0.83), driveability was acceptable and CO and NOx emissions met the 1977 standards. However, the unburned fuel emissions exceeded the 1977 standards for hydrocarbons, even though the car was equipped with a catalytic converter. At 0.83 average equivalence ratio, NOx emissions were reduced below the statutory standard (0.4) by retarding spark timing; however, driveability and fuel economy deteriorated.

78N30327# ISSUE 21 PAGE 2788 CATEGORY 28  
78/03/00 3 PAGES UNCLASSIFIED DOCUMENT

UTTL: Alcohol/gasoline blends: Lean misfire limits

AUTH: A/ADT, R. R., JR.

CORP: Miami Univ., Fla. AVAIL.NTIS SAP: HC A20/MF A01  
In DOE Highway Vehicle Systems p 362-365 (SEE  
N78-30293 21-31)

MAJS: /\*AUTOMOBILE FUELS/\*GASOLINE/\*METHYL ALCOHOLS

MINS: / MIXTURES/ PERFORMANCE/ SPARK IGNITION

ABA: L.S.

ABS: Various methods were used for measuring lean misfire limit (LMI) characteristics. The methods and their relative merits are discussed. The four-cylinder Pontiac engine used in the tests is described and all testing was done at steady state conditions. It is shown that there is an extension of the LML when a 20 percent methanol blend is substituted for Indolene (gasoline). This LML extension is attributed to an extension of ignition failure to leaner mixtures with the blend. Of the commonly-used LML detection methods, the counting of motoring cycles, as ascertained from in-cylinder pressure transducer measurement, is more sensitive than the monitoring of HC emissions. The sensitivity of counting misfires audible at the exhaust pipe falls between the sensitivities of the motoring cycle- and HC monitoring-methods. The sensitivity of the standard deviation of the leanest cylinder blowdown-purge pressure as a LML detector is about the same as the sensitivity of the method using motoring cycling frequency-of-occurrence as a LML detector.

78A35704 ISSUE 14 PAGE 2500 CATEGORY 28  
77/00/00 11 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Methanol - A boiler fuel alternative  
AUTH: A/DUHL, R. W. PAA: A/(Vulcan Cincinnati, Inc.,  
Cincinnati, Ohio)  
AICHE Symposium Series, vol. 73, no. 165, 1977, p.  
338-348.  
MAJS: /\*BOILERS/\*COMBUSTION PRODUCTS/\*FUEL TESTS/\*METHYL  
ALCOHOLS/\*POLLUTION CONTROL/\*SYNTHETIC FUELS  
MINS: / ALDEHYDES/ CARBON DIOXIDE/ CARBON MONOXIDE/ ENERGY  
TECHNOLOGY/ HYDROCARBONS/ NATURAL GAS/ NITROGEN OXIDES  
/ SUBSTITUTES  
ABA: (Author)  
ABS: Current energy shortages and the increasing demands  
for improved air quality led to the adaptation of  
proven chemical grade methanol technology for  
production of a new liquid fuel having all the  
environmental advantages of natural gas and low sulfur  
fuel oil. A potential use is for power generation in  
stationary boilers. Potential sources are the large  
reserves of associated gas not being utilized in the  
major oil producing countries overseas and also the  
domestic coal reserves. The application of this fuel  
to power generation has been demonstrated by  
full-scale operation in a utility boiler.

J 78A27808 ISSUE 10 PAGE 1791 CATEGORY 44  
77/00/00 16 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Fuels and chemicals from crops  
AUTH: A/BUNGAY, H. R.; B/WARD, R. F. PAA: B/(U.S.  
Department of Energy, Div. of Solar Energy,  
Washington, D.C.)  
In: Fuels from waste. (A76-27801 10-44) New York,  
Academic Press, Inc., 1977, p. 105-120.  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*CHEMICAL FUELS/\*CROPS/\*  
ENERGY SOURCES/\*SYNTHETIC FUELS/\*WASTE UTILIZATION  
MINS: / ENERGY TECHNOLOGY/ FERMENTATION/ GASIFICATION/  
HYDROGEN FUELS/ PHOTOLYSIS/ PYROLYSIS  
ABA: J.M.B.  
ABS: Biomass conversion processes designed to provide fuels  
and chemicals in the long term are discussed;  
conversion processes for both aquatic and terrestrial  
plants are considered. Products of biomass conversion  
include synthesis gas, ammonia, methanol,  
formaldehyde, alcohols, aromatics, ethylene,  
heterocyclics, gum naval stores, and cellulose  
derivatives. Anaerobic digestion, pyrolysis,  
gasification, fermentation processes, and the  
production of hydrogen by biophotolysis are the chief  
processing methods applicable to biomass conversion.

77A33300 ISSUE 14 PAGE 2370 CATEGORY 44  
77/05/00 3 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Methanol gasoline blends - Future automotive fuels  
AUTH: A/JOHNSON, R. T. PAA: A/(Missouri-Rolla, University,  
Rolla, Mo.)  
Energy, vol. 2, Spring 1977, p. 27-29.  
MAJS: /\*AUTOMOBILE FUELS/\*GASOLINE/\*METHYL ALCOHOLS  
MINS: / AIR POLLUTION/ ANTIKNOCK ADDITIVES/ ENERGY SOURCES  
ABA: W.L.  
ABS: The characteristics of methanol/gasoline blends were  
determined by a number of tests. The Research Octane  
Number, RON, for blends increases with increased  
amounts of methanol while increased amounts of  
methanol have virtually no effect on the Motor Octane  
Number, MON. A high octane rating means the fuel has  
good anti-knock properties. The use of a 10%  
methanol/gasoline blend in comparison with unleaded  
gasoline alone results in a lower carbon monoxide  
emission and nonsignificant changes in the emission of  
unburned hydrocarbon and oxides of nitrogen. The  
addition of 10% methanol to the fuel reduces the  
ability of a cold engine to accelerate or idle  
smoothly. This blend, however, did not adversely  
affect the driveability of a Compound Vortex  
Controlled Combustion engine. Some problems that would  
be associated with widescale use of a 10%  
methanol/gasoline blend are: the driveability of some  
cars is severely reduced by the blend; contamination  
by a small amount of water can cause separation  
problems for the blend; and the presence of methanol  
would cause some corrosion problems.

77A48173 ISSUE 23 PAGE 4023 CATEGORY 45  
77/00/00 10 PAGES UNCLASSIFIED DOCUMENT  
UTTL: In situ optical measurement of automobile exhaust gas  
particulate size distributions - Regular fuel and  
methanol mixtures  
AUTH: A/HIRLIMAN, E. D., JR.; B/WITTIG, S. L. K. PAA:  
B/(Purdue University, West Lafayette, Ind.)  
In: Symposium on Combustion (International), 16th,  
Cambridge, Mass., August 15-20, 1976. Proceedings,  
(A77-48158 23-25) Pittsburgh, Pa., Combustion  
Institute, 1977, p. 245-252; Comments, p. 253, 254.  
Research supported by the Danmarks  
Teknisk-Videnskabelige Forskningsrad, NATO, and NSF.  
MAJS: /\*AUTOMOBILE FUELS/\*EXHAUST GASES/\*METHYL ALCOHOLS/\*  
OPTICAL MEASUREMENT/\*PARTICLE SIZE DISTRIBUTION  
MINS: / AIR POLLUTION/ AUTOMOBILE ENGINES/ ENGINE TESTS/  
OSCILLOGRAPHY/ POLLUTION MONITORING

PRODUCTION OF SYNTHETIC METHANOL FROM AIR AND WATER  
USING CONTROLLED THERMONUCLEAR REACTOR POWER-II.  
CAPITAL INVESTMENT AND PRODUCTION COSTS

Vi Duong Dang & Meyer Steinberg

Energy Conversion, vol. 17, no. 4, June 1977, p.133-

**Abstract**—Energy requirement and process development of methanol production from air and water using controlled thermonuclear fusion power was discussed in part I of this paper. This second part of the paper presents an economic analysis of the nine alternate processes presented for obtaining carbon dioxide recovery from the atmosphere or the sea for methanol production.

It is found that the most economical process of obtaining carbon dioxide is by stripping from sea water. The process of absorption/stripping by dilute potassium carbonate solution is found to be the most economical for the extraction of carbon dioxide from air at atmospheric pressure. The total energy required for methanol synthesis from these sources of carbon dioxide is 3.90 kWh(e)/lb methanol of which 90% is used for generation of hydrogen. The process which consumes the greatest amount of energy is the absorption/stripping of air by water at high pressure and amounts to 13.2 kWh(e)/lb methanol.

With nuclear fusion power plants of 1000 to 9000 MW(e), it is found that the cost of methanol using the extraction of carbon dioxide from air with dilute potassium carbonate solution is estimated to be in the range between \$1.73 and \$2.90/MMB.t.u. (energy equivalent—1974 cost) for plant capacities of 21400 to 193000 bbl/day methanol. This methanol cost is competitive with gasoline in the range of 19 ~ 33¢/gallon. For the process of stripping of carbon dioxide from sea water, the cost is found to lie in the range of \$1.65 to \$2.71/MMB.t.u. (energy equivalent) for plant capacities of 21700 to 195000 bbl/day methanol which is competitive with gasoline in the range of 18 ~ 30¢/gallon.

Projection of methanol demand in the year 2020 is presented based on both its conventional use as chemicals and as a liquid fuel substituting for oil and gas.

79N12239# ISSUE 3 PAGE 306 CATEGORY 2B RPT#:  
FPL-12 77/06/00 21 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Methanol from wood waste: A technical and economic study  
AUTH: A/HOKANSON, A. E.; B/ROWELL, R. M. PAA: A/(Raphael Katzen Assoc., Cincinnati)  
CORP: Forest Products Lab., Madison, Wis. AVAIL.NTIS  
SAP: HC A02/MF A01  
MAJS: /\*ECONOMIC ANALYSIS/\*METHYL ALCOHOLS/\*TECHNOLOGY ASSESSMENT/\*WASTE UTILIZATION/\*WOOD  
MINS: / CHEMICAL REACTORS/ ENERGY TECHNOLOGY/ GASIFICATION  
ABA: Author  
ABS: A methanol-from-wood waste facility having a capacity of 50 million gallons per year requires 1,500 oven-dry tons (ODT) of wood waste per day. The yield of methanol from wood is about 38 percent, or about 100 gallons per ODT of wood. This yield is based on all process energy required coming from the wood waste. At a wood waste cost of \$15/ODT, the selling price of methanol is estimated at \$0.77/gal; at \$34/ODT, the selling price is \$0.96/gal.

78A27812 ISSUE 10 PAGE 1792 CATEGORY 44  
77/00/00 23 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Methanol production from organic waste  
AUTH: A/HAIDER, G. PAA: A/(Utah, University, Salt Lake City, Utah)  
In: Fuels from waste. (A78-27801 10-44; New York, Academic Press, Inc., 1977, p. 171-193.  
MAJS: /\*COST EFFECTIVENESS/\*METHYL ALCOHOLS/\*ORGANIC WASTES (FUEL CONVERSION)/\*REACTION KINETICS/\*SYNTHETIC FUELS /\*WASTE UTILIZATION  
MINS: / CARBON MONOXIDE/ CATALYTIC ACTIVITY/ ENERGY SOURCES/ ENERGY TECHNOLOGY/ GAS COMPOSITION/ HYDROGEN/ PRODUCTION ENGINEERING  
ABA: J.M.B.  
ABS: Methanol production from organic residues is reviewed, with attention given to the thermodynamics, kinetics and catalytic processes associated with the production, as well as to the economics of the high-, medium-, and low-pressure manufacturing techniques. For methanol synthesis from carbon monoxide and hydrogen, the effect of inlet gas composition on equilibrium methanol concentration in the effluent is analyzed, and side reactions are discussed. Reaction equilibria and side reactions are also investigated for methanol synthesis from carbon dioxide and hydrogen. Catalysts considered include zinc oxide, copper and chromium oxide. Selection of an appropriate pressure range for economical methanol manufacturing is generally dependent on the size of the plant.

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Encyclopedia of chemical processing and design, v. 2. Additives to alpha / executive editor, John J. McKetta, associate editor, William A. Cunningham. — New York : M. Dekker, c1977.  
xi, 498 p. : ill. ; 26 cm.  
Includes bibliographical references.  
ISBN 0-8247-2452-6

Alcohol, Methanol as a Motor Fuel  
R. R. Davison

340

Methyl alcohol has many desirable characteristics as a motor fuel. It has long been popular in automobile racing because of its high power output, its high octane rating, its cooling effect, and its miscibility with power boosting nitroparaffins.

78A35703 ISSUE 14 PAGE 2544 CATEGORY 37  
77/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Engine performance and exhaust emission characteristics of spark-ignition engines burning methanol and methanol-gasoline mixtures

AUTH: A/LEE, W.; B/GEFFERS, W. PAA: B/(Volkswagenwerk AG, Wolfsburg, West Germany)  
AICHE Symposium Series, vol. 73, no. 165, 1977, p. 328-337. Research supported by the Bundesministerium fuer Forschung und Technologie.

MAJS: /\*AUTOMOBILE FUELS/\*COMBUSTION EFFICIENCY/\*EXHAUST GASES/\*FUEL COMBUSTION/\*INTERNAL COMBUSTION ENGINES/\* METHYL ALCOHOLS

MINS: / AUTOMOBILE ENGINES/ CARBON MONOXIDE/ FUEL CONSUMPTION/ FUEL-AIR RATIO/ GASOLINE/ HYDROCARBON COMBUSTION/ HYDROCARBON FUELS

ABA: (Author)

ABS: Engine dynamometer tests and road tests using pure methanol, methanol-gasoline blend (15 vol. % methanol plus 85 vol. % gasoline) called M 15 blend and commercial gasoline were made. The results showed that, in principle, from technological aspects it is possible to use methanol as a gasoline extender or in methanol/gasoline blends for automobiles. With regard to energy consumption, methanol and methanol/gasoline blend (M 15) lead to interesting results. But the fuel economy benefits of using M 15 was found to be just in the part-throttle operation of a 1975 car. The emission characteristics except aldehyde emission and unburnt methanol are improved by using pure methanol, a considerable reduction in NO(x) by using pure methanol, in CO by using M 15, and in PNA by using both found in this paper. The potential problems are, on the one hand, cold start and unacceptable driveability in warm-up phase when using pure methanol and, on the other hand, vapor lock in summer and phase separation in winter when using a methanol/gasoline blend (M 15).

Automotive Engineering  
Vol. 85, no 12, December 1977,  
p. 48-55.

#### Methanol: Fuel of the Future?

48

"Use Unleaded Gasoline Only" labels may give way to "Use Methanol Only" before the end of this century. A study by VW engineers discusses some of the problems of methanol-fueled vehicles.

77A48172 ISSUE 23 PAGE 4023 CATEGORY 45  
77/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Combustion technology for the improvement of engine efficiency and emission characteristics

AUTH: A/BERNHARDT, W. PAA: A/(Volkswagenwerk AG, Wolfsburg, West Germany)  
In: Symposium on Combustion (International), 16th, Cambridge, Mass., August 15-20, 1976. Proceedings, (A77-48158 23-25) Pittsburgh, Pa., Combustion Institute, 1977, p. 223-232.

MAJS: /\*AUTOMOBILE ENGINES/\*COMBUSTION EFFICIENCY/\*ENGINE DESIGN/\*POLLUTION CONTROL/\*TECHNOLOGICAL FORECASTING

MINS: / EXHAUST GASES/ FUEL AIR RATIO/ MANIFOLDS/ MATHEMATICAL MODELS/ NITROGEN OXIDES/ WASTE ENERGY UTILIZATION

ABA: G.R.

ABS: The fuel characteristics required for future engines are considered. It is found that future automotive Otto engines have the potential of comparatively low energy consumption which can be obtained by virtue of efficient lean operation and utilizing the high octane ratings of future fuels at high compression ratios. Future diesel engines preserve high fuel economy, while soot formation and odor are suppressed by utilizing methanol injection or using diesel-water emulsion. An employment of mathematical modeling as a tool for the development of combustion technology is discussed and a description of new methods for the improvement of fuel-air mixture preparation is presented. A new Inlet Manifold-Exhaust-Package (MEP) which integrates a lean thermal reactor is examined, giving attention to aspects of MEP evaluation, the thermal efficiency of MEP-equipped internal combustion engines, and the emission characteristics of a methanol engine.

#### METHANOL, PAST, PRESENT, AND SPECULATION ON THE FUTURE.

Alvin B. Stoles

AICHE Journal, vol. 23, no. 3, May 1977, p. 362 - 375

Methanol is overviewed from the standpoint of history: how the history relates to the present and how it could relate to the future. The overview includes ingredients (fuels, catalysts, etc.), synthesis gas generating procedures, processing techniques, and equipment and other considerations for the present and the near and more distant term future.

78A35702 ISSUE 14 PAGE 2544 CATEGORY 37 CNT#: EPA-R-803401-01-0 77/00/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Methanol-gasoline blends - Performance and emissions  
AUTH: A/ADT, R. R., JR.; B/CHESTER, K. A.; C/PAPPAS, J.; D/SWAIN, M. R. PAA: B/(Miami, University, Miami, Fla.); D/(Hawthorne Research and Testing, Inc., Coral Gables, Fla.)

AICHE Symposium Series, vol. 73, no. 165, 1977, p. 319-327. U.S. Environmental Protection Agency

MAJS: /\*AIR POLLUTION/\*ENGINE TESTS/\*GASOLINE/\*METHYL ALCOHOLS

MINS: / AUTOMOBILE FUELS/ BINARY MIXTURES/ CARBON MONOXIDE/ EXHAUST GASES/ NITROGEN OXIDES/ STEADY STATE/ TORQUE

ABA: (Author)

ABS: Some steady state performance and emissions characteristics of a multicylinder, carbureted engine fueled with Indolene and 10, 20, and 30% methanol-Indolene blends over a limited range of operation (about 2000 r.p.m. and about 10-in. Hg or about 16-in. Hg manifold vacuum with lean fuel-air ratios) are presented. The blend-leaning effect is found to be in agreement with elementary carburetor theory. With no engine adjustments, the torque is found to decrease with increasing blend levels, the rate of decrease becoming greater at higher blend levels. At torque and engine speed equal to those of gasoline-fueled operation: (1) brake thermal efficiency for the blends is greater than that for gasoline up to about a 30% methanol blend level; (2) NO(x) mass emissions are less for the blends, about 60% less for the 30% blend; (3) CO mass emissions increase with increasing blend levels; and (4) intake manifold mixture temperatures are decreased by about 5.6 C for each 10% increase in methanol blend level.

78N32283# ISSUE 23 PAGE 3065 CATEGORY 28 RPT#: ORNL/FE-1 CNT#: W-7405-ENG-26 77/11/00 69 PAGES UNCLASSIFIED DOCUMENT

UTTL: Synthetic fuels process research digest

AUTH: A/OHARA, F. M., JR.; B/SPIEWAK, A. R. PAT: B/ed. CORP: Oak Ridge National Lab., Tenn. AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /\*ENERGY CONVERSION/\*ENERGY POLICY/\*SYNTHETIC FUELS  
MINS: / CHEMICAL ENGINEERING/ COAL UTILIZATION/ ENERGY TECHNOLOGY/ RESEARCH AND DEVELOPMENT

ABA: U.S.

ABS: Coal energy conversion processes are described. They are: (1) coal gasification with chemically incorporated catalysts, (2) flash hydrolysis of coal, (3) zinc chloride hydrocracking of coal and coal extracts, and (4) conversion of methanol to high octane gasoline.

78A11126 ISSUE 1 PAGE 63 CATEGORY 44 77/00/00 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy and materials from the forest biomass.

AUTH: A/SAEMAN, J. F. PAA: A/(U.S. Forest Service, Forest Products Laboratory, Madison, Wis.)

In: Clean fuels from biomass and wastes: Proceedings of the Second Symposium, Orlando, Fla., January 25-28, 1977. (A78-11120 01-44) Chicago, Ill., Institute of Gas Technology, 1977, p. 153-168.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*FORESTS/\*ORGANIC WASTES (FUEL CONVERSION)/\*WASTE UTILIZATION/\*WOOD

MINS: / COST EFFECTIVENESS/ ECONOMIC FACTORS/ ENERGY POLICY/ ENERGY TECHNOLOGY/ INDUSTRIAL ENERGY

ABA: J.M.B.

ABS: The contribution of forests to reducing U.S. dependency on foreign energy sources is discussed, with mention made of the direct application of wood residues as fuel and the conversion of forest products to ethanol, furfural, methanol, formaldehyde and phenol, as well as to indirect savings resulting from the use of conventional forest products instead of more energy-intensive alternatives. It is suggested that energy available from unused but accessible manufacturing and logging wastes could produce two times ten to the 15th power Btus per year, amounting to a 3% contribution to the national energy budget. Environmental problems associated with the handling and burning of wood residues are held to be minimal. However, the chemical or biochemical conversion of forest biomass appears at present to involve high capital costs and low profits.

77A34114 ISSUE 15 PAGE 2475 CATEGORY 23 77/05/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Methanol, past, present, and speculation on the future --- manufacture techniques and fuel applications

AUTH: A/STILES, A. B. PAA: A/(Delaware, University, Newark, Del.)

AICHE Journal, vol. 23, May 1977, p. 362-375.

MAJS: /\*CHEMICAL ENGINEERING/\*METHYL ALCOHOLS/\*SYNTHETIC FUELS

MINS: / AUTOMOBILE FUELS/ CHEMICAL REACTIONS/ FLOW CHARTS

ABA: (Author)

ABS: Methanol is overviewed from the standpoint of history: how the history relates to the present and how it could relate to the future. The overview includes ingredients (fuels, catalysts, etc.), synthesis gas generating procedures, processing techniques, and equipment and other considerations for the present and the near and more distant term future.

PRODUCTION OF SYNTHETIC METHANOL FROM AIR  
AND WATER USING CONTROLLED THERMONUCLEAR  
REACTOR POWER - I. TECHNOLOGY AND ENERGY  
REQUIREMENT.

Meyer Steinberg & Vi - Duong Dang  
Energy Conversion, Vol. 17, No. 2/3, 1977,  
p. 97-112.

**Abstract**—Methanol synthesis from carbon dioxide, water and nuclear fusion energy is extensively investigated. The entire system is analyzed from the point of view of process design of various processes. The main potential advantage of a fusion reactor (CTR) for this purpose is that it provides a large source of low cost, environmentally acceptable electric power based on an abundant fuel source. Carbon dioxide is obtained by extraction from the atmosphere or from sea water. Hydrogen is obtained by electrolysis of water. Methanol is synthesized by the catalytic reaction of carbon dioxide and hydrogen. The water electrolysis and methanol synthesis units are considered to be technically and commercially available. The benefit of using air or sea water as a source of carbon dioxide is to provide an essentially unlimited renewable and environmentally acceptable source of hydrocarbon fuel. Extraction of carbon dioxide from the atmosphere also allows a high degree of freedom in plant siting.

The significant contribution of the present study is the evaluation of various methods of separation of carbon dioxide from air or sea water. Eight different methods of extraction of carbon dioxide from air are analyzed: (1) absorption and stripping of air by water at atmospheric pressure, (2) absorption and stripping of air by water at atmospheric pressure with a cooling tower as part of the absorption unit, (3) absorption and stripping of air by water at higher pressure, 20 atm, (4) absorption and stripping of air by methanol at 20 atm and  $-80^{\circ}\text{F}$ , (5) removal of water vapor by adsorption on molecular sieves and subsequent extraction of carbon dioxide by refrigeration, (6) removal of water vapor by compression refrigeration and subsequent extraction of carbon dioxide by refrigeration, (7) absorption and stripping of air by a dilute aqueous potassium carbonate solution, and (8) removal of water vapor by adsorption on molecular sieves and adsorption/desorption of carbon dioxide from dry air by molecular sieves. A method of stripping of carbon dioxide from sea water is also presented. In order to compare these newly developed methods for  $\text{CO}_2$  separation with other conventional non-fossil sources of carbon, the calcination of limestone is also examined.

For the extraction of carbon dioxide from air, the process of absorption/stripping of air by dilute potassium carbonate solution is found to require the least amount of energy. The total energy required for methanol synthesis from these sources of carbon dioxide is  $390\text{ kWh(e)/lb}$  methanol of which 90% is used for generation of hydrogen. The process which consumes the greatest amount of energy is the absorption/stripping of air by water at high pressure and amounts to  $13.2\text{ kWh(e)/lb}$  methanol. A subsequent paper will consider the important topic of economic evaluation.

79N77989# CATEGORY 28 RPT#: NZERDC-23 77/00/00  
30 PAGES UNCLASSIFIED DOCUMENT

UTTL: Methanol from natural gas for engine fuel  
AUTH: A/JUDD, B. T.; B/WALKER, B. V.; C/GRAHAM, E. E.;  
D/REES, I. F.; E/GIRARDIN, E. K.  
CORP: New Zealand Energy Research and Development Committee,  
Auckland. AVAIL NTIS  
MAJS: /\*ENGINE TESTS/\*GASOLINE/\*METHANE/\*NATURAL GAS  
MINS: / CORROSION/ DISTRIBUTION (PROPERTY)/ ECONOMIC  
ANALYSIS/ FUEL SYSTEMS/ MIXTURES/ TECHNOLOGY  
UTILIZATION/ TOLERANCES (MECHANICS)/ VAPOR PRESSURE

79N32284# ISSUE 23 PAGE 3065 CATEGORY 28 RPT#:  
NP-22771 IR-2 REPT-23 77/06/00 30 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Methanol from natural gas for engine fuel  
AUTH: A/JUDD, B. T.; B/WALKER, B. V.; C/GRAHAM, E. E.;  
D/REES, I. F.; E/GIRARDIN, E. K. PAA: C/(Canterbury  
Univ., N. Zealand); D/(Canterbury Univ., N. Zealand);  
E/(Canterbury Univ., N. Zealand)  
CORP: Department of Scientific and Industrial Research,  
Lower Hutt (New Zealand). AVAIL NTIS SAP: (US  
Sales Only) HC A03/MF A01; ERDA Depository Libraries  
N. Zealand Energy Res. and Develop. Comm.  
MAJS: /\*FUEL SYSTEMS/\*NATURAL GAS  
MINS: / BENZENE/ DISTRIBUTION (PROPERTY)/ ENGINES/ GASOLINE/  
METHANE/ OCTANES/ PRESSURE DISTRIBUTION/ TECHNOLOGY  
ASSESSMENT/ VAPOR PRESSURE  
ABA: ERA  
ABS: The water tolerance of the methanol/1-octane/benzene  
system was studied, including the effect on the water  
tolerance of the presence of selected additives. The  
conclusion that methanol/gasoline/1-butanol blends can  
be obtained of adequate stability for commercial  
distribution is derived. Results show that the use of  
emulsifying agents to achieve stable blends is not  
technically possible at the present time. The  
corrosive effect of methanol on the materials  
currently used in vehicle fuel systems and in the fuel  
distribution system is discussed. It is recognized  
that the introduction of methanol/gasoline blends  
could create problems in the area of materials  
compatibility vis-a-vis gasoline and it is recommended  
that additional work be initiated to provide more  
detailed information than is presently available. The  
problem of increased vapor pressure and methods of  
distribution of methanol/gasoline blends are noted.  
Results of initial experimental work undertaken with a  
single cylinder Ricardo engine are described. The need  
for further extensive work is indicated, however, both  
with single cylinder and multicylinder engines.

78N78914# CATEGORY 28 RPT#: FE-2447-9 CNT#:  
EF-77-C-01-2447 77/09/00 151 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Research guidance studies to assess gasoline from coal  
by methanol-to-gasoline and Sasol-type Fischer-Tropsch  
technologies  
AUTH: A/SCHREINER, M.  
CORP: Mobil Research and Development Corp., Princeton, N. J.  
AVAIL NTIS  
MAJS: /\*COAL/\*GASOLINE/\*TECHNOLOGY ASSESSMENT  
MINS: / ECONOMIC ANALYSIS/ METHYL ALCOHOLS/ PRODUCT  
DEVELOPMENT

78A27475 ISSUE 10 PAGE 1789 CATEGORY 44  
77/00/00 388 PAGES UNCLASSIFIED DOCUMENT

UTTL: Future automotive fuels: Prospects, performance, perspective --- Book

AUTH: A/COLUCCI, J. M.; B/GALLOPOULOS, N. E. PAA: B/(GM Research Laboratories, Warren, Mich.) PAI: A/(ED.) SAP: \$39.50

New York, Plenum Press, 1977. 388 p

MAJS: /\*AUTOMOBILE FUELS/\*TRANSPORTATION ENERGY  
MINS: / ALTERNATIVES/ COAL UTILIZATION/ DIESEL FUELS/ ENERGY CONSERVATION/ ENERGY POLICY/ EXHAUST GASES/ FISSILE FUELS/ FUEL COMDUCTION/ HYDROCARBON FUELS/ HYDROGEN FUELS/ METHYL ALCOHOLS/ NUCLEAR ENERGY/ SHALE OIL/ SYNTHETIC FUELS

ABA: G.R.

ABS: Attention is given to the future demand for automotive fuels, the U.S. energy outlook through 1990, aspects of energy conservation and fuel-vehicle optimization, and opportunity for maximizing transportation energy conservation, the matching of future automotive fuels and engines for optimum energy efficiency, coal as a source of automotive fuels, motor fuels from oil shale, and the influence of nuclear energy on transportation fuels. The automotive utilization of intermediate-term future fuels is discussed, taking into account the characteristics of conventional fuels from nonpetroleum sources, the application of a new combustion analysis method in the study of alternate fuel combustion and emission characteristics, engine performance and exhaust emission characteristics of a methanol-fueled automobile, the combustion of methanol in an automotive gas turbine, and alternative fuels for automotive diesel engines. Hydrogen as a reciprocating engine fuel is considered in connection with an evaluation of long term future fuels. The use of hydronitrogens, such as hydrazine and ammonia, as future automotive fuels is also discussed.

79N73512# CATEGORY 28 RPT#: FE-2490-12 Cat#: EX-76-C-01-2490 E(49-18)-2490 77/10/00 164 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fluid bed process studies on selective conversion of methanol to high octane gasoline TLSP: Annual Report

AUTH: A/LEE, W.  
CORP: Mobil Research and Development Corp., Paulsboro, N. J. AVAIL.NTIS

MAJS: /\*FLUIDIZED BED PROCESSORS/\*GASOLINE/\*METHANE  
MINS: / ALCOHOLS/ CAPACITANCE/ GLASS/ MODELS/ PILOT PLANTS

78N18535# ISSUE 9 PAGE 1179 CATEGORY 44  
77/12/00 26 PAGES UNCLASSIFIED DOCUMENT

UTTL: Synthetic liquid fuels development: Assessment of critical factors

AUTH: A/WALTON, B. L.  
CORP: SRI International Corp., Menlo Park, Calif. CSS: ( Center for Resource and Environmental Systems Studies. ) AVAIL.NTIS SAP: HC A24/MF A01  
In Union Coll. Effects of Energy Constraints p 115-140 (SEE N78-18529 09-44)

MAJS: /\*SYNTHETIC FUELS/\*TECHNOLOGY ASSESSMENT  
MINS: / COAL LIQUEFACTION/ CRUDE OIL/ ENERGY POLICY/ SHALE OIL

ABA: Author

ABS: The study related to the technology assessment of selected liquid fuels derived from coal and oil shale. These fuels were considered to be the most likely alternatives to substitute for/or augment petroleum derived fuels in the transportation sector in the 1980-2000 time frame. The core of the study deals with the preparation of maximum credible implementation (MCI) scenario for the deployment of a synthetic liquid fuel industry based on the use of coal and oil shale to produce synthetic crude oils and methanol. The preparation of the MCI was followed by detailed exploration of the broad consequences if the scenario were to become a reality.

78N29259# ISSUE 20 PAGE 2648 CATEGORY 28 RPT#: IT-7708 77/07/00 35 PAGES UNCLASSIFIED DOCUMENT DCAF F090352

UTTL: Methanol as a possible fuel for automotive use

AUTH: A/LUCAS, G. G.; B/CHOI, M. F.  
CORP: Loughborough Univ. of Technology (England). CSS: ( Dept. of Transport Technology. ) AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /\*AUTOMOBILE FUELS/\*METHYL ALCOHOLS  
MINS: / ENERGY SOURCES/ EXHAUST GASES/ PRODUCTION ENGINEERING/ TECHNOLOGY ASSESSMENT

ABA: F.O.S.

ABS: The state-of-the-art of the use of methanol in internal combustion engines is reviewed. Fuel economy, power output and emission characteristics of methanol-fuel vehicles are reported. Problems associated with automobiles operating with straight methanol are identified. Existing processes for the manufacture of methanol are described, and further new material sources for methanol production and uses are assessed.

78N25243# ISSUE 16 PAGE 2097 CATEGORY 28 RPT#:  
BNL-50663 CNT#: EY-76-C-02-0016 BNL-368150-S  
77/04/00 178 PAGES UNCLASSIFIED DOCUMENT

UTTL: Production economics for hydrogen, ammonia and  
methanol during the 1980-2000 period  
AUTH: A/CORNEIL, H. G.; B/HEINZELMANN, F. J.; C/NICHOLSON,  
E. W. S.

CORP: Exxon Research and Engineering Co., Linden, N. J.;  
Brookhaven National Lab., Upton, N. Y. CSS: (Government  
Research Labs.) AVAIL.NTIS SAP: HC  
A09/MI A01  
Prepared for BNL

MAJS: /\*AMMONIA/\*ECONOMICS/\*HYDROGEN/\*METHYL ALCOHOLS  
MINS: / CATALYTIC ACTIVITY/ MANUFACTURING/ NATURAL GAS/  
STEAM

ABA: ERA

ABS: Refinery hydrogen, ammonia, and methanol, the  
principal industrial hydrogen products, are now  
manufactured mainly by catalytic steam reforming of  
natural gas or some alternative light-hydrocarbon feed  
stock. Anticipated increases in the prices of  
hydrocarbons are expected to exceed those for coal,  
thus gradually increasing the incentive to use coal  
gasification as a source of industrial hydrogen during  
the 1980 to 2000 period. Although the investment in  
industrial hydrogen plants will exceed those for  
reforming by a factor of 2 or more, coal gasification  
will provide lower production costs (including 20%/y  
before tax return) for methanol manufacture in the  
early 1980's and for ammonia 5 years or so later.  
However, high costs for transporting coal to major  
refining centers will make it difficult to justify  
coal gasification for refinery hydrogen production  
during the 1980 to 2000 period.

#### THE METHANOL ENGINE: A TRANSPORTATION STRATEGY FOR THE POST-PETROLEUM ERA

Energy and Technology Review, Dec. 1976, p. 6 - 11,

#### METHANOL CONVERSION FOR YOUR CAR?

E.F. Eindsley.

Popular Science, Aug. 1977, p.90-91,148,149.

A clever trick makes it easier to use alcohol:  
Vaporize it with gasoline.

J 78N12243# ISSUE 3 PAGE 317 CATEGORY 28 RPT#:  
PB-270401/3 DOT-TSC-OST-74-38 DOT-TSC-OST-77-31  
77/04/00 89 PAGES UNCLASSIFIED DOCUMENT

UTTL: Methanol as an automotive fuel with special emphasis  
on methanol-gasoline blends TLSP: Final Report, Jun.  
- Oct. 1974

AUTH: A/LANDMAN, A.

CORP: Transportation Systems Center, Cambridge, Mass.  
AVAIL.NTIS SAP: HC A05/MF A01

MAJS: /\*AUTOMOBILE FUELS/\*ENERGY TECHNOLOGY/\*FUEL  
CONSUMPTION/\*METHYL ALCOHOLS/\*MIXTURES/\*TECHNOLOGY  
ASSESSMENT

MINS: / AIR POLLUTION/ AUTOMOBILE ENGINES/ CHEMICAL  
PROPERTIES/ COST ANALYSIS/ EXHAUST GASES/ TOXICITY

ABA: GRA

ABS: Methanol is characterized and the results of various  
studies on methanol and methanol-gasoline blends, and  
their use and effects in engines and vehicles are  
presented and compared. Cost information, although  
limited, is given as available. Methanol production  
processes are described as well as their promise and  
expansion possibilities in relation to potential  
requirements. Various raw material sources are  
considered in the light of future production potential  
needs.

78N20356# ISSUE 11 PAGE 1427 CATEGORY 28 RPT#:  
FE-2490-8 CNT#: EX-76-C-01-2490 77/06/00 22 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Fluid bed process studies on selective conversion of  
methanol to high octane gasoline TLSP: Monthly  
Report, May 1977

CORP: Mobil Research and Development Corp., Paulsboro, N. J.  
AVAIL.NTIS SAP: HC A02/MF A01

MAJS: /\*ENERGY CONVERSION/\*FLUIDIZED BED PROCESSORS/\*  
GASOLINE/\*METHYL ALCOHOLS/\*OCTANE NUMBER

MINS: / BEDS (PROCESS ENGINEERING)/ FEED SYSTEMS/ FLUID FLOW  
/ HIGH TEMPERATURE/ REGENERATORS

ABA: Author (ERA)

ABS: In the fluid bed flow studies the major  
accomplishments were the experimental testing of  
different designs for feed distributor and selection  
of a five prong nozzle with atomizer, design of  
capacitance probe for high temperature operation, and  
testing of reactor cyclone with subsequent design  
improvement. In the methanol to gasoline pilot plant  
design and construction, the major accomplishments  
were the completion of the assembly of the reactor  
regenerator system, completion of wiring on the  
instrument panel, and installation of heating elements  
on the reactor regenerator system.

77A48706 ISSUE 23 PAGE 3964 CATEGORY 37  
77/00/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Computer predicted compression ratio effects on NOx emissions from a methanol fueled SI engine

AUTH: A/BROWNING, L. H.; B/PEFLEY, R. K. PAA: B/(Santa Clara, University, Santa Clara, Calif.)  
In: Intersociety Energy Conversion Engineering Conference, 12th, Washington, D.C., August 28-September 2, 1977, Proceedings, Volume 1. (A77-48701 23-44) La Grange Park, Ill., American Nuclear Society, Inc., 1977, p. 37-43. Research supported by the U.S. Environmental Protection Agency and ERDA.

MAJS: /\*AIR POLLUTION/\*AUTOMOBILE ENGINES/\*COMPUTERIZED SIMULATION/\*METHYL ALCOHOLS/\*SPARK IGNITION

MINS: / COMBUSTION PHYSICS/ ENGINE DESIGN/ MATHEMATICAL MODELS/ NITROGEN OXIDES/ REACTION KINETICS/ THERMODYNAMIC EFFICIENCY

ABA: (Author)

ABS: A combustion kinetics computer model was used to study the compression ratio effects on performance and emissions of a methanol fueled spark ignition (SI) engine. Earlier experimental work by two independent research workers had shown that volumetric NOx emissions decreased when compression ratio was increased from 9.7:1 to 14:1 at MBT spark settings. The computer model, however, predicted a continual increase in volumetric NOx emissions for increasing compression ratio at MBT spark timing. With only a 3-deg retard from MBT, the computer predicted volumetric NOx emission at 14:1 compression ratio was reduced to that at 8.44:1 compression ratio and MBT spark timing. With this spark retard setting, there was a net increase in power and thermal efficiency of 13.7% relative to the MBT values at 8.44:1 compression ratio.

### KINETICS OF THE PYROLYSIS OF METHANOL

D. Aronowitz, D. W. Naegeli and I. Glassman  
The Journal of Physical Chemistry  
Vol. 81 no. 25 Dec. 15, 1977  
p. 2555-2559

An adiabatic turbulent flow reactor was used to examine the pyrolysis of methanol in the temperature range 1070-1225 K at atmospheric pressure. Emphasis has been placed on determining the important initiation and termination steps and estimating rate constants for several reactions. A steady state treatment of the proposed 19-step mechanism yields a complex rate law for methanol decay. The roles of hydrogen as a promoter and methane as an inhibitor are accounted for in the proposed mechanism.

### Experimental Results Using Methanol and Methanol/Gasoline Blends as Automotive Engine Fuel.

J. R. Allsup.

Energy Research and Development Administration,  
Bartlesville, Okla. Bartlesville Energy Research Center. Jan 77, 87p

BERC/RI-76/15 Price code: PC A05/MF A01

Comparative emission and fuel energy economy data were generated using 1975 model vehicles adjusted for gasoline fuel and using gasoline and gasoline blended with 5 and 10% methanol; tests were made at temperatures of 20 exp 0, 75 exp 0, and 100 exp 0 F on a chassis dynamometer in a climate-controlled test chamber. Results suggest that emissions and fuel energy economy are generally affected to the extent that methanol addition affects air-fuel stoichiometry, fuel heat content, and fuel vapor pressure. The term "fuel energy economy" is used to denote calculations on the basis of fuel energy content in lieu of fuel quantity. Vehicle emissions and fuel economy were essentially unchanged during approximately 7,500 miles of road testing; no engine or fuel system component failures were encountered during that testing. Road octane measurements were made for the fuels containing 5, 10, and 15% methanol in base gasolines of 84, 87, and 91 research octane quality. Results show significantly better octane improvement in blending methanol with the lower octane fuels as compared with the improvement in blending with the higher octane fuels. Steady-state engine emission and fuel energy economy data were generated using a late model automotive engine fueled with 5, 10, 15, and 100% methanol/gasoline blend. Test variables and engine parametric adjustments included engine speed, exhaust gas recirculation rate, air-fuel ratio, ignition timing, and compression ratio. Results suggest that operation with pure methanol may allow use of high-compression engines to realize improved fuel energy economy with relatively low oxides of nitrogen emission. (ERA citation 02:024999)

78N23261# ISSUE 14 PAGE 1829 CATEGORY 28 RPT#:  
PB-277135/O EPA-460/3-77-012A CNT#:  
EPA-R-803401-01-3 77/07/00 204 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Characterization of methanol/gasoline blends as  
automotive fuel: Performance and emissions  
characteristics  
AUTH: A/ADT, R. R., JR.; B/CHESTER, K. A.; C/KURUCZ, C. N.  
: D/PAPPAS, J.; E/RAJAN, S.; F/SWAIN, M.  
CORP: Miami Univ., Coral Gables, Fla. CSS: (Dept. of  
Mechanical Engineering.) AVAIL.NTIS SAP: HC  
A10/MF A01  
MAJS: /\*AIR QUALITY/\*AUTOMOBILE FUELS/\*EXHAUST GASES/\*METHYL  
ALCOHOLS/\*PARTICLE EMISSION  
MINS: / AUTOMOBILE FUELS/ CHEMICAL FUELS/ COAL GASIFICATION/  
FEASIBILITY ANALYSIS/ PERFORMANCE TESTS  
ABA: GRA  
ABS: Recent concern about environmental problems and the  
eventual shortage of conventional petroleum based  
fuels coupled with the potential of obtaining methyl  
alcohol (methanol) as a product of coal gasification  
has brought about a recent interest in the use of  
methanol as a fuel. In order to assess the feasibility  
of using methanol as a motor vehicle fuel, either  
alone (neat) or as a blend in gasoline type base  
stocks, its performance, emissions and practical use  
characteristics must be ascertained. A series of  
experiments was conducted to determine methanol blend  
fuel engine characteristics information.

**Methanol: Its Synthesis, Use as a Fuel,  
Economics, and Hazards**  
David LeRoy Hagen  
National Technical Information  
Service (NTIS)  
U.S. Dept. of Commerce  
5285 Port Royal Rd.  
Springfield, VA 22161

This report gives a state-of-the-art  
overview of methanol fuel technology.  
An extensive bibliography is included.  
-d.m.

78N25242# ISSUE 16 PAGE 2057 CATEGORY 28 RPT#:  
CONS/2693-1 CNT#: EG-77-X-01-2693 77/08/31 88  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Sources of alcohol fuels for vehicle fleet tests  
AUTH: A/BARR, W. J.; B/PARKER, F. A.  
CORP: American Energy Research Co., Mclean, Va.  
AVAIL.NTIS SAP: HC A05/MF A01  
MAJS: /\*COAL GASIFICATION/\*FUELS/\*METHYL ALCOHOLS  
MINS: / COST ANALYSIS/ INDUSTRIAL PLANTS/ PROJECT PLANNING/  
TECHNOLOGY ASSESSMENT  
ABA: ERA  
ABS: Twenty-five coal gasification projects were reviewed  
for the purpose of determining if they offered an  
opportunity to provide a source of methanol for a  
fleet vehicle test program. All were concerned with  
the gasification of coal to produce a low, medium, or  
high Btu gas or a liquid fuel. The analysis revealed  
that only four programs offered a reasonable  
opportunity for completion of a commercial scale  
gasification plant and full operation in the  
foreseeable future. Further, all four elected to use  
the Lurgi gasification technology together with the  
Lurgi Rectisol gas cleanup process incorporating  
methanol as the absorbing medium. Consequently all  
four projects are candidates for supplying the 150 ton  
needed for a fleet vehicle test program.

77N22630# ISSUE 13 PAGE 1746 CATEGORY 44 RPT#:  
TID-27156 76/00/00 61 PAGES UNCLASSIFIED DOCUMENT

UTTL: Economic feasibility: Fuel grade methanol from coal  
AUTH: A/MCGEORGE, A.  
CORP: Du Pont de Nemours (E. I.) and Co., Wilmington, Del.  
CSS: (Research and Development Div.) AVAIL.NTIS  
SAP: HC A04/MF A01  
Sponsored by ERDA  
MAJS: /\*COAL UTILIZATION/\*ECONOMICS/\*LIQUEFIED NATURAL GAS/\*  
PRODUCTION ENGINEERING  
MINS: / COST ESTIMATES/ INVESTMENTS/ PILOT PLANTS  
ABA: ERA  
ABS: A plant to make fuel grade methanol from coal based on  
partial oxidation pressure gasifiers and low pressure  
methanol synthesis is described. The process is  
capital intensive and thus is sensitive to plant  
investment but relatively insensitive to coal price.  
The financing method is important because of the  
capital intensive nature of the process. Snipping and  
distribution costs, assuming a mix of tank wagons,  
tank cars, unit trains and terminals, were estimated  
to be about 11 cents/gal.

77A27299# ISSUE 11 PAGE 1060 CATEGORY 44 CNT#: E(49-1B)-1773 76/08/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: Mobil process for the conversion of methanol to gasoline  
AUTH: A/WISE, J. J.; B/SILVESTRI, A. J. PAA: A/(Mobil Research and Development Corp., Paulsboro, N.J.); B/(Mobil Research and Development Corp., Princeton, N.J.)  
University of Pittsburgh, Annual International Conference on Coal Gasification and Liquefaction, 3rd Pittsburgh, Pa., Aug. 3-5, 1976. Paper, 15 p.  
MAJS: /\*COAL GASIFICATION/\*GASOLINE/\*HYDROCARBON FUEL PRODUCTION/\*METHYL ALCOHOLS  
MINS: / CHEMICAL ENGINEERING/ SYNTHANE/ TABLES (DATA)/ THERMODYNAMIC EFFICIENCY  
ABA: S.D.  
ABS: The paper shows that coupling the Mobil Methanol-to-Gasoline Process with coal-to-methanol technology provides a new route for the conversion of coal to gasoline. In the manufacture of gasoline from coal, coal is gasified to form synthesis gas which, after purification, is converted to methanol; crude methanol is then converted to gasoline and water. The equipment used in the Mobil Methanol-to-Gasoline Process is described as a petroleum hydrotreater. Typical process conditions and yields are tabulated. The gasoline produced in the Mobil Process is of very high quality, where the octanes exceed the current requirements for both unleaded regular and leaded premium. Particular attention is given to the coproduction of gasoline and SNG via the Mobil Process. The advantage of coproduction stems from the retention of the methane produced in the gasification step as SNG rather than converting it to additional synthesis gas. The Mobil Process is used to convert the crude methanol to gasoline, LPG, and a small amount of additional SNG. The high thermal efficiency of this combination process is discussed.

77N75724# CATEGORY 44 RPT#: UCRL-TRANS-11076 76/04/00 27 PAGES UNCLASSIFIED DOCUMENT

UTTL: Methanol as an energy source and its synthesis  
AUTH: A/YAMAMOTO, T.  
CORP: Addis Translations International, Portola Valley, Calif. AVAIL. NTIS  
Sponsored by ERDA Transl. into ENGLISH from Koatsu Gasu (Japan), v. #2, no. 4, 1975 p 141-145  
MAJS: /\*CHEMICAL ENGINEERING/\*ENERGY POLICY/\*ENERGY TECHNOLOGY/\*METHANE  
MINS: / CRUDE OIL/ ENERGY SOURCES/ LIQUEFIED NATURAL GAS/ NAPHTHALENE/ NATURAL GAS/ NUCLEAR ENERGY

77A12801 ISSUE 2 PAGE 215 CATEGORY 37 76/00/00 6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Alternate fuel capability of Rankine cycle engines  
AUTH: A/BURTZ, R. D.; B/DUFFY, T. E. PAA: A/(Steam Power Systems, Inc., San Diego, Calif.); B/(International Harvester Co., Solar Div., San Diego, Calif.)  
In: Intersociety Energy Conversion Engineering Conference, 11th, State Line, Nev., September 12-17, 1976. Proceedings, Volume 2. (A77-12662 02-44) New York, American Institute of Chemical Engineers, 1976, p. 1192-1197.  
MAJS: /\*AUTOMOBILE ENGINES/ BOILERS/\*EXTERNAL COMBUSTION ENGINES/\*FUEL SYSTEMS/\*RANKINE CYCLE  
MINS: / CARBON MONOXIDE/ COMBUSTION CHAMBERS/ COMBUSTION PRODUCTS/ ENGINE DESIGN/ FUEL INJECTION/ FUEL OILS/ METHYL ALCOHOLS/ NITROGEN OXIDES  
ABA: B.J.  
ABS: The paper describes a Rankine cycle steam engine for automotive applications which has surpassed the ultimate Federal emissions standards and demonstrated low emissions characteristics on a broad range of petroleum based and on non-petroleum fuels. Results of continued development of this engine with alternate fuels are presented. Emissions with coal derived fuel oil and methanol are characterized across a wide range of fuel flows. The rotating cup fuel injection system is found to have excellent characteristics with a wide range of liquid fuel types. Extension of the fuel injection technology to powdered solid fuel in a water slurry or directly for powder slinger injection appears practical.

TP  
358  
.L5

Lincoln, John Ware.  
Methanol and other ways around the gas pump / John Ware Lincoln. --  
Charlotte, Vt. : Garden Way Pub., c1976.  
134 p. : ill. ; 23 cm.  
Bibliography: p. 129-132.  
Includes index.  
ISBN 0-88266-052-7. ISBN 0-88266-051-9 pbk. : \$4.95

1. Alcohol as fuel. 2. Methanol.  
3. Gas-producers. 4. Synthetic fuels. I. Title.  
TP358.L5 629.2'53 76-366340

76V17913

77N12533# ISSUE 3 PAGE 356 CATEGORY 44 RPT#:  
PB-255994/6 SRI-EGU-3505-UR-1-VOL-1 EPA-600/7-76-004-A  
CNT#: EPA-68-03-2016 76/06/00 117 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Impacts of synthetic liquid fuel development.  
Automotive market. Volume 1: Summary TLSP: Final  
Report  
AUTH: A/DICKSON, E. M.; B/STEELE, R. V.; C/HUGHES, E. E.;  
D/WALTON, B. L.; E/ZINK, R. A.  
CORP: Stanford Research Inst., Menlo Park, Calif.  
AVAIL.NTIS SAP: HC A06/MF A01  
MAJS: /\*AUTOMOBILE FUELS/\*ENERGY POLICY/\*ENVIRONMENTAL  
SURVEYS/\*FUEL CONSUMPTION/\*SYNTHETIC FUELS  
MINS: / AIR POLLUTION/ COAL LIQUEFACTION/ COST ESTIMATES/  
CRUDE OIL/ ECONOMIC FACTORS/ LAW (JURISPRUDENCE)/  
METHYL ALCOHOLS/ SHALE OIL  
ABA: GRA  
ABS: The impacts of the development of synthetic liquid  
fuels from coal and oil shale are assessed. The fuels  
considered are synthetic crude oils from coal and oil  
shale and methanol from coal. Key issues examined in  
detail are the technology and all of its resource  
requirements, net energy analyses of the technological  
options, a maximum credible implementation schedule,  
legal mechanisms for access to coal and oil shale  
resources, financing of a synthetic liquid fuels  
industry, decision making in the petroleum industry,  
government, incentive policies, local and national  
economic impacts, environmental effects of strip  
mining, urbanization of rural areas, air pollution  
control, water resources and their availability, and  
population growth and boom town effects in previously  
rural areas.

77N23619# ISSUE 14 PAGE 1877 CATEGORY 44 RPT#:  
PB-262980/6 MIT-EL-76-013 76/04/00 57 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Methanol as an automotive fuel: A summary of research  
in the M.I.T. Energy Laboratory TLSP: Final Report  
AUTH: A/DONNELLY, R. G.; B/HEYWOOD, J. B.; C/LURUSSO, J.;  
D/OBRIEN, F.; E/REED, T. B.; F/TACACZYNSKI, R. J.  
CORP: Massachusetts Inst. of Tech., Cambridge, CSS: (Energy Lab.)  
AVAIL.NTIS SAP: HC A04/MF A01  
MAJS: /\*AUTOMOBILE FUELS/\*FEASIBILITY/\*METHYL ALCOHOLS  
MINS: / COMBUSTION/ EXHAUST GASES/ PHASE TRANSFORMATIONS/  
THERMODYNAMIC EFFICIENCY  
ABA: GRA  
ABS: The current status of studies on the use of methanol  
blends as automotive fuels is briefly reviewed.

77N17594# ISSUE B PAGE 1056 CATEGORY 44 RPT#:  
PB-257615/5 EPRI-AF-202 76/CB/00 112 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Liquid phase methanol TLSP: Annual Report  
AUTH: A/SHERWIN, M.; B/BLUM, D.  
CORP: Chem Systems, Inc., New York. AVAIL.NTIS SAP: HC  
A06/MF A01  
Sponsored by Elec. Power Res. Inst.  
MAJS: /\*ENERGY TECHNOLOGY/\*FLUIDIZED BED PROCESSORS/\*METHYL  
ALCOHOLS/\*REACTION KINETICS/\*SYNTHETIC FUELS  
MINS: / COAL GASIFICATION/ ECONOMIC ANALYSIS/ ENERGY POLICY/  
THERMODYNAMIC EFFICIENCY  
ABA: GRA  
ABS: A three phase fluidized system is described for  
methanol synthesis. An inert liquid is used as a sink  
for the exotherm of the synthesis reaction. This  
temperature control feature allows greater per pass  
conversion and improved thermal efficiency as compared  
to presently available technology. Experimental  
findings from a bench scale apparatus are reported.  
Thermodynamic calculations and a preliminary economic  
analysis are presented. This technology has potential  
as an efficient method of energy storage from  
coal-based gasification power plants. Another  
application is in a plant to produce fuel grade  
methanol for export to power plants for intermediate  
or peak load use.

77A12935 ISSUE 2 PAGE 250 CATEGORY 44 76/11/00  
3 PAGES UNCLASSIFIED DOCUMENT

UTTL: Air, water, nuclear power make gasoline  
AUTH: A/STEINBERG, M.; B/BARON, S. FAA: A/(Brookhaven  
National Laboratory, Upton, N.Y.); B/(Burns and Roe,  
Inc., Oradell, N.J.)  
Energy, vol. 1, Summer-fall 1976, p. 27-29.  
MAJS: /\*AUTOMOBILE FUELS/\*CARBON DIOXIDE/\*COST ESTIMATES/\*  
GASOLINE/\*NUCLEAR ENERGY/\*SYNTHETIC FUELS  
MINS: / ELECTROLYSIS/ ENERGY POLICY/ ENERGY TECHNOLOGY/  
HYDROGEN-BASED ENERGY  
ABA: B.J.  
ABS: The production of synthetic carbonaceous fuels using  
nuclear power, air and water is proposed. Nuclear  
power is used to generate heat and electricity which,  
in turn, is used to decompose water thermally and  
electrolytically to produce hydrogen and oxygen. CO2  
is extracted from either or both the atmosphere and  
water. The hydrogen is combined thermocatalytically  
with CO2 to produce methanol which is further  
thermocatalytically dehydrated to synthetic  
hydrocarbon fuels. Tables are presented listing  
synthetic hydrocarbon fuel production capacity,  
methanol plant capital costs, methanol production  
cost, gasoline production cost, and projections of  
capacity and capital requirements for methanol fuel.

ORIGINAL PAGE IS  
OF POOR QUALITY

79A45996 ISSUE 20 PAGE 3785 CATEGORY 44  
79/09/00 32 PAGES UNCLASSIFIED DOCUMENT

UTTL: Vehicle evaluation of neat methanol - Compromises among exhaust emissions, fuel economy and driveability  
AUTH: A/BRINKMAN, N. D. PAA: A/(GM Research Laboratories, Warren, Mich.)  
International Journal of Energy Research, vol. 3, July-Sept. 1979, p. 243-274.

ABA: C.F.W.

ABS: Methanol as an alternative fuel in vehicles with spark-ignited, internal combustion engines is evaluated. A methanol-fueled model car, equipped with electronic fuel injection was modified to provide proper air-fuel ratios for methanol. Exhaust emissions and fuel economy, using an average equivalence air-fuel ratio of 0.96 and spark-timing, designed for the production gasoline car, were compared. It was found that methanol fuelling with a 0.96 ratio using best-power rather than production spark timing increased fuel economy from 3 to 6% without significantly affecting emissions and driveability. Furthermore, with best-power spark-timing and a maximum economy air-fuel ratio of 0.83, driveability was acceptable and the CO and NO emissions met the 1977 standard. Although feasibility and benefits of operating vehicles with neat methanol were demonstrated, not all problems of methanol fuelling (i.e., cold starts) were solved and other alternatives such as obtaining hydrocarbon liquids from coal should be considered.

**Methanol as Automotive Fuel. Part I. Straight Methanol.**

**R. D. Gleming, and T. W. Chamberlain.**

**Bureau of Mines, Bartlesville, Okla. 1976, 24p**

**CONF-750264-1 Price code: PC A02/MF A01**

A study of methanol as an automotive fuel was conducted using a single-cylinder research engine, a 4-cylinder 122-CID (2,000 cc) engine, and an 8-cylinder 350-CID engine. Results showed that when using methanol as fuel, the single-cylinder engine could operate leaner than the multicylinder engines. This difference is attributable to air-fuel mixture mal-distribution associated with the multicylinder engines. Steady-state fuel economy and emissions data are presented and discussed. Results indicate that fuel economy (on an energy input basis) using methanol fuel is about 5 percent improved as compared to gasoline fuel economy and with substantially lower nitrogen oxides emissions for methanol. (ERA citation 02:026918)

77A45956 ISSUE 21 PAGE 3614 CATEGORY 44  
76/00/00 234 PAGES UNCLASSIFIED DOCUMENT

UTTL: Power plants and future fuels; Proceedings of the Conference, London, England, January 21, 22, 1975  
SAP: \$38  
Conference sponsored by the Institution of Mechanical Engineers, London and New York, Mechanical Engineering Publications, Ltd., 1976, 234 p  
WAJS: /\*AUTOMOBILE ENGINES/\*AUTOMOBILE FUELS/\*CONFERENCES/\*RAIL TRANSPORTATION  
WINS: / COAL UTILIZATION/ DIESEL ENGINES/ ELECTRIC BATTERIES / ENERGY TECHNOLOGY/ FUEL CELLS/ FUEL CONSUMPTION/ GAS TURBINE ENGINES/ GASOLINE/ INTERNAL COMBUSTION ENGINES / METHYL ALCOHOLS/ RESEARCH AND DEVELOPMENT/ STIRLING CYCLE/ STORAGE BATTERIES

ABA: R.D.V.

ABS: The contributed papers lay emphasis on vehicular power plants. The outlook for the stratified-charge engine, automotive gas turbine engine, Stirling engines, Wankel rotary engine, the Honda CVCC carbureted three-valve stratified-charge engine, fuel cell power plants, spark-ignition engines, diesel engines for small vehicles, sodium/sulfur battery (for railroad traction), and aviation engines are discussed. Alcohol-gasoline mixtures, coal (for diesels), methanol/gasoline blends, fuel vaporization schemes, and use of heat pipes in fuel vaporization are dealt with.

78A27827# ISSUE 10 PAGE 1769 CATEGORY 37  
76/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Use of methanol in diesel engine - An experimental study of engine performance  
AUTH: A/SAXENA, M.; B/GANDHI, K. K. PAA: B/(Indian Institute of Petroleum, Dehra Dun, India)  
In: National Conference on Internal Combustion Engines and Combustion, 3rd, Roorkee, India, December 10-12, 1976, Proceedings, (A78-27826 10-25) Meerut, India, Sarita Prakashan, 1976, p. 139-146.

ABA: (Author)

ABS: The paper discusses the performance of the engine with methanol as an auxiliary fuel. The effect of load on optimum methanol induction, input heat utilization, exhaust temperature and smoke density along with pressure-time diagrams were studied. The engine performance studies show that better heat utilization is achieved at and above rated load with reduced exhaust smoke density. From the peak pressure, rate of pressure rise and a study of delay periods, it is concluded that for methanol-diesel operation the engine can run economically (energy basis), with reduced engine vibrations, and higher power/weight ratio. In addition, for the case of field operation, engine performance for a constant quantity of methanol induction at any load was also done.

77A33383# ISSUE 14 PAGE 2357 CATEGORY 37  
76/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Methods of on-board generation of hydrogen for vehicular use

AUTH: A/ULLMAN, A. Z.; B/VAN VORST, W. D. PAA:  
B/(California, University, Los Angeles, Calif.)  
In: World Hydrogen Energy Conference, 1st, Miami  
Beach, Fla., March 1-3, 1976, Proceedings, Volume 2,  
(A77-33326 14-44) Coral Gables, Fla., University of  
Miami; New York, Pergamon Press, 1976, p. 38-53 to  
38-62.

MAJS: /\*COMBUSTION EFFICIENCY/\*ENERGY STORAGE/\*ENERGY  
TECHNOLOGY/\*HYDROGEN FUELS/\*HYDROGEN PRODUCTION/\*  
HYDROGEN-BASED ENERGY/\*ONBOARD EQUIPMENT

MINS: / AMMONIA/ AUTOMOBILE FUELS/ BORON COMPOUNDS/ ENERGY  
CONVERSION EFFICIENCY/ METHYL ALCOHOLS/ THERMODYNAMIC  
EFFICIENCY/ WASTE ENERGY UTILIZATION

ABA: S.D.

ABS: The paper reviews some possible alternatives of hydrogen storage for use as the sole or major fuel for vehicular use and as a supplementary fuel for enhancement of the combustion behavior. Energetics of hydrogen as a supplementary vehicular fuel is analyzed. Chemical storage of hydrogen for vehicular use is discussed relative to borohydrides, methanol decomposition, and ammonia decomposition. Conditions under which the net thermal efficiency of the engine can be improved with hydrogen storage are identified.

78A27828# ISSUE 10 PAGE 1732 CATEGORY 28  
76/00/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Investigations into the suitability of methanol and methanol gasoline blends as s.i. engine fuels - spark ignition engine emission decrease

AUTH: A/MATHUR, H. B.; B/BAKSHI, R. K. PAA: B/(Indian Institute of Technology, New Delhi, India)  
In: National Conference on Internal Combustion Engines and Combustion, 3rd, Roorkee, India, December 10-12, 1976, Proceedings, (A78-27826 10-25) Meerut, India, Sarita Prakashan, 1976, p. 155-166.

ADM:

ABS: A single-cylinder research engine is employed to test methanol and methanol-gasoline blends as fuels for spark ignition engines; power output, volume-based fuel economy and energy-based fuel economy are studied for the various fuel mixtures. A 10% methanol blend gives the best fuel economy on the volumetric as well as the equivalent energy basis; methanol blending also leads to decreases in exhaust carbon monoxide, unburnt hydrocarbons and oxides of nitrogen at all air/fuel ratios.

J 77A14584 ISSUE 3 PAGE 390 CATEGORY 44 .76/11/00  
8 PAGES In GERMAN UNCLASSIFIED DOCUMENT

UTTL: Alternate fuels for road vehicles of the future  
AUTH: A/GWINNER, D. PAA: A/(Daimler-Benz AG, Stuttgart, West Germany)  
VDI-Z, vol. 118, no. 22, Nov. 1976, p. 1053-1060. In German.

MAJS: /\*AUTOMOBILE FUELS/\*HYDROGEN-BASED ENERGY/\*METHYL  
ALCOHOLS/\*MOTOR VEHICLES/\*POLLUTION CONTROL/\*  
TRANSPORTATION ENERGY

MINS: / AIR POLLUTION/ COST EFFECTIVENESS/ ENERGY  
CONSUMPTION/ ENERGY CONVERSION EFFICIENCY/ ENERGY  
STORAGE/ SURFACE VEHICLES

ABA: G.R.

ABS: An evaluation of fuels shows that presently only methanol and hydrogen can be considered as possible substitutes for gasoline and Diesel oil as motor-vehicle fuels. Questions related to a use of methanol and hydrogen for the propulsion of road vehicles are investigated, taking into account the availability of the raw materials for a production of the two fuels, problems of fuel storage on board the vehicle, and aspects of motor operation. It is pointed out that the use of either fuel as a substitute for the currently used fuels for motor vehicles would lead to a significant reduction of air pollution problems. An introduction of methanol as fuel on a relatively short-term basis is possible. A use of hydrogen, however, requires the solution of a number of problems mainly related to the economic production of the gas and its storage on board the vehicle.

N77-23619# Massachusetts Inst. of Tech., Cambridge, Energy Lab.

**METHANOL AS AN AUTOMOTIVE FUEL: A SUMMARY OF RESEARCH IN THE M.I.T. ENERGY LABORATORY Final Report**

Richard G. Donnelly, John B. Heywood, Jules LoRusso, Frank O'Brien, Thomas B. Reed, and Rodney J. Tabaczynski Apr 1976  
57 p refs  
(PB 262980/6; MIT-EL-76-013) Avail NTIS  
HC A04/MF A01 CSCL 21D

The current status of studies on the use of methanol blends as automotive fuels is briefly reviewed. Experiments with a single-cylinder spark-ignition engine that methanol-gasoline blends show emissions and efficiency closely comparable to gasoline alone and that the blends yield a slight extension of the lean limit of operation. Methanol alone significantly extends the lean limit of operation and permits operation at much higher compression ratios with corresponding improvements in efficiency. GRA

77A12663\* ISSUE 2 PAGE 231 CATEGORY 44 CNT#:  
NAS7-100 76/00/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Onboard hydrogen generation for automobiles  
AUTH: A/HOUSEMAN, J.; B/CERINI, D. J. PAA: B/(California  
Institute of Technology, Jet Propulsion Laboratory,  
Pasadena, Calif.)  
CORP: Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.  
In: Intersociety Energy Conversion Engineering  
Conference, 11th, State Line, Nev., September 12-17,  
1976, Proceedings, Volume 1. (A77-12662 02-44) New  
York, American Institute of Chemical Engineers, 1976,  
p. 6-16.

MAJS: /\*AUTOMOBILE FUELS/\*GAS GENERATORS/\*HYDROGEN FUELS/\*  
INTERNAL COMBUSTION ENGINES  
MINS: / CARBON DIOXIDE/ ENERGY TECHNOLOGY/ HYDROCARBON FUELS  
/ HYDROGEN-BASED ENERGY/ LIQUEFIED GASES/ METHYL  
ALCOHOLS/ ONBOARD EQUIPMENT/ REACTION KINETICS

ABA: G.R.

ABS: Problems concerning the use of hydrogen as a fuel for  
motor vehicles are related to the storage of the  
hydrogen onboard a vehicle. The feasibility is  
investigated to use an approach based on onboard  
hydrogen generation as a means to avoid these storage  
difficulties. Two major chemical processes can be used  
to produce hydrogen from liquid hydrocarbons and  
methanol. In steam reforming, the fuel reacts with  
water on a catalytic surface to produce a mixture of  
hydrogen and carbon monoxide. In partial oxidation,  
the fuel reacts with air, either on a catalytic  
surface or in a flame front, to yield a mixture of  
hydrogen and carbon monoxide. There are many  
trade-offs in onboard hydrogen generation, both in the  
choice of fuels as well as in the choice of a chemical  
process. Attention is given to these alternatives, the  
results of some experimental work in this area, and  
the combustion of various hydrogen-rich gases in an  
internal combustion engine.

79N77538# CATEGORY 28 RPT#: NZERDC-5 76/00/00  
23 PAGES UNCLASSIFIED DOCUMENT

UTTL: Methanol from natural gas for engine fuel  
AUTH: A/JUDD, B. T.; B/WALKER, B. U.; C/REES, I. F.  
CORP: New Zealand Energy Research and Development Committee,  
Auckland. AVAIL.NTIS  
MAJS: /\*FUEL CONSUMPTION/\*METHANE/\*NATURAL GAS  
MINS: / DEMAND (ECONOMICS)/ ENGINES/ EXHAUST GASES/ GASOLINE  
/ PRODUCTION ENGINEERING

78N70867# CATEGORY 28 RPT#: CONF-761028-3 CNT#:  
EY-76-C-04-3683 76/00/00 6 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Methanol fuel modification for highway vehicle use  
CORP: Union Oil Co. of California, Los Angeles.  
AVAIL.NTIS  
Presented at ERDA Contractor Coord. Meeting, Ann  
Arbor, Michigan, 17 Oct. 1976

MAJS: /\*AUTOMOBILE FUELS/\*AUTOMOBILES/\*METHYL ALCOHOLS  
MINS: / FUEL TESTS/ FUELS/ PROJECT PLANNING

77N79970# CATEGORY 28 RPT#: PB-264632/1  
EPA-460/3-76-016 CNT#: EPA-R-803548 76/08/00 91  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Characterization and research investigation of  
methanol and methyl fuels in automobile engines:  
First year report TLSP: Technical Report, Feb. 1975  
- Feb. 1976

AUTH: A/PEFLEY, R. K.; B/ROYCE, A. E.; C/BROWNING, L. H.;  
D/MCCORMICK, M. C.; E/SWEENEY, M. A.

CORP: Santa Clara Univ., Calif. CSS: (Dept. of Mechanical  
Engineering.) AVAIL.NTIS

MAJS: /\*AIR POLLUTION/\*AUTOMOBILE ENGINES/\*GASOLINE/\*METHYL  
ALCOHOLS/\*THERMODYNAMIC EFFICIENCY

MINS: / CARBON MONOXIDE/ CONCENTRATION (COMPOSITION)/  
EXHAUST GASES/ FUEL SYSTEMS/ MATHEMATICAL MODELS

77N77143# CATEGORY 44 RPT#: NP-21121 REPT-5  
76/01/00 23 PAGES UNCLASSIFIED DOCUMENT

UTTL: Methanol from natural gas for engine fuel  
AUTH: A/REES, I. F.; B/JUDD, B. T.; C/WALKER, B. V.  
CORP: Auckland Univ. (New Zealand). AVAIL.NTIS  
Sponsored by New Zealand Energy Res. and Develop.  
Comm.

MAJS: /\*METHANE/\*NATURAL GAS/\*PRODUCTION ENGINEERING  
MINS: / ENERGY TECHNOLOGY/ HYDROCARBON FUELS

77N75754# CATEGORY 44 RPT#: FE-1773-18 OPR-4  
CNT#: E(49-18)-1773 76/03/00 101 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Development studies on conversion of methanol and  
related oxygenates to gasoline TLSP: Quarterly  
Progress Report, Nov. 1975 - Jan. 1976

AUTH: A/VOLTZ, S. E.; B/WISE, J. J.

CORP: Mobil Research and Development Corp., Paulsboro, N. J.  
AVAIL.NTIS

MAJS: /\*CHEMICAL ENGINEERING/\*ENERGY CONVERSION/\*ENERGY  
POLICY/\*GASOLINE/\*METHYL ALCOHOLS

MINS: / DURENE/ EVALUATION/ REACTION KINETICS/ REACTORS/  
RECYCLING

78N23253# ISSUE 14 PAGE 1828 CATEGORY 28 RPT#:  
NP-22159/2 76/09/00 249 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Economic pre-feasibility study: Large-scale methanol fuel production from surplus Canadian forest biomass. Part 2: Working papers

CORP: Intergroup Consulting Economists Ltd., Winnipeg (Manitoba); SNC, Inc., Montreal (Quebec); Charnell (Gordon S.) and Associates, Vancouver (British Columbia); Gardiner (S. G.) Engineering Services Ltd., Vancouver (British Columbia). AVAIL.NTIS  
SAP: (US Sales Only) HC A11/MF A01; ERDA Depository Libraries

Prepared in cooperation with SNC, Inc., Montreal (Quebec), Charnell (Gordon S.) and Associates, Vancouver (British Columbia) and Gardiner (S. G.) Engineering Services Ltd., Vancouver (British Columbia)

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY TECHNOLOGY/\*METHYL ALCOHOLS/\*TREES (PLANTS)

MINS: / CANADA/ ECONOMIC ANALYSIS/ PRODUCTION ENGINEERING  
ABA: ERA

ABS: The practicability of using methanol produced from surplus renewable Canadian forest roundwood as a substitute for non-renewable hydrocarbons in meeting Canadian energy requirements is addressed. Titles of the five working papers are: methanol plant technologies, characteristics and costs; resource harvesting; opportunity costs; product demand analysis; and alternative feedstocks for methanol production.

77N19469# ISSUE 10 PAGE 1321 CATEGORY 37 RPT#:  
UCRL-52041 CNT#: W-7405-ENG-48 76/03/25 34 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Methanol engine: A transportation strategy for the post-petroleum era

AUTH: A/VANTINE, H. C.; B/CHANG, J.; C/O'CONNELL, L. G.; D/RUBIN, B.; E/WESTBROOK, C. K.

CORP: California Univ., Livermore. Lawrence Livermore Lab. AVAIL.NTIS SAP: HC A03/MF A01

ABA: ERA

ABS: Several types of heat engines are considered as candidates for a methanol engine. A stratified charge engine optimized for methanol fuel is projected to result in an energy economy advantage of 44 to 71 percent in comparison to an Otto engine operating on gasoline. This advantage arises from (1) the high octane rating of the fuel, which allows a high compression ratio to be used; (2) methanol's fuel-lean combustion characteristics, which allow efficient lean operation; and (3) the low flame temperature, which allows effective control of nitrogen oxide emissions. The design and optimization of a methanol engine are examined in terms of an experimental and calculational program. The socioeconomic impact of methanol fueled transportation is discussed.

77N22291# ISSUE 13 PAGE 1704 CATEGORY 28 RPT#:  
BNWL-2080(RAP-4) CNT#: E(45-1)-1830 76/09/00 57  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Potential for producing and marketing gasoline substitutes from western coal

AUTH: A/CURRIE, J. W.; B/BRAUN, D. J.

CORP: Battelle Pacific Northwest Labs., Richland, Wash. AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /\*COAL/\*GASOLINE/\*MARKETING

MINS: / BUDGETING/ CRUDE OIL/ ECONOMICS/ MONTANA/ WYOMING

ABA: ERA

ABS: A multisector model with regional detail was required to thoroughly assess the likelihood of commercial-scale liquefaction occurring in Montana and Wyoming under market conditions. Significant information was obtained from a constrained partial analysis. Some fundamental terminology used in this analysis is reviewed. Future demand and potential supply of gasoline from domestic crude oil are treated. The costs of supplying synthetic gasoline and methanol from western coal as well as the qualitative aspect of these fuels are examined. The supply and demand functions are solved simultaneously under various import schemes to trace out a family of gasoline-market equilibrium price curves over time. Three scenarios are then analyzed by comparing the costs of supplying synthetic fuels with the market equilibrium prices for gasoline. Market potential for the synthetic fuels is estimated for a wide range of coal prices.

78N76320# CATEGORY 28 RPT#: UC10-16528-REV-1  
CNT#: W-7405-ENG-48 75/02/03 37 PAGES  
UNCLASSIFIED DOCUMENT

Revised

UTTL: Use of methanol in transportation

AUTH: A/CROGERS, W. T.

CORP: California Univ., Livermore. Lawrence Livermore Lab. AVAIL.NTIS

Sponsored by DOE

MAJS: /\*FUELS/\*METHYL ALCOHOLS/\*TRANSPORTATION

MINS: / AIR POLLUTION/ ENGINE DESIGN/ EXHAUST GASES

78N74473# CATEGORY 44 RPT#: UCRL-TRANS-10908  
75/07/00 21 PAGES UNCLASSIFIED DOCUMENT

UTTL: Methanol: A raw material for synthesis and an energy source

AUTH: A/SCHWARZMANN, M.

CORP: McElroy (Ralph) Co., Austin, Tex. AVAIL.NTIS  
Transl. into ENGLISH from Chem.-Ing.-Tech., (West Germany) v. 47, n. 2, 1975 p 56-61

MAJS: /\*ENERGY CONSUMPTION/\*FUELS/\*METHYL ALCOHOLS

MINS: / ECONOMIC FACTORS/ SYNTHETIC FUELS/ TECHNOLOGY UTILIZATION

77N11200# ISSUE 2 PAGE 171 CATEGORY 28 RPT#:  
ORAU-126 LEA-75-2 76/02/00 61 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Methanol from coal fuel and other applications  
AUTH: A/THOMAS, C. O.; B/HODGSON, J. W.; C/CARROLL, S. L.;  
D/HARDIN, T. C.; E/MUNOZ-CANDELARIO, R. PAA:  
A/(Tenn. Univ.); B/(Tenn. Univ.); C/(Tenn. Univ.);  
D/(Clemson Univ.); E/(Puerto Rico Univ.)

CORP: Institute for Energy Analysis, Oak Ridge, Tenn.  
AVAIL NTIS SAP: HC A04/MF A01  
Sponsored by ERDA

MAJS: /\*COAL/\*ENERGY CONVERSION/\*METHYL ALCOHOLS  
MINS: / ENERGY CONSERVATION/ ENVIRONMENT EFFECTS/ FUEL  
CONSUMPTION

ABA: ERA

ABS: The automobile accounts for about one-third of the  
petroleum consumption in the U.S. Other transportation  
sectors, utilities, manufacturing, industrial  
chemicals, residences, etc., also are heavy consumers.  
Project Independence goals require a significant  
reduction in petroleum imports which probably cannot  
be fully offset by increased domestic production.  
Three parallel actions therefore are necessary:  
conservation; improved fuel economy; and development  
of substitute liquid or gaseous fuels derived from  
coal, shale, or other carbonaceous raw materials. The  
technologies for conversion of coal to low-BTU gas and  
the subsequent synthesis of methanol already exist.  
The methanol fuel issues then are the technical  
suitability of methanol for large-scale fuel  
applications, energy yields versus other synthetic  
fuel strategies, economics, environmental effects, and  
competitive supply/demand considerations in terms of  
both raw materials and end uses.

77N73246 CATEGORY 98 75/00/00 183 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Oversight hearings, methanol derived from fossil  
fuels, volume 1

CORP: Committee on Science and Technology (U. S. House).  
SAP: Avail: Subcomm. on Energy Res., Development, and  
Demonstration (Fossil Fuels)  
Washington GPO Hearings before Subcomm. on Energy  
Res., Development, and Demonstration (Fossil Fuels) of  
Comm. on Sci. and Technol., 94th Congr., 1st Sess., 24  
Jun. 1975

MAJS: /\*FOSSIL FUELS/\*HYDROCARBON FUELS  
MINS: / COAL GASIFICATION/ COSTS/ ENERGY CONVERSION/ ENERGY  
POLICY

78N14180# ISSUE 5 PAGE 585 CATEGORY 28 RPT#:  
FE-1773-25 CNT#: EX-76-C-01-1773 76/11/00 340  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Development studies on conversion of methanol and  
related oxygenates to gasoline TLSP: Final Report

AUTH: A/VOLTZ, S. E.; B/WISE, J. J.

CORP: Mobil Research and Development Corp., Paulsboro, N. J.  
AVAIL NTIS SAP: HC A15/MF A01

ABA: ERA

ABS: A novel process for the conversion of methanol to high  
octane gasoline has been successfully demonstrated.  
Both fixed and fluid bed process concepts have been  
pursued. Two reactors are used in the fixed bed  
process. Methanol is partially dehydrated to an  
equilibrium mixture of methanol, dimethylether, and  
water over a dehydration catalyst in the first  
reactor, and both methanol and dimethylether are  
converted to high octane gasoline by a catalyst in the  
second reactor. Over 200 days of successful operation  
were achieved during nine cycles in a fixed bed pilot  
plant. About 8000 lb methanol/lb conversion catalyst  
were processed, and catalyst performance was still  
satisfactory when the aging test was terminated. The  
dehydration catalyst did not require any regeneration  
during the entire aging test. A single reactor is used  
in the fluid bed process. The feasibility of  
converting methanol to gasoline in a fluid bed was  
demonstrated during an aging test of two months  
duration.

79N75775# CATEGORY 28 RPT#: PB-289114/1  
NSF/OFPP-7423963/1/5 CNT#: NSF OEP-74-23963  
74/07/00 70 PAGES UNCLASSIFIED DOCUMENT

UTTL: Methanol as an alternate fuel. Volume 1: Conference  
report of 1974 engineering foundation

CORP: United Engineering Trustees, Inc., New York.  
AVAIL NTIS

Conf. held at New England College, Henniker, New  
Hampshire, 7-12 Jul. 1974

MAJS: /\*CONFERENCES/\*METHYL ALCOHOLS/\*SYNTHETIC FUELS  
MINS: / COAL GASIFICATION/ CRUDE OIL/ NATURAL GAS/ SOLID  
WASTES

79N70349# CATEGORY 28 RPT#: TID-27753 CNT#:  
EX-76-C-01-1773 75/00/00 96 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Development studies on conversion of methanol and  
related oxygenates to gasoline

CORP: Mobil Research and Development Corp., Paulsboro, N. J.  
AVAIL NTIS

MAJS: /\*ENERGY TECHNOLOGY/\*GASOLINE/\*METHYL ALCOHOLS  
MINS: / DURENE/ FLUIDIZED BED PROCESSORS/ OXYGENATION

77A29930# ISSUE 12 PAGE 2043 CATEGORY 44  
75/09/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Methanol - A clean burning fuel for automobile engines  
AUTH: A/MATHUR, H. B.; B/BAKSHI, K. K. PAA: B/(Indian  
Institute of Technology, New Delhi, India)  
Mechanical Engineering Bulletin, vol. 6, Sept. 1975,  
p. 102-108.

ABA: W.L.

ABS: Unmodified car engines can use mixtures of methanol  
and gasoline for fuel, with up to one quarter of the  
blend being methanol. Engines burning methanol can be  
made more efficient than gasoline engines since  
compression ratios can be increased to take advantage  
of methanol's higher flame speed and good antiknock  
properties. Comparison of exhaust emissions from  
automobiles fitted with control devices to keep  
emission levels within prescribed limits and fueled  
alternatively by either gasoline or methanol show that  
engines using methanol produce about half as much  
carbon monoxide and about an eighth as much of  
nitrogen oxides as do engines using gasoline. Use of  
methanol, in comparison with gasoline, results in  
slightly higher emissions of hydrocarbons, most of  
which is unburnt methanol. Though methanol has only  
about half as much energy as gasoline per unit volume,  
it is less likely to contribute to the formation of  
photochemical smog than do emissions from  
gasoline-fueled cars.

79N75776# CATEGORY 28 RPT#: PB-289115/8  
NSF/OEP-7423963/2/5 CNT#: OEP-74-23963 74/07/00  
546 PAGES UNCLASSIFIED DOCUMENT

UTTL: Methanol as an alternate fuel. Volume 2: Reprints of  
papers of 1974 engineering foundation  
CORP: United Engineering Trustees, Inc., New York.

AVAIL.NTIS  
Conf. held at New England College, Henniker, New  
Hampshire, 7-12 Jul. 1974

MAJS: /\*FUELS/\*METHYL ALCOHOLS  
MINS: / BIOMASS/ COAL GASIFICATION/ COST ANALYSIS/ NATURAL  
GAS

77N74911# CATEGORY 44 RPT#: UCRL-76232 74/12/06  
42 PAGES UNCLASSIFIED DOCUMENT

UTTL: Production of methanol from coal for fuel use  
AUTH: A/JAFFE, H.; B/ENDELMAN, F.; C/HIGHTOWER, J. R., JR.  
; D/BERGER, B.; E/CROTHERS, W.; F/PASTERNAK, A.;  
G/CARTER, R.

CORP: California Univ., Livermore, Lawrence Livermore Lab.  
AVAIL.NTIS

Sponsored by ERDA

MAJS: /\*COAL LIQUEFACTION/\*FUELS/\*HYDROCARBONS  
MINS: / COAL GASIFICATION/ COST ANALYSIS/ ENERGY TECHNOLOGY

77N27246# ISSUE 18 PAGE 2369 CATEGORY 28 RPT#:  
CONF-750264-1 76/00/00 24 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Methanol as automotive fuel. Part 1: Straight  
methanol

AUTH: A/GLEMING, R. D.; B/CHAMBERLAIN, T. W.  
CORP: Bureau of Mines, Bartlesville, Okla. AVAIL.NTIS  
SAP: HC A02/MF A01  
Presented at Automotive Eng. Congr. and Exposition,  
Detroit, 24 Feb. 1975

MAJS: /\*AUTOMOBILE FUELS/\*METHYL ALCOHOLS  
MINS: / ENERGY CONSERVATION/ EXHAUST GASES/ FUEL CONSUMPTION  
/ GASOLINE/ POLLUTION CONTROL

ABA: ERA

ABS: Methanol was studied as an automotive fuel using a  
single-cylinder research engine, a 4-cylinder 122-CID  
(2,000 cc) engine, and an 8-cylinder 350-CID engine.  
Results showed that when using methanol as fuel, the  
single-cylinder engine could operate leaner than the  
multicylinder engines. This difference is attributable  
to air-fuel mixture mal-distribution associated with  
the multicylinder engines. Steady-state fuel economy  
and emissions data are presented and discussed.  
Results indicate that fuel economy (on an energy input  
basis) using methanol fuel is about 5 percent improved  
as compared to gasoline fuel economy and with  
substantially lower nitrogen oxides emissions for  
methanol.

78N74912# CATEGORY 28 RPT#: UCID-16442 CNT#:  
W-7405-ENG-4B 74/01/00 77 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: LLL contribution to the AEC methanol report: Fuel  
utilization and environmental impact

AUTH: A/ANDERSON, C. J.; B/BERGER, B.; C/CARLSON, J.;  
D/CROTHERS, W.; E/GREGG, D.; F/GRENS, J.;  
G/PASTERNAK, A.

CORP: California Univ., Livermore. AVAIL.NTIS

MAJS: /\*AUTOMOBILE FUELS/\*ENERGY POLICY/\*ENVIRONMENTAL  
SURVEYS/\*METHYL ALCOHOLS

MINS: / ASSESSMENTS/ CHEMICAL ENGINEERING/ COAL GASIFICATION  
/ EXHAUST GASES/ MANAGEMENT PLANNING/ TOXICOLOGY

78N74316# CATEGORY 28 RPT#: UCRL-76064 74/09/24  
7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Environmental aspects of methanol as vehicular fuel  
air quality effects

AUTH: A/POLLACK, R. I.  
CORP: California Univ., Livermore, Lawrence Livermore Lab.  
AVAIL.NTIS

MAJS: /\*AIR QUALITY/\*ENVIRONMENT EFFECTS/\*FUELS/\*METHYL  
ALCOHOLS

MINS: / AIR POLLUTION/ EMISSION/ EXHAUST GASES/ HYDROCARBONS

77N74423# CATEGORY 9R RPT#: PB-255449/1 SWAP-74-2  
WSNW-74-243-1 74/09/00 357 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Feasibility study: Conversion of solid waste to  
methanol or ammonia ILSP: Final Report  
CORP: Mathematical Sciences Northwest, Inc., Seattle, Wash.  
AVAIL.NTIS  
Sponsored by City of Seattle  
NAJS: /\*FUELS/\*PYROLYSIS/\*RECLAMATION/\*RECYCLING/\*SOLID  
WASTES/\*WASTE DISPOSAL  
WINS: / AMMONIA/ CHEMICAL ENGINEERING/ ECONOMIC ANALYSIS/  
INCINERATORS/ METHYL COMPOUNDS/ OXIDATION/ WASHINGTON

78N74515# CATEGORY 44 RPT#: WASH-1337-2 74/02/01  
118 PAGES UNCLASSIFIED DOCUMENT

UTTL: Methanol from coal for the automotive market  
AJTH: A/JAFFE, H.; B/ENDELMAN, F.; C/HIGHTOWER, J. R., JR.  
: D/BERGER, B.; E/CROTHERS, W.; F/PASTERNAK, A.;  
G/CARTER, R.  
CORP: Atomic Energy Commission, Washington, D. C.  
AVAIL.NTIS  
NAJS: /\*AUTOMOBILE FUELS/\*COAL LIQUEFACTION/\*ENERGY POLICY/\*  
METHYL ALCOHOLS  
WINS: / COAL GASIFICATION/ COST ANALYSIS/ ENVIRONMENT  
EFFECTS/ FLOW CHARTS

GASOHOL

79451775 ISSUE 23 PAGE 4306 CATEGORY 28  
79/00/00 2 PAGES UNCLASSIFIED DOCUMENT

UTTL: Improving octane values of unleaded gasoline via  
gasohol

AUTH: A/JAWETZ, P.

In: Intersociety Energy Conversion Engineering  
Conference, 14th, Boston, Mass., August 5-10, 1979,  
Proceedings, Volume 1. (A79-51726 23-44) Washington,  
D.C., American Chemical Society, 1979, p. 301, 302.

MAJS: /\*GASOHOL (FUEL)/\*GASOLINE/\*OCTANE NUMBER

MINS: / CRUDE OIL/ ENERGY CONVERSION EFFICIENCY/ ENERGY  
TECHNOLOGY/ ETHYL ALCOHOL/ Q VALUES

AEA: (Author)

AES: Gasohol is defined as a mixture of 10% ethyl alcohol  
and 90% gasoline. This may not be the most favorable  
composition and we use it as it presents mathematical  
simplifications in our calculations. The requirements  
of the United States in what concerns motor vehicle  
fuels are: (1) to boost the octane rating of regular  
unleaded gasoline by 3 points, (2) to keep the price  
differential between unleaded and leaded gasoline at  
no more than 3 cents/gallon and (3) to use renewable  
resources. It will be shown that gasohol answers  
favorably these needs. A series of utility factors  
will be developed and it will be shown that one BTU of  
ethanol replaces 3.6 BTUs of petroleum when viewing  
the ethanol as an octane boosting additive.

ORIGINAL PAGE IS  
OF POOR QUALITY

Gasohol

Chemical Engineering Progress,  
v.75, no.4, p.11-19.

Apr.  
1979

BRAZIL'S GASOHOL PROGRAM. V. Yand and S.C.  
Trindade.

79453724 ISSUE 24 PAGE 4354 CATEGORY 44  
79/00/00 147 PAGES UNCLASSIFIED DOCUMENT

UTTL: Gasohol for energy production --- Book

AUTH: A/CHEREMISINOFF, N. P. PAA: A/(Exxon Research and  
Engineering Co., Florham Park; New Jersey Institute of  
Technology, Newark, N.J.) SAP: \$14.95  
Ann Arbor, Mich., Ann Arbor Science Publishers, Inc.,  
1979, 147 p.

MAJS: /\*AUTOMOBILE FUELS/\*BIOMASS ENERGY PRODUCTION/\*ETHYL  
ALCOHOL/\*GASOHOL (FUEL)/\*GASOLINE/\*METHYL ALCOHOLS

MINS: / CHEMICAL ENGINEERING/ ENERGY TECHNOLOGY/ GRAPHS  
(CHARTS)/ INDUSTRIAL MANAGEMENT/ TABLES (DATA)/  
THERMODYNAMIC EFFICIENCY

ABA: (Author)

ABS: The book is an overview of the present state of the  
art as well as the potentials and uses of biomass as a  
source of alcohols and chemical feedstocks. Several  
topics are discussed, such as biomass as a source of  
energy, the chemistry of alcohols, methanol synthesis  
from synthesis gas and wood wastes, ethanol synthesis,  
and mass production of biomass for synthetic fuels.  
Also discussed are automotive uses of methanol,  
special uses and problems of alcohol fuels, and the  
development of a nationwide biomass-based  
alcohol-gasoline fuel system.

WHAT ABOUT ALCOHOL? Stage II Engine an Alternative Fuel  
Possibility.

WAA, vol 6, no 9, September 1979, p. 18-con't on page  
22.

World of Agricultural Aviation

79N31423# ISSUE 22 PAGE 2936 CATEGORY 28 RPT#:  
BETC/R1-79/2 79/05/00 17 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Ethanol/gasoline blends as automotive fuel

AUTH: A/ALLSUP, J. R.; B/ECCLESTON, D. B.

CORP: Department of Energy, Bartlesville, Okla. (SS: 1-  
Energy Technology Center.) AVAIL NTIS SAP: HC  
A02/MF A01

MAJS: /\*AUTOMOBILE FUELS/\*ENERGY POLICY/\*GASOHOL (FUEL)/\*  
TRANSPORTATION ENERGY

MINS: / ENERGY CONVERSION EFFICIENCY/ EXHAUST GASES/  
GASOLINE/ HYDROCARBONS/ OCTANE NUMBER/ TEMPERATURE  
EFFECTS

ABA: DOE

ABS: Vehicle tests were conducted to determine the  
influence of ethanol in a 10% ethanol/90% gasoline  
fuel mixture on fuel economy, regulated and  
unregulated exhaust emissions, exhaust hydrocarbon  
distribution, and road octane quality. Volumetric fuel  
economy was shown to be slightly decreased while  
energy economy was slightly increased using the  
ethanol/gasoline blend compared to gasoline. When  
compared to the base gasoline, the use of the  
ethanol/gasoline blend caused no deleterious effects  
upon regulated emissions at ambient temperatures from  
20 to 75 F; at 100 F ambient there were minor  
increases in emissions using the ethanol/gasoline  
blend. The ethanol/gasoline blend generally had either  
no effect on or reduced all unburned hydrocarbon  
components except at the 100 F test conditions  
compared to gasoline. Road octane quality was shown to  
be increased by the use of the ethanol/gasoline blend  
compared to gasoline.

#### THE ALCOHOL-GASOHOL FUEL SOLUTION.

The Mother Earth News, no. 55, January/February  
1979, p. 84-85.

The fact is that—especially since that 1974 crisis—some folks  
have actually been *doing* something about the fuel problem  
other than just talking about it. Folks like Albert Turner, who,  
together with his colleagues at the Southeast Farmer's Cooper-  
ative in Selma, Alabama have succeeded in producing up to 90  
gallons of grain alcohol per day from crop wastes . . . fuel  
which they mix with low-octane gasoline to make "gasohol" to  
power their pickups and tractors. On the other hand, people  
like aeronautical engineer Richard Blaser went beyond the  
gasohol concept and modified existing engines to run directly  
on straight alcohol . . . with striking results.

RON10644# ISSUE 1 PAGE 89 CATEGORY 44 RPT#:  
DOE/TIC-1011B 79/12/00 158 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Summary of major energy legislation of the 95th  
Congress

CORP: Department of Energy, Washington, D. C. (SS: (Div.  
of Legislative Research and Analysis.) AVAIL NTIS  
SAP: HC A08/MF A01

MAJS: /\*ALASKA/\*ENERGY POLICY/\*ENVIRONMENT PROTECTION

MINS: / APPROPRIATIONS/ COAL/ ENERGY CONSERVATION/ POLLUTION  
CONTROL

ABA: DOE

ABS: The title, sponsor, synopsis, and legislative status  
of major energy legislation of the 95th Congress  
includes the following subjects: Alaska lands, Alaska  
gas transportation, antiboycott legislation,  
backhauling, Canadian fuel imports, cargo  
preference/tanker safety, Clean Air Act, coal  
conversion, coal leasing, coal slurry pipelines,  
cogeneration, dealer protection, Department of Energy  
(organization), DOE FY-79 appropriations and  
authorizations, divestiture, electric energy and  
utilities, energy conservation, energy impact  
assistance, Energy Policy Institute, ERDA FY-78  
authorizations, ERDA/FEA FY-78 appropriations,  
enhanced oil recovery, environment and safety, FEA  
FY-78 authorization, fuels transportation safety,  
gasohol, geothermal energy, insulation standards,  
liquefied natural gas, mine safety, National Energy  
Act, natural gas, nuclear energy, nuclear siting and  
licensing, nuclear waste management, oil and gas  
leasing, oil import fees, oil pollution liability, oil  
shale commercialization, outer continental shelf,  
pipeline destruction, Safe Drinking Water Act, solar  
energy, state energy management program, strip mining,  
and uranium mill tailings.

CN-150,867 Gasohol 1979  
GASOHOL: A TECHNICAL MEMORANDUM. Spring  
1979. 71p.

Office of Technology Assessment,  
Washington, D.C.

Ethyl alcohol

80A11331# ISSUE 1 CATEGORY 25 79/06/00 7 PAGES  
UNCLASSIFIED DOCUMENT DCAF A005042

UTTL: Minimum ignition energies and quenching distances of methanol blends  
AUTH: A/YANO, T.; B/ITO, K. PAA: B/(Hokkaido University, Sapporo, Japan)  
Hokkaido University, Faculty of Engineering, Bulletin, June 1979, p. 31-37.  
MAJS: /\*FUEL COMBUSTION/\*GASOHOL (FUEL)/\*IGNITION TEMPERATURZ/\*METHYL ALCOHOLS/\*QUENCHING (COOLING)  
MINS: / AUTOMOBILE FUELS/ DIFFUSION COEFFICIENT/ ELECTRIC COILS/ ELECTRODES/ FUEL-AIR RATIO/ IGNITION LIMITS/ IGNITION SYSTEMS/ INTERNAL COMBUSTION ENGINES/ LIQUID-GAS MIXTURES/ OCTANES  
ABA: A.T.  
ABS: A study of minimum ignition energies and quenching distances for methanol, iso-octane, and iso-octane/methanol blends in the 100 to 1500 range and at 1 atm pressure is presented. Minimum ignition energies were measured with a conventional automobile ignition system and expressed by the primary current of the ignition coil, and the measurement methods of the quenching distances used the teflon-flanged electrode technique. The experimental results indicated that the minimal value of the minimum ignition energies, and the minimum quenching distances of methanol and iso-octane air mixtures were attained with a slightly rich mixture; the iso-octane/methanol blend yields larger flammability ranges than those of fuel in air. The quenching distances of iso-octane/methanol blend depend on that of iso-octane and do not become larger than that of either fuel.

**DEHYDRATION OF ETHANOL: NEW APPROACH GIVES POSITIVE ENERGY BALANCE.**

Science, vol 205, no 4409, August 31, 1979, p. 898-900

*Abstract. Water was removed from aqueous ethanol by using cellulosic materials, starch, corn, and other agents. The combustion energy of the ethanol product can exceed the energy needed to carry out the dehydration by a factor of 10.*

79A33227# ISSUE 13 PAGE 2407 CATEGORY 44  
79/00/00 12 PAGES In PORTUGUESE UNCLASSIFIED DOCUMENT

UTTL: The development of alternate combustibles for diesel engines  
AUTH: A/VENTURA, L. M. PAA: A/(Mercedes-Benz, Sao Paulo, Brazil)  
In: Brazilian Conference on Energy, 1st, Rio de Janeiro, Brazil, December 12-14, 1978, Proceedings, Volume A. (A79-33212 13-44) Rio de Janeiro, Universidade Federal do Rio de Janeiro, 1979, p. 236-247. In Portuguese.  
MAJS: /\*AUTOMOBILE FUELS/\*DIESEL FUELS/\*ETHYL ALCOHOL/\*FUEL OILS/\*GASOHOL (FUEL)  
MINS: / BRAZIL/ DIESEL ENGINES/ ENERGY TECHNOLOGY/ VEGETABLES  
ABA: J.M.B.  
ABS: Ethanol, vegetable oils and blends of diesel oil and other combustibles have been considered for use in diesel engines. High-efficiency performance was found for diesel engines fueled by a mixture of diesel oil and vegetable oil. Blends of diesel oil and gasoline also proved promising for use in the diesel engine.

79A49383# ISSUE 22 PAGE 4126 CATEGORY 26  
79/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: A general history of the Nebraska Grain Alcohol and Gasanol Program  
AUTH: A/FRICKE, C. R. PAA: A/(Agricultural Products Industrial Utilization Committee, Lincoln, Neb.)  
In: Utilization of alternative fuels for transportation; Proceedings of the Symposium, Santa Clara, Calif., June 19-23, 1978. (A79-49376 22-28) New York, American Institute of Aeronautics and Astronautics, Inc., 1979, p. 155-162. Research supported by the Agricultural Products Industrial Utilization Committee.  
MAJS: /\*ETHYL ALCOHOL/\*GASOHOL (FUEL)/\*HYDROCARBON FUELS  
MINS: / DISTILLATION/ ENERGY TECHNOLOGY/ PRODUCT DEVELOPMENT / TECHNOLOGY ASSESSMENT/ TRANSPORTATION ENERGY

79A44276# ISSUE 19 PAGE 3622 CATEGORY 44  
79/08/00 4 PAGES UNCLASSIFIED DOCUMENT

UTTL: Future energy alternatives

AUTH: A/GREY, J. PAA: A/(Long Island University,  
Brookville; American Institute of Aeronautics and  
Astronautics, Inc., New York, N.Y.)  
AIAA Student Journal, vol. 17, Summer 1979, p. 28-31.

MAJS: /\*ELECTRIC GENERATORS/\*ENERGY SOURCES/\*ENERGY  
TECHNOLOGY

MINS: / BIOMASS ENERGY PRODUCTION/ GASOHOL (FUEL)/

GEOTHERMAL RESOURCES/ SOLAR ARRAYS/ WATERWAVE ENERGY/  
WINDPOWER UTILIZATION

ABA: C. F. W.

ABS: Future energy sources such as photovoltaic arrays,  
solar thermal electric systems, biomass energy,  
gasohol, wind energy, water power and geothermal  
energy are discussed. It is noted that the energy  
problems do not lie in federal R&D, but in the  
implementation of nationwide and worldwide systems and  
it is suggested that massive implementation of  
building and appliance efficiency standards,  
industrial and commercial cogeneration of electrical  
power and heat, and capital-intensive options such as  
district heating via power plant waste, be developed  
to reduce our expanding energy requirements.

79N29674# ISSUE 20 PAGE 2699 CATEGORY 44 RPT#:  
PB-295234/9 79/05/00 24 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Rural development initiatives: Energy for rural  
America

CORP: Executive Office of the President, Washington, D. C.  
CSS: (Assistant to the President for Intergovernmental  
Affairs.) AVAIL. NTIS SAP: HC A02/MF A01

MAJS: /\*COAL GASIFICATION/\*ENERGY POLICY/\*GASOHOL (FUEL)/\*  
HYDROELECTRIC POWER STATIONS/\*RURAL AREAS/\*SHALE OIL/\*  
WOOD

MINS: / ALCOHOLS/ ENERGY CONVERSION/ NATURAL GAS/ SOLAR  
ENERGY CONVERSION/ WASTE UTILIZATION

ABA: GRA

ABS: The initiatives undertaken to provide energy for rural  
America are described. These initiatives include  
small-scale hydroelectric power, the production of  
natural gas from coal and shale, the production of  
gasohol from renewable agricultural products, and the  
use of wood as a source of energy.

79A49385# ISSUE 22 PAGE 4126 CATEGORY 28  
79/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Synthetic fuels program --- in California for  
automotive transportation

AUTH: A/STONE, C. L.

In: Utilization of alternative fuels for  
transportation; Proceedings of the Symposium, Santa  
Clara, Calif., June 19-23, 1978. (A79-49376 22-28) New  
York, American Institute of Aeronautics and  
Astronautics, Inc., 1979, p. 175-182.

MAJS: /\*AUTOMOBILE FUELS/\*GASOHOL (FUEL)/\*METHYL ALCOHOLS/\*  
SYNTHETIC FUELS/\*TRANSPORTATION ENERGY

MINS: / CALIFORNIA/ COMBUSTION PRODUCTS/ ENERGY TECHNOLOGY/  
HYDROCARBON FUEL PRODUCTION

ABS: The paper reviews a synthetic fuels program proposed  
and developed by the California Legislature. The  
discussion highlights alternative fuels for  
transportation, and the uses of methanol-X and gasohol

79A49379# ISSUE 22 PAGE 4125 CATEGORY 28  
79/00/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Storage and distribution of synthetic fuels

AUTH: A/BERGER, J. E. PAA: A/(Shell Oil Co., Houston,  
Tex.)

In: Utilization of alternative fuels for  
transportation; Proceedings of the Symposium, Santa  
Clara, Calif., June 19-23, 1978. (A79-49376 22-28) New  
York, American Institute of Aeronautics and  
Astronautics, Inc., 1979, p. 69-79.

MAJS: /\*ALCOHOLS/\*ENERGY DISTRIBUTION/\*ENERGY STORAGE/\*  
GASOHOL (FUEL)/\*HYDROCARBON FUELS/\*SYNTHETIC FUELS

MINS: / COAL UTILIZATION/ ENERGY TECHNOLOGY/ TRANSPORTATION  
ENERGY

ASA: B. J.

ABS: The paper discusses the storage and distribution of  
noncryogenic 'conventional' synthetic fuels. The scope  
of the discussion is limited to reasonably foreseeable  
alternate synthetic fuels in the transportation  
industry; particular attention is given to automotive  
applications for a time frame of the order of 15  
years. Consideration is given to the specific problems  
that synthetic fuels may pose to the transportation  
and distribution network which now exists.

79N32395# ISSUE 23 PAGE 3071 CATEGORY 28 RPT#:  
PB-295814/B 79/00/00 12 PAGES UNCLASSIFIED  
DOCUMENT

**UTTL:** For today: Membrane-produced gasanol. For tomorrow:  
Membrane-produced alcohol

**CORP:** Columbia Univ., New York. CSS: (Dept. of Chemical  
Engineering and Applied Chemistry.) AVAIL.NTIS  
SAP: HC A02/MF A01  
Sponsored in part by Office of Minority Business  
Enterprise and Agency for International Development,  
Wash., D. C.

**MAJS:** /\*ALCOHOLS/\*ELECTRODIALYSIS/\*FERMENTATION/\*GASOHOL  
(FUEL)/\*MEMBRANES/\*OSMOSIS

**MINS:** / CELLULOSE/ COST ANALYSIS/ FLUID FILTERS/ GRAINS  
(FOOD)/ HYDROLYSIS/ SUGARS

**ABA:** GRA

**ABS:** Conventional processes for production of fuel grade  
ethanol from sugars are discussed. Alcohol from grain  
or molasses with membrane treatment of stillages is  
reported. Treatment costs of stillages are presented.  
Membrane controlled fermentation of sugars to ethanol  
and membrane facilitated hydrolysis of cellulose are  
described. Energy and cost reductions for the  
processes are presented.

Gasohol

Chemical Engineering Progress,  
v.75, no.4, p.11-19.

Apr.  
1979

**BRAZIL'S GASOHOL PROGRAM.** V. Yand and S.C.  
Trindade.

Although Brazil's effort to derive more of its fuel  
and feedstocks from alcohol faces a number of  
problems, it holds much promise for providing  
substantial energy and technological independence to  
South America's largest country.

**AN ALCOHOL FUEL ALTERNATIVE,** R. K. Pefley

Mechanical Engr., v.101, no.11, Nov. 1979, p.52-53

Gasohol and other forms of alcohol-blended automotive  
fuels are gradually making their way in to the market-  
place, bringing with them a cloud of controversy. Are  
they economical and efficient? Do they reduce emissions?  
Will they function in a conventional internal combustion  
engine without damage it? These and many other related  
questions have been extensively studied since 1968 by  
Mechanical Engr. at Univ. of Santa Clara. Their findings  
definitely establish that alcohol-blended fuels are not  
only feasible but are a desirable step in the national  
effort to conserve and supplant petroleum.

**GASOHOL: DOES IT OR DOESN'T IT PRODUCE POSITIVE NET  
ENERGY?** R. S. Chambers, R. A. Herendeen.

Science

Science, vol 206, no 4420, November 16, 1979, p. 789-  
794.

*Summary.* A detailed analysis of energy inputs and outputs is performed on grain-  
based gasohol (10 percent grain-based ethanol, 90 percent gasoline). Existing dif-  
ferences of opinion on the energy balance derive mainly from variations in inter-  
pretation which are several examples of inherent methodological problems in energy  
analysis. The result is strongly dependent on assumptions about use of crop residues  
for fuel and the miles-per-gallon rating of gasohol. In terms of total nonrenewable  
energy, gasohol is close to the energy break-even point. On the other hand, in terms  
of petroleum or petroleum-substitutable energy, gasohol is an unambiguous energy  
producer, since most energy inputs to the process can be supplied by nonpetroleum  
sources such as coal.

CN-150,492 1979  
AUTOMOBILE DRIVING EXPERIENCES WITH GASOHOL  
MIXTURE AS FUEL. Jag J. Singh, LaRC. Feb.  
1979.

NASA,  
Langley Research Center

Gasohol  
Automobiles

GASOHOL CONSUMPTION SKYROCKETS. Clare E. Wise.

Machine Design, vol 51, no 24, October 25, 1979..  
p. 28-30, 32-33

Gasohol shows promise as a short-term supplement to the nation's supply of motor  
fuel, but its net energy contribution is clouded in controversy.

N80 15280# Department of Energy, Washington, D C  
ETHANOL/GASOLINE BLENDS AS AUTOMOTIVE FUELS  
J R Allsup and D B Eccleston 1979 13 p refs Presented  
at the 3rd Intern. Alcohol Fuels Technol. Asilomar, Calif. 28  
May 1979  
(CONF-790520 5) Avail. NTIS HC A02/MF A01

An experimental study of gasoline and 10% ethanol/90%  
gasoline blends was made using five late-model vehicles operated  
on a climate controlled chassis dynamometer. Data were obtained  
to permit comparisons of fuel economy, emissions, and other  
significant operational characteristics observed in tests with the  
two fuels. Volumetric fuel economy was shown to be slightly  
decreased, while energy economy was slightly increased using  
the ethanol/gasoline blend. Compared with the results using base  
gasoline, the use of the ethanol/gasoline blend had no adverse  
effect upon regulated emissions at test temperatures within the  
range 20 to 75 F; at 100 F there were mirror increases in  
emissions using the ethanol/gasoline blends. DOE

CN-150,492 1979  
AUTOMOBILE DRIVING EXPERIENCES WITH GASOHOL  
MIXTURE AS FUEL. Jag J. Singh, LaRC. Feb.  
1979.

NASA,  
Langley Research Center

Gasohol  
Automobiles

79N30394# ISSUE 21 PAGE 2796 CATEGORY 28  
79/07/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Cooperative extension service: Energy resource notes  
CORP: Maryland Univ., College Park. AVAIL. NTIS SAP: HC  
A02/MF A01

MAJS: / ENERGY POLICY/ GASOHOL (FUEL)/ MARYLAND  
MINS: / DIESEL ENGINES/ ENERGY CONSERVATION/ GEOTHERMAL  
ENERGY CONVERSION/ PRODUCTION ENGINEERING/ TECHNOLOGY  
ASSESSMENT

ABA: M.M.M.

ABS: The production, potential uses, legislation,  
availability, and economic feasibility of gasohol in  
Maryland are addressed.

ALCOHOL AS "AVGAS" HOW MUCH PROOF DO YOU NEED?  
B. Welch.

Air Progress, vol 41, no 12, December 1979, p. 24-25.

BRAZIL'S GASOHOL PROGRAM.

CEP Chemical Engineering Progress, vol 75, no 4, April  
1979, p. 11-19.

79N12250# ISSUE 3 PAGE 308 CATEGORY 28 RPT#:  
PB-284742/4 NSF/RA-780196 CNT#: NSF ISP-76-02379  
78/02/00 45 PAGES UNCLASSIFIED DOCUMENT

UTTL: Parameters for legislative consideration of  
bioconversion technologies  
AUTH: A/ABELES, T. P.; B/KING, J. R.  
CORP: Minnesota Legislature Science and Technology Project,  
St. Paul. AVAIL.NTIS SAP: HC A03/MF A01  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY POLICY/\*ETHYL  
ALCOHOL/\*ORGANIC WASTES (FUEL CONVERSION)  
MINS: / BIOMASS/ CROPS/ ETHANE/ FERMENTATION/ WASTE ENERGY  
UTILIZATION  
ABA: GRA  
ABS: Conclusions and recommendations are reported that  
evolved from the examination of various models of  
biomass production of nonpetroleum fuels. It was  
determined that it was neither economically nor  
energetically wise at this time for Minnesota to  
commit itself to a gasoline program modelled after  
Nebraska's program. Instead of adopting the single  
source, large scale Nebraska model, it was concluded  
that Minnesota should do the pilot and demonstration  
plants for the production of ethanol on the small  
scale (farm or local co-op size), and encourage the  
utilization of a variety of feedstocks such as, sugar  
beets, grains and cellulosic residues.

79N27322# ISSUE 18 PAGE 2389 CATEGORY 28 RPT#:  
GPO-22-334 78/00/00 712 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Alcohol fuels  
CORP: Committee on Appropriations (U. S. Senate). SAP:  
Avail: SOD HC  
Washington GPO Special hearing before the Comm. on  
Appropriations, 95th Congr., 2d Sess., 1978  
MAJS: /\*ALCOHOLS/\*CONGRESSIONAL REPORTS/\*GASOLINE/\*SYNTHETIC  
FUELS  
MINS: / DISTILLATION/ GRAINS (FOOD)/ INTERNAL COMBUSTION  
ENGINES/ METHYL ALCOHOLS/ SYSTEMS ENGINEERING  
ABA: W.M.M.  
ABS: The potential value of alcohols as an additional  
energy source was presented. Gasohol fuel production,  
uses, and combustion efficiency were discussed.

78N30393# ISSUE 21 PAGE 2796 CATEGORY 28  
78/02/00 2 PAGES UNCLASSIFIED DOCUMENT  
UTTL: The effect of blending methanol with gasoline on  
geometric distribution

AUTH: A/ADT, R. R., JR.  
CORP: Miami Univ., Coral Gables, Fla. AVAIL.NTIS SAP:  
HC A22/MF A01  
In NATO Proc. of the 4th Intern. Symp. on Automotive  
Propulsion Systems, Vol. 2 p 730-732 (see N78-30370  
21-31)  
MAJS: /\*AUTOMOBILE FUELS/\*DISTRIBUTION (PROPERTY)/\*GASOLINE  
/\*METHYL ALCOHOLS/\*MIXTURES  
MINS: / EXHAUST GASES/ FUEL TESTS/ FUEL-AIR RATIO/ INTERNAL  
COMBUSTION ENGINES

ABA: Author  
ABS: A four cylinder, carbureted engine was fueled with  
Indolene (gasoline) and a blend of Indolene and 20  
percent by volume methanol to determine the effect of  
the blend on geometric distribution. The engine  
parameters varied were: engine speed, manifold vacuum,  
equivalence ratio, and simulated cruising speed. The  
results show that while both fuels, in general,  
exhibited similar distribution patterns as a function  
of the engine parameters, the blend fueled mode of  
operation yielded a greater difference between the  
fuel-air equivalence ratios of the richest and leanest  
cylinders.

79N24193# ISSUE 15 PAGE 1965 CATEGORY 28 RPT#:  
PB-290569/3 TAEB-79-4A 78/12/00 42 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Gasohol test program  
AUTH: A/LAWRENCE, R.  
CORP: Environmental Protection Agency, Ann Arbor, Mich.  
CSS: (Technology Assessment and Evaluation Branch.)  
AVAIL.NTIS SAP: HC A03/MF A01  
MAJS: /\*AIR POLLUTION/\*GASOHOL (FUEL)  
MINS: / AUTOMOBILES/ EXHAUST GASES/ HYDROCARBONS  
ABA: GRA  
ABS: Eleven vehicles (4 three-way systems and 7 oxidation  
catalyst systems) were tested on five fuels. A summer  
grade gasoline was selected as the base fuel and was  
used both before and after testing on the two  
commercial gasohols. Indolene and a gasohol fuel  
containing Indolene and ethanol were the other two  
fuels. All gasohol fuels used in this program  
contained 10 percent ethanol (by volume). Duplicate  
tests were planned on four fuels and four tests were  
planned on the base fuel.

78N30400# ISSUE 21 PAGE 2797 CATEGORY 28  
78/02/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: A study on reformed fuel for an automotive gasoline engine  
AUTH: A/ONODA, K.  
CORP: Toyota Motor Co., Tokyo (Japan). AVAIL.NTIS SAP: HC A22/MF A01  
In NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 p 759-768 (SEE N78-30370 21-31)  
MAJS: /\*COMBUSTION EFFICIENCY/\*FUEL-AIR RATIO/\*HYDROGEN FUELS/\*INTERNAL COMBUSTION ENGINES  
MINS: / COMBUSTION STABILITY/ FUEL CONSUMPTION/ GASOLINE/ HYDROGEN/ JAPAN/ MOTOR VEHICLES/ NITROGEN OXIDES  
ABA: Author  
ABS: A prototype on-board fuel reformer was developed and laboratory tests were conducted to determine the effects of the amount of reformed fuel on combustion. The results of these tests are discussed in this paper. On the Japanese test cycle, an extremely low NOx emission level was attained with relatively good fuel economy. However, in a limited combination of engine size and vehicle weight, engine power was sacrificed somewhat because of this lean combustion. A solution to this problem, while maintaining the lower NOx emission level, is to adopt a richer air-fuel ratio and a higher EGR rate. In this approach, the amount of hydrogen must be increased to improve combustion stability. For this purpose, methanol reforming was introduced whereby the additional hydrogen was supplied without any deterioration in energy efficiency.

7611 (CONF-771175—, pp 2.3.1-2.3.22) Problems in the application of ethanol as fuel for utility vehicles. Bandel, W. (Daimler-Benz A.G., Stuttgart). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

The use of ethanol as engine fuel from plant-sources is of special interest to petroleum-poor countries with advantageous climatic conditions and sufficient planting space. No noteworthy difficulties are to be expected in this connection for the operation of Otto-type engines. More problematic is the application of ethanol to utility vehicles that are originally operated with diesel engines. Two approaches to the solution, that are different in principle are discussed: The adaptation of the engine to the substitute-fuel ethanol and the adaptation of substitute-fuel to a diesel engine that is as unchanged as possible. The advantages and disadvantages of the individual methods must be weighed with a special view to the economy of the utility vehicles.

79N11237# ISSUE 2 PAGE 167 CATEGORY 28 RPT#:  
HCP/M2096-01 78/04/10 19 PAGES UNCLASSIFIED DOCUMENT

UTTL: Denaturants for ethanol/gasoline blends  
CORP: Mueller Associates, Inc., Baltimore, Md. AVAIL.NTIS SAP: HC A02/MF A01  
MAJS: /\*ADDITIVES/\*AUTOMOBILE FUELS/\*ETHYL ALCOHOL  
MINS: / CHEMICAL FUELS/ GASOLINE/ GOVERNMENT PROCUREMENT  
ABA: DCE  
ABS: A major source of revenue for the Federal Government  
MAJS: is the tax placed on ethyl alcohol used for human consumption. If ethyl alcohol (ethanol) is used as an automotive fuel, it will be necessary to deter any potential public damage or attempts at avoiding the taxation of potable ethanol, both of which could occur through uncontrolled distribution of bootleg alcohol products. A study assesses: (1) if the ordinary methods denaturing ethyl alcohol are satisfactory to prevent the recovery of potable ethanol from any future ethanol/gasoline fuel blends; and (2) if there is a need for the development of a more effective denaturant. The effects that any government tax credit programs (designed to encourage the use of alcohol as a gasoline extender) may have on the possible recovery of potable ethanol from ethanol/gasoline fuel blends were considered.

78N30268# ISSUE 21 PAGE 2780 CATEGORY 28 RPT#:  
PB-280120/7 ESCS-11 AGERSF-21 78/01/19 23 PAGES UNCLASSIFIED DOCUMENT

UTTL: Gasohol from grain: The economic issues 1LSP: Final Report, 1977 - 1978  
CORP: Economics, Statistics and Cooperatives Service, Washington, D. C. AVAIL.NTIS SAP: HC A02/MF A01  
Sponsored in part by Committee on the Budget (US House). Task force on physical resources  
MAJS: /\*ALCOHOLS/\*AUTOMOBILE FUELS/\*ECONOMIC FACTORS  
MINS: / AGRICULTURE/ FEASIBILITY ANALYSIS/ MARKETING/ SYNTHETIC FUELS  
ABA: GRA  
ABS: Proposals for using fermentation alcohol from grains as a motor fuel supplement are considered in economic feasibility. These proposals originate from the desire of farm groups to develop an added market for of grains and coincide with the Nation's desire to find alternatives to petroleum fuels. Results indicate a national program would require the production of 10 billion gallons of ethanol to mix with 90 billion gallons of gasoline to produce 100 billion gallons of gasohol annually.

79N24191# ISSUE 15 PAGE 1965 CATEGORY 28 RPT#:  
PB-290612/1 TAEB-79-1 7B/10/00 29 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Exhaust emissions and fuel economy from automobiles using alcohol/gasoline blends under high-altitude conditions

AUTH: A/RICHARDSON, D.  
CORP: Environmental Protection Agency, Ann Arbor, Mich.  
CSS: (Technology Assessment and Evaluation Branch.)  
AVAIL NTIS SAP: HC A03/MF A01

MAJS: /\*AUTOMOBILES/\*EXHAUST GASES/\*GASOLINE/\*HIGH ALTITUDE  
MINS: / AIR POLLUTION/ COLORADO/ ETHYL ALCOHOL/ METHYL ALCOHOLS

ABA: GRA

ABS: Results of emissions tests on ten passenger cars operated on fuel blends containing methanol and ethanol are described. The purpose of the program was to determine the immediate exhaust emission and fuel economy changes due to use of alcohol/gasoline blends under high altitude conditions. The vehicles represented the 1973-1978 model years and were randomly selected from private owners in the Denver area. The test procedures used were the federal test procedure (exhaust emissions only) and the highway fuel economy test. Fuel economy was measured and recorded using the carbon balance technique.

7609 (CONF-771175—, pp 2.1.1-2.1.5) Tests on unleaded gasoline containing 10% ethanol; Nebraska GASOHOL, Scheller, W.A. (Univ. of Nebraska, Lincoln), Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

On December 23, 1974, a 2 million mile (3.2 million km) road test program involving 45 Nebraska owned vehicles was begun to compare an unleaded fuel blend containing 10 percent anhydrous ethanol (GASOHOL) with regular grade unleaded gasoline. Odometer reading and quantity of fuel added were recorded at each fueling stop. Spark plugs were examined and compression measurements were made periodically. The engine heads were also removed from ten cars, the valves and valve seats examined and micrometer measurements of the cylinder diameter were made. Standard emissions tests were conducted at the ERDA Energy Research Center in Bartlesville, Oklahoma. Total emissions from GASOHOL were about 15.7 gm/mile lower than from unleaded. The GASOHOL cars obtained up to 5.3 percent more miles per gallon and 8.7 percent more miles per Btu than the cars using unleaded fuel. GASOHOL performance was satisfactory under all conditions of weather and driving.

BON10393# ISSUE 1 PAGE 54 CATEGORY 28 RPI#:  
HCP/T4101-03 CNT#: EG-77-C-01-4101 7B/0B/00 84  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Biomass-based alcohol fuels: The near-term potential for use with gasoline

AUTH: A/PARK, W.; B/PRICE, G.; C/SALO, D. J.  
CORP: Vitre Corp., McLean, Va. CSS: (METREK Div.)  
AVAIL NTIS SAP: HC A05/MF A01

MAJS: /\*BIOMASS/\*ETHYL ALCOHOL/\*GASOHOL (FUEL)/\*GASOLINE/\*METHYL ALCOHOLS/\*MIXTURES

MINS: / AUTOMOBILE FUELS/ COST ESTIMATES/ ENERGY TECHNOLOGY/ PRODUCTION ENGINEERING

ABA: DOE

ABS: The requirements and prospects for a nationwide alcohol-gasoline fuel system based on alcohols derived from biomass resources are assessed. Technological and economic factors of the production and use of biomass-based methanol and ethanol fuels are evaluated relative to achieving 5 or 10 percent alcohol-gasoline blends by 1990. It is concluded the maximum attainable is a nationwide 5 percent methanol or ethanol-gasoline system replacing gasoline by 1990. Relative to existing gasoline systems, costs of alcohol-gasoline systems will be substantial.

7610 (CONF-771175—, pp 2.2.1-2.2.8) Factors that improve the performance of an ethanol-diesel oil dual-fuel engine. Panchapakesan, N.R.; Gopalakrishnan, K.V.; Murthy, B.S. (Indian Inst. of Tech., Madras), Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Some of the factors which affect the performance of an alcohol-diesel oil dual-fuel engine, in which alcohol forms the principal fuel, are investigated. The aim is to achieve the maximum use of alcohol with the best possible thermal efficiency and output. The chief problems of this type of engine are identified and remedial measures explored. The effectiveness of injection timing, compression ratio and ignition accelerating additives to alcohol in achieving the above aims have been investigated. The performance of the engine has been assessed on the basis of thermal efficiency, degree of use of alcohol, combustion characteristics and exhaust emissions. The results show that it is possible to derive as much as 70 to 80 percent of the total heat requirement of the engine from alcohol for most of the load range. Possibilities of further improvement are also indicated by the results.

**Gasohol from Grain--The Economic Issues.**

Economics, Statistics, and Cooperatives Service.

Washington, D.C. 19 Jan 78, 23p ESCS-11, AGERSF-21

PB-280 120/7WE Price code: PC A02/MF A01

78N 30268  
Proposals for using fermentation alcohol from grains as a motor fuel supplement raise questions regarding its economic feasibility. These proposals originate from the desire of farm groups to develop an added market for grains and coincide with the Nation's desire to find alternatives to petroleum fuels. This study is a preliminary economic assessment of introducing a national gasohol program. A national program would require the production of 10 billion gallons of ethanol to mix with 90 billion gallons of gasoline to produce 100 billion gallons of gasohol annually.

N80-15297# Texas A&M Research Foundation, College Station  
Dept of Chemical Engineering  
CONVERSION OF COAL BASED METHANOL TO ETHYLENE  
AND A GASEOUS FUEL Final Report, 1 Oct. 1975 - 30 Sep.  
1978

Rayford G. Anthony 1 Dec 1978 47 p ref  
(Grant NSF AER-74-20135)

(PB-301256/4; NSF/RA-780616) Avail. NTIS  
HC A03/MF A01 CSCL 07A

Development of a catalytic process which converts methanol into ethylene and a gaseous fuel similar to natural gas is reported. An AW500 type catalyst proved to be the best catalyst for converting methanol into ethylene. 80 to 98 percent of the alcohol being converted into 16 to 60 percent yields of ethylene. Coal-based methanol was converted into a gaseous mixture composed of 50 percent dimethyl ether, 33.3 percent hydrogen and 16.7 percent carbon monoxide by passing the alcohol over alumina and zinc chromite catalysts at 300-500 C. The major cost of producing ethylene or gaseous fuel is the initial cost of synthesis gas produced from coal that is subsequently used to produce methanol. GRA

79N78977# CATEGORY 28 RPT#: NP-23604-VOL-C  
78/03/00 410 PAGES UNCLASSIFIED DOCUMENT

UTTL: Liquid fuels from renewable resources: Feasibility

study. Volume C: Forest studies

CORP: Intergroup Consulting Economists Ltd., Winnipeg  
(Manitoba). AVAIL. NTIS

MAJS: /\*ALCOHOLS/\*ENERGY TECHNOLOGY/\*GASOHOL (FUEL)/\*  
SYNTHETIC FUELS

MINS: / CANADA/ FEASIBILITY ANALYSIS/ FORESTS/ PRODUCTION  
ENGINEERING

8\* N70-32608  
18264 (PB-280120) Gasohol from grain: the economic issues.  
Final report 1977/1978. (Economics, Statistics, and Cooperatives  
Service, Washington, DC (USA)). 19 Jan 1978. 23p. (ESCS-11).  
NTIS PC A02/MF A01.

Proposals for using fermentation alcohol from grains as a motor fuel supplement raise questions regarding its economic feasibility. These proposals originate from the desire of farm groups to develop an added market for grains and coincide with the Nation's desire to find alternatives to petroleum fuels. This study is a preliminary economic assessment of introducing a national gasohol program. A national program would require the production of 10 billion gallons of ethanol to mix with 90 billion gallons of gasoline to produce 100 billion gallons of gasohol annually.

7608 (CONF-771175-- pp 1.5.1-1.5.13) Possibilities for cost-effective use of alcohol fuels in Otto engine-powered vehicles. Bernhardt, W. (Volkswagenwerk A.G., Wolfsburg, Ger.) Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Technical, economic, and logistic aspects of the introduction of alcohols (methanol or ethanol) as an alternative automotive fuel are discussed. The energy conversions obtainable are cited from experimental data. The economic aspects discussed include production costs, cost effectiveness of alcohols, changeover costs, and cost relationship of alcohol to gasoline. New engine concepts for the utilization of pure alcohol fuels are briefly discussed. (JSR)

J 79N78978# CATEGORY 28 RPT#: NP-23604-VOL-A  
78/03/00 276 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Liquid fuels from renewable resources: Feasibility  
study. Volume A: Demand studies  
CORP: Intergroup Consulting Economists Ltd., Winnipeg  
(Manitoba). AVAIL. NTIS  
MAJS: /\*ALCOHOLS/\*ENERGY TECHNOLOGY/\*GASOHOL (FUEL)/\*  
SYNTHETIC FUELS  
MINS: / DEMAND (ECONOMICS)/ ENERGY CONSUMPTION/ ENERGY  
SOURCES/ FEASIBILITY ANALYSIS

77N27245# ISSUE 18 PAGE 2369 CATEGORY 28 RPT#:  
BERC/RI-76/15 77/01/00 87 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Experimental results using methanol and methanol/gasoline blends as automotive engine fuel

AUTH: A/ALLSUP, J. R.

CORP: Energy Research and Development Administration, Bartlesville, Okla. CSS: (Bartlesville Energy Research Center.) AVAIL,NTIS SAP: HC A05/MF A01

MAJS: /\*AUTOMOBILE FUELS/\*FUEL TESTS/\*GASOLINE/\*METHYL ALCOHOLS

WINS: / AUTOMOBILE ENGINES/ ECONOMIC FACTORS/ EMISSION/ ENERGY POLICY/ HYDROCARBON FUELS

ABA: GRA

ABS: Comparative emission and fuel energy economy data were generated using 1975 model vehicles adjusted for gasoline fuel and using gasoline and gasoline blended with 5 and 10 percent methanol; tests were made at temperatures of 20, 75, and 100 F on a chassis dynamometer in a climate controlled test chamber. Results suggest that emissions and fuel energy economy are generally affected to the extent that methanol addition affects air-fuel stoichiometry, fuel heat content, and fuel vapor pressure. Vehicle emissions and fuel economy were essentially unchanged during approximately 7,500 miles of road testing; no engine or fuel system component failures were encountered during that testing. Road octane measurements were made for the fuels containing 5, 10, and 15 percent methanol in base gasolines of 84, 87, and 91 research octane quality. Results show significantly better octane improvement in blending methanol with the lower octane fuels as compared with the improvement in blending with the higher octane fuels.

7623 **Methyl alcohol: a potential fuel for transportation.** Pasternak, A. (Univ. of California, Livermore) pp 444-449 of Energy technology handbook Considine, D.M. (ed.) New York, McGraw-Hill, Inc. (1977).

Methanol is attractive as an alternative transportation fuel because it is a liquid and is therefore easy to handle and because it can be made from coal with known technology. A number of reports describe operating experience for cars running on methanol-gasoline blends and also neat methanol. At a limit of 10 to 15 percent methanol in gasoline, no modifications are necessary to the carburetion of existing automobiles although late model cars may suffer some loss of performance. For operation on pure methanol, several modifications are necessary: carburetors must be rejiggered to lower the air/fuel ratio, and exhaust heat must be recycled to compensate for methanol's lower energy content. Operation of vehicles on pure methanol has some potential advantages: 1. Methanol has a high octane rating which may permit increases in engine compression ratios and higher efficiencies. 2. There are data which show that existing engines can operate at higher efficiencies on methanol than on gasoline. 3. Methanol's high heat of vaporization makes possible the recycle of exhaust heat and should lead to higher thermodynamic efficiency. 4. There are data which show that emissions of CO, NO/sub x/, and unburned hydrocarbons are lower when cars are operated on methanol than on gasoline.

(NP--20971) **Ethanol and methanol: production schemes and use as fuels.** Lewis, R. (Minnesota Univ., Minneapolis (USA) Center for Studies of the Physical Environment). 1 Apr 1974. 13p. Univ. of Minnesota, Minneapolis.

As ethanol and methanol could become important as liquid fuels, a brief discussion is presented of possible production schemes, difficulties that may be encountered with their use as fuels, and estimates of production costs. The most economically attractive method for methanol synthesis at the present is its synthesis from natural gas or naphtha. Synthesis from coal is discussed and the difficulties briefly cited. Ethanol could be synthesized from farm residues and could be economically attractive depending on the cost of the collection and transportation of the residues and on the sale of by-products of the production method. Although ethanol could be used to power farm equipment, its general use as a blend with gasoline might present some difficulties. (JSR)

J 77N33375# ISSUE 24 PAGE 3204 CATEGORY 28 RPT#:  
BERC/R1-76/12 77/01/00 84 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Physical properties of gasoline/methanol mixtures

AUTH: A/ECCLESTON, B. H.; B/COX, F. W.

CORP: Energy Research and Development Administration,  
Bartlesville, Okla. CSS: (Bartlesville Energy  
Research Center.) AVAIL:NTIS SAP: HC A05/MF A01

MAJS: /\*BINARY MIXTURES/\*GASOLINE/\*METHYL ALCOHOLS/\*PHYSICAL  
PROPERTIES

WINS: / CONTAMINANTS/ DISTILLATION/ ESTIMATES/ TOLERANCES  
(MECHANICS)/ VAPOR PRESSURE/ WATER

ABA: ERA

ABS: Experimental work was done to relate selected physical properties of gasoline/methanol solutions, containing contaminant levels of water, to compositional and physical properties of the blending gasoline. Water tolerance, octane number, vapor pressure, and distillation data are presented for eight gasolines and for their methanol solutions at methanol levels up to 20 wt-pct. The water tolerances of these fuels were strongly dependent upon temperature, methanol concentration, and gasoline composition. It is shown that an estimate can be made of the water tolerance of a gasoline/methanol mixture when the composition of the gasoline is known in sufficient detail. Portions of the D-86 distillation curves of gasoline/methanol mixtures can be estimated from a knowledge of the base gasoline distillation curves. In the region of 5 to 20 pct methanol content, vapor pressures can be estimated from those of the gasolines. The blending octane numbers resulting from the study agree well with previously published values.

(NP-20972) Methanol and ethanol: short history, current production, future and available literature. Lewis, R. (Minnesota Univ., Minneapolis (USA). Center for Studies of the Physical Environment). 27 Feb 1974. 16p. Univ. of Minnesota, Minneapolis.

A review is given of the most common methods for the production of ethanol and methanol and their potentials as a fuel source. Methanol or methanol-gasoline blends appear attractive because of the fewer pollution products formed with no loss of engine power. Methanol can be produced synthetically from natural gas or coal at a price competitive with the current non-taxed price of gasoline if low cost sources of the raw materials are available. Insufficient information is available to determine energy requirements and economics of methanol production from crop wastes. Ethanol can be produced from waste cellulose materials by fermentation but not at a cost competitive with gasoline. The energy requirements for its production from crop wastes have not been evaluated. A bibliography of current literature on the production and fuel uses of methanol and ethanol is appended. (JSR)

PERFORMANCE OF AN  
ETHANOL-GASOLINE BLEND IN AUTOMOBILES AND LIGHT TRUCKS. A two million mile ethanol-gasoline road test program is being conducted with 36 vehicles supplied by the Nebraska Department of Roads and is being financed by the Nebraska Agriculture Products Industrial Utilization Committee. The fuel being tested is a mixture of 10% anhydrous ethanol and 90% unleaded regular grade gasoline. This blend is known by the name Gasohol. Based on the results of preliminary testing of about 250,000 miles, a computer program has been developed to process the fuel consumption and mileage data. Through the use of linear regression it has been found that the significant factors in the fuel consumption are the driver, the vehicles, average daily temperature, average relative humidity and maintenance schedule. Tire pressure while known to be significant cannot be accounted for. Normal fluctuations in atmospheric pressure, precipitation, and visibility were not found to be significant. When the significant factors have been accounted for in the fuel consumption the significance of the residuals will be tested for the unleaded gasoline and gasohol fuel. 5 refs.

Scheller, William A. Univ of Nebr, Lincoln; Mohr, Brian J. *Am Chem Soc Div Fuel Chem Prepr* v 20 n 2, 1975, for Meet, Philadelphia, Pa, Apr 6-11 1975, p 71-75.

IV. LIQUID/SOLID WASTES AND BIOMASS . . . . .	448
A. General . . . . .	449
B. Organic Wastes/Biomass . . . . .	461
1. Direct Burning . . . . .	461
2. Fuel Production . . . . .	483



LIQUID/SOLID WASTES AND BIOMASS - GENERAL

79A46660# ISSUE 20 PAGE 3791 CATEGORY 44  
79/06/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Conserving energy via cogeneration  
AUTH: A/WILSON, W. B. PAA: A/(General Electric Co.,  
Schenectady, N.Y.)  
Mechanical Engineering, vol. 101, Aug. 1979, p. 20-27.

ABA: M.E.P.

ABS: Consideration is given to the problem of whether industrial plants can realize a return on investment (ROI) with the installation of a cogeneration system, as opposed to a system with process boilers and purchased electric power. Topics covered include low-level heat recovery, waste gas-flow requirements for steam generation and inlet steam pressure effects. Data are also given showing capital requirements and annual operating costs of process boilers versus steam turbine cogeneration, along with the effect of investment tax credit and depreciation allowances on discounted rate of return. It is concluded that for cogeneration projects with a typical 4 or 5 yr gross payout period, such tax incentives should significantly increase the number that will be implemented.

79A38893# ISSUE 16 PAGE 3031 CATEGORY 44 RPT#:  
AIAA PAPER 79-0988 79/06/00 7 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Rough cost estimates of solar thermal/coal or biomass derived fuels

AUTH: A/COPELAND, R. J. PAA: A/(Solar Energy Research  
Institute, Golden, Colo.)  
American Institute of Aeronautics and Astronautics,  
Terrestrial Energy Systems Conference, Orlando, Fla.,  
June 4-6, 1979, 7 p.

A5A: C.K.D.

ABS: Approximate costs of producing synthetic methane by a hybrid process combining solar thermal energy with coal or biomass starting material are calculated parametrically. The solar thermal heat source considered is a central receiver system assumed to be located in a region of the Southwest with direct insolation of 6.9 to 7.3 kWh/sq m-day. Cost ranges considered for plant startup in 2000 are: coal, \$1.26-3.26/MBtu; biomass (from residues and fresh biomass produced by energy plantations), \$2-4/MBtu. Solar heat costs over a range of \$3-10/MBtu are considered. It is concluded that solar thermal hybrid fuels could be cost competitive with methane produced from coal or biomass alone if the future cost of coal and biomass is near the high end of the projections or if the cost of solar thermal heat can be reduced below current estimates.

HOT BUG FOR ENERGY. Julie Ann Miller.

Science News, vol 116, no 18, November 3, 1979.  
p. 317.

Bacteria from hot springs are promising for alcohol production.

REFUSE RESEARCH PROVES ELECT RIFYING. James  
Hazelwood.

Industrial Research/Development, October, 1979.  
p. 47-49.

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79A51772 ISSUE 23 PAGE 4371 CATEGORY 44 CNT#: EX-76-C-01-2548 ET-78-C-01-3024 79/00/00 6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Analysis of the Photosynthesis Energy Factory as an integrated bioconversion system  
AUTH: A/FRASER, M. D.; B/HENRY, J. F.; C/BORCHI, L. C.; D/BARBERA, N. J. PAA: D/(InterTechnology/Solar Corp., Warrenton, Va.)  
In: Intersociety Energy Conversion Engineering Conference, 14th, Boston, Mass., August 5-10, 1979, Proceedings, Volume 1. (A79-51726 23-44) Washington D.C., American Chemical Society, 1979, p. 279-284.

ABA: (Author)

ABS: A Photosynthesis Energy Factory (PEF) is an integrated bioconversion system consisting of a dry-land Energy Plantation, a wood-fired power plant, and a wetlands biological wastewater treatment system, such as an algae pond. Products of a PEF are electricity from the power plant, synthetic natural gas from digestion of the wetlands biomass, and reclaimed wastewater. The possible advantages are that effluents and by-products from one system part can be beneficially used by other parts, leading to increased energy conversion and resource recovery at lower costs. In the initial study a general technoeconomic model was used to investigate possible interactions between the various subsystems. In a second project the PEF model has been expanded and generalized by analyzing possible model improvements in the areas of materials transportation, water and nutrient balances, other types of wetlands biological systems, and improvements in wood-fired combustion systems. Direct application of municipal wastewater to a dry-land Energy Plantation has been analyzed, also. Potential sites for PEF systems will be evaluated with the improved technoeconomic model.

CN-150,696 *Fuels, Biomass & waste* 1979  
SPEAKING OF SCIENCE. (Evening lectures).

Royal Institution of Gr. Brit., 1977-78  
Proceedings, v.51.

Lectures - Science  
Lectures - Royal Institution of Great Britain

The Plant Chloroplast: the Renewable Source of Food, Chemicals and Fuel / D. O. Hall

79A38616 ISSUE 16 PAGE 3026 CATEGORY 44 78/00/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: Design, operation, and economics of the Energy Plantation as an alternate source of fuels  
AUTH: A/SZEGO, G. C.; B/FRASER, M. D.; C/HENRY, J.-F. PAA: C/(InterTechnology/Solar Corp., Warrenton, Va.)  
In: International Solar Forum, 2nd, Hamburg, West Germany, July 12-14, 1978, Reports, Volume 2, (A79-38576 16-44) Munich, Deutsche Gesellschaft fuer Sonnenenergie, 1978, p. 1-15.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*PLANTS (BOTANY)/\*SOLAR ENERGY/\*SYNTHETIC FUELS

MINS: / CLEAN ENERGY/ COST ESTIMATES/ ENERGY TECHNOLOGY/ LAND MANAGEMENT/ TREES (PLANTS)

ABA: (Author)

ABS: An Energy Plantation is a means for producing fuels by collecting and storing solar radiation in plants grown purposely for their fuel value. Appropriate selection of plant species and plantation cultural practices is the key to producing fuels by this means at attractive cost. This paper discusses how the Energy Plantation is designed and operated for maximum productivity of plant material. Also included in the discussion are the equipment requirements and the estimated costs for plantation operation. The cost of the fuel produced is estimated to be between \$1.00 and \$1.50 per million Btu.

78N26585# ISSUE 17 PAGE 2279 CATEGORY 44 RPT#: CONF-780109-3 CNT#: W-7405-FMS-48 78/00/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy from biomass: An overview of environmental aspects

AUTH: A/ROOP, R. D.

CORP: Oak Ridge National Lab., Tenn. CSS: (Environmental Sciences Div.) AVAIL:NTIS SAP: HC A02/MF A01  
Presented at Technol. for Energy Conserv., Albuquerque, N. Mex., 23 Jan. 1978

MAJS: /\*BIBLIOGRAPHIES/\*BIOMASS ENERGY PRODUCTION/\*ENERGY POLICY/\*ENVIRONMENTAL SURVEYS

MINS: / AGRICULTURE/ ASSESSMENTS/ ENERGY SOURCES/ FORESTS/ MARINE RESOURCES/ WASTE UTILIZATION

ABA: ERA

ABS: Recent literature regarding energy from biomass is reviewed in order to delineate environmental issues and suggest research needed for assessment of this energy option. Potential sources of biomass for conversion to energy include agricultural and forestry residues, municipal and industrial wastes, biomass plantations, and freshwater and marine grown plant material. The impacts of using wastes and of growing biomass for fuel are summarized.

79N21224# ISSUE 12 PAGE 1546 CATEGORY 28 RPT#:  
PB-289775/9 EPA-600/7-78-204 CNT#: EPA-68-02-1323  
78/10/00 366 PAGES UNCLASSIFIED DOCUMENT

UTTL: Preliminary environmental assessment of biomass  
conversion to synthetic fuels TLSP: Report for Jul.  
1976 - Dec. 1976  
AUTH: A/DINOVO, S. T.; B/BALLANTYNE, W. E.; C/CURRAN, L.  
M.; D/BAYTOS, W. C.; E/DUKE, K. M.  
CORP: Battelle Columbus Labs., Ohio. AVAIL.NTIS SAP: HC  
A16/MF A01

ABA: GRA

ABS: A preliminary evaluation of biomass production and  
conversion technologies, and their associated  
environmental consequences is presented. Five  
categories of biomass production were considered in  
detail. Thermochemical and biochemical technology were  
considered for conversion processes. Regionalized  
scenarios were prepared using commercial scale plants  
processing appropriate regionalized feedstock. Most  
processes use heterogeneous solid waste as a feed  
stock which are believed to pose more severe control  
requirements for emissions and effluents than other  
biomass feedstocks. The environmental and  
socio-economic effects of locating large conversion  
plants in rural environments need to be studied.

79A34179 ISSUE 13 PAGE 2496 CATEGORY B3  
78/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Function of economics in energy policy  
AUTH: A/ZELBY, L. W. PAA: A/(Oklahoma, University, Norman,  
Okla.)  
In: Alternative energy sources; Proceedings of the  
Miami International Conference, Miami Beach, Fla.,  
December 5-7, 1977. Volume 10. (A79-34158 13-B3)  
Washington, D.C., Hemisphere Publishing Corp., 1978,  
p. 4955-4962.  
MAJS: /\*AGRICULTURE/\*BIOMASS ENERGY PRODUCTION/\*ECONOMICS/\*  
ENERGY POLICY  
MINS: / ETHYL ALCOHOL/ METHANE/ METHYL ALCOHOLS  
ABA: P.T.H.

ABS: In response to the current 'energy crisis', the author  
proposes that a move away from a energy intensive  
economy to a labor-intensive one be made. Conversion  
to more labor-intensive agriculture would increase the  
ratio of output energy to input energy and lead to a  
greater number of jobs. Use of biomass for fuel  
production such as methane, methanol, and ethanol  
would further increase agricultural production and  
demand for labor.

79N10553# ISSUE 1 PAGE 74 CATEGORY 44 RPT#:  
NTIS/PS-78/0936/3 NTIS/PS-77/0458 78/08/00 31 PAGES  
UNCLASSIFIED DOCUMENT  
Updates NTIS/PS-77/0458

UTTL: Solar ponds. Citations from the NTIS data base  
TLSP: Progress Report, 1976 - Jun. 1978

AUTH: A/HURDEMANN, A. S.  
CORP: National Technical Information Service, Springfield,  
Va. AVAIL.NTIS SAP: HC \$28.00/MF \$28.00  
MAJS: /\*BIBLIOGRAPHIES/\*SOLAR COLLECTORS/\*SOLAR PONDS (HEAT  
STORAGE)

MINS: / ABSTRACTS/ BIOMASS ENERGY PRODUCTION/ ELECTRIC POWER  
/ INDUSTRIAL ENERGY

ABA: GRA

ABS: This bibliography contains 27 abstracts of  
federally-funded research reports on the design,  
performance, and use of solar ponds. Topic areas cover  
the use of solar ponds in industrial process heat  
production, roof ponds for passive solar buildings,  
and solar pond use in the production of biomass for  
renewable fuels.

79N11241# ISSUE 2 PAGE 167 CATEGORY 28 RPT#:  
DOE/ET-0022/1 78/01/00 104 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Fuels from biomass program: Program summary  
CORP: Department of Energy, Washington, D. C. CSS: (Div.  
of Solar Energy.) AVAIL.NTIS SAP: HC A06/MF A01  
MAJS: /\*BIOMASS/\*FUELS  
MINS: / BIBLIOGRAPHIES/ CONTRACTORS/ INDEXES (DOCUMENTATION)  
ABA: DOE  
ABS: An overview of the ongoing research, development, and  
demonstration efforts of the period Oct. 1, 1976 -  
Sept. 30, 1977 is presented. Accomplishments were  
highlighted and plans for continued activities are  
included. The following section headings are  
discussed: the fuel from biomass program;  
organizational and functional responsibilities;  
program funding; fiscal year 1977 summary tables;  
current projects; production and collection of biomass  
and conversion of biomass; bibliography; index or  
contractors; and, appendix-unolicited proposal  
requirements.

79A50876 ISSUE 22 PAGE 4192 CATEGORY 45  
78/00/00 628 PAGES UNCLASSIFIED DOCUMENT

UTTL: Conference on Environmental Aspects of  
Non-Conventional Energy Resources - II, Denver, Colo.,  
September 26-29, 1978. Proceedings  
AUTH: A/SAINT CLAIR, A. E. PAA: A/(Oak Ridge National  
Laboratory, Oak Ridge, Tenn.) PAT: A/(ED.) SAP:  
\$38  
Conference sponsored by the American Nuclear Society  
La Grange Park, Ill., American Nuclear Society, 1978.  
628 p (For individual items see A79-50877 to

A79-50900)

MAJS: /\*CLEAN ENERGY/\*CONFERENCES/\*ENERGY TECHNOLOGY/\*  
ENVIRONMENT EFFECTS/\*FOSSIL FUELS  
MINS: / BIOMASS ENERGY PRODUCTION/ COAL GASIFICATION/ ENERGY  
STORAGE/ GEOTHERMAL RESOURCES/ HYDROELECTRIC POWER  
STATIONS/ SHALE OIL/ SOLAR ENERGY/ WASTE UTILIZATION  
V.i.

ABA: The conference presents papers on such topics as solar  
energy, coal conversion, biomass and waste conversion,  
oil shale, indirect solar energy, energy storage and  
hydroelectric, and geothermal energy. A review of the  
environmental effects and benefits of solar  
technologies and siting considerations for solar  
thermal electric generating plants are given.  
Environmental investigations of in situ coal  
classification experiments and environmental aspects  
of the DOE's underground coal conversion program are  
discussed. Environmental aspects of wood fuel are  
outlined along with social, economic, and legal  
implications of bioenergy and primary impacts of  
growing aquatic plants for energy. Emphasis is placed  
on geyser geothermal operations and other geothermal  
energy resources and their environmental aspects.

**N79-30825#** Mathematica, Inc., Princeton, N. J.  
**ENERGY FROM URBAN WASTES: REPORT ON A FOCUS  
GROUP DISCUSSION**  
W. E. Nicholson 10 Nov. 1978 42 p  
(Contract EV-78-C-01-6388)  
(DOE/TIC-10022) Avail: NTIS HC A03/MF A01

A qualitative assessment of the opinion concerning the  
commercialization potential of urban waste technologies is  
presented. Barriers to the commercialization of the urban waste  
energy production systems that were discussed include problems  
in serving long-term contracts, uncertainty about environmental  
laws, problems with the supply of refuse, disposal and use of

residue, uncertainties about future tax laws, legal barriers,  
technical reliability, and citizen dissent. DOE

79N27334# ISSUE 18 PAGE 2390 CATEGORY 28 RPT#:  
NP-23641 78/09/00 111 PAGES UNCLASSIFIED DOCUMENT

UTTL: IEA biomass information service. Current awareness  
bulletin, May - June 1978 --- b:bibliographies  
CORP: Institute for Industrial Research and Standards,  
Dublin (Ireland); National Board for Science and  
Technology, Dublin (Ireland). AVAIL:NTIS SAP: (US  
Sales Only) HC A06/MF A01: DOE Depository Libraries  
Prepared in cooperation with Natl. Board for Sci. and  
Technol., Dublin  
MAJS: /\*BIBLIOGRAPHIES/\*BIOMASS ENERGY PRODUCTION/\*WASTE  
UTILIZATION  
MINS: / RECYCLING/ VEGETATION  
ABA: DOE  
ABS: This bibliography covers fuel generation and premium  
biomass usage of animal wastes and crop residues;  
general utilization, fuel generation, and named  
systems for domestic urban wastes; forest residue and  
cellulose utilization in short rotation forestry; and  
general and review topics.

79A14760 ISSUE 3 PAGE 423 CATEGORY 44 78/00/00  
954 PAGES UNCLASSIFIED DOCUMENT

UTTL: Miami International Conference on Alternative Energy  
Sources, Miami Beach, Fla., December 5-7, 1977.  
Proceedings of Condensed Papers  
AUTH: A/VEZIROGLU, T. N. PAA: A/(Miami, University, Coral  
Gables, Fla.) PAT: A/(ED.) SAP: \$50  
Conference sponsored by the U.S. Department of Energy  
and University of Miami Coral Gables, Fla., University  
of Miami, 1978. 954 p (For individual items see  
A79-14761 to A79-14773)  
MAJS: /\*CONFERENCES/\*ENERGY TECHNOLOGY  
MINS: / BIOMASS ENERGY PRODUCTION/ BREEDER REACTORS/ COAL  
UTILIZATION/ ECONOMIC ANALYSIS/ ENERGY CONSERVATION/  
ENERGY POLICY/ ENERGY TRANSFER/ GEOTHERMAL ENERGY  
CONVERSION/ HEAT STORAGE/ HYDROGEN-BASED ENERGY/  
NUCLEAR ENERGY/ NUCLEAR FUSION/ OCEAN THERMAL ENERGY  
CONVERSION/ OFFSHORE ENERGY SOURCES/ PHOTOVOLTAIC  
CONVERSION/ SOLAR COLLECTORS/ SOLAR ENERGY CONVERSION/  
THERMOELECTRIC POWER GENERATION/ WINDPOWER UTILIZATION  
ABA: B.J.  
ABS: Consideration is given to such areas as solar energy  
economics, solar collectors, ocean thermal energy  
conversion, coal conversion, geothermal energy,  
nuclear breeders, and fusion power. Papers are also  
presented in such fields as power generation and  
transportation, hydrogen energy, solar heating and  
cooling, energy transmission, bioconversion, energy  
conservation, photovoltaics, heat storage and  
transfer, wind energy, and synthetic fuels.

79A50877 ISSUE 22 PAGE 4193 CATEGORY 45  
78/00/00 12 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Resolving the environmental issues in developing fuels  
from biomass  
AUTH: A/DUNWOODY, J. E. PAA: A/(Mittelhauser Corp., tisle,  
Ill.)  
In: Conference on Environmental Aspects of  
Non-Conventional Energy Resources - II, Denver, Colo.,  
September 26-29, 1978. Proceedings. (A79-50876 22-45)  
La Grange Park, Ill., American Nuclear Society, 1978.  
p. 3-3 to 3-14.  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENVIRONMENT EFFECTS  
MINS: / AIR POLLUTION/ ANAEROBES/ ENERGY TECHNOLOGY/ EROSION  
/ FARMLANDS/ TABLES (DATA)/ WATER POLLUTION/ WATER  
RESOURCES

ABA: (Author)  
ABS: This paper reviews recent studies on the potential for  
environmental impact by biomass energy technologies  
and outlines a framework for a national program of  
biomass energy environmental research. Although there  
has been considerable research on environmental  
impacts of intensive agriculture, silviculture and  
urban waste energy technology most of this information  
has not yet been applied to biomass energy  
technologies. The need for a substantial biomass  
energy environmental research program spanning the  
next 3-5 years is emphasized to prevent environmental  
concerns from inhibiting the commercial application of  
biomass energy technologies.

79A15915 ISSUE 4 PAGE 648 CATEGORY 44 78/00/00  
8 PAGES UNCLASSIFIED DOCUMENT  
UTTL: New concepts in waste utilization and biomass  
AUTH: A/BENTE, P. F., JR.  
In: Energy technology V: Challenges to technology;  
Proceedings of the Fifth Conference, Washington, D.C.,  
February 27-March 1, 1978. (A79-15879 04-44)  
Washington, D.C., Government Institutes, Inc., 1978.  
p. 796-803.  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY TECHNOLOGY/\*WASTE  
UTILIZATION  
MINS: / PHOTOSYNTHESIS/ SOLAR ENERGY/ TREES (PLANTS)  
ABA: V.P.  
ABS: The present paper reviews some highlights in the  
rapidly developing field of bioenergy, i.e., the solar  
energy stored up in plant matter by the photosynthesis  
process. Particular attention is given to some  
remarkable research work that was carried out with  
euphorbia trees which produce a hydrocarbon-rich sap.

78A50146 ISSUE 22 PAGE 4035 CATEGORY 44  
78/00/00 6 PAGES UNCLASSIFIED DOCUMENT  
UTTL: Biochemical routes to energy recovery from municipal  
wastes  
AUTH: A/KLEE, A. J.; B/ROGERS, C. J. PAA: B/(U.S.  
Environmental Protection Agency, Municipal  
Environmental Research Laboratory, Cincinnati, Ohio)  
In: Pacific Chemical Engineering Congress, 2nd,  
Denver, Colo., August 28-31, 1977. Proceedings, Volume  
2. (A78-50126 22-45) New York, American Institute of  
Chemical Engineers, 1978, p. 759-764.  
MAJS: /\*BIOCHEMISTRY/\*BIOMASS ENERGY PRODUCTION/\*WASTE  
UTILIZATION  
MINS: / ACIDITY/ ALKALIES/ ANAEROBES/ CARBOHYDRATES/  
CHEMICAL REACTIONS/ ENERGY CONVERSION EFFICIENCY/  
ENERGY TECHNOLOGY/ ENVIRONMENT EFFECTS/ ENZYME  
ACTIVITY/ FERMENTATION/ FUEL COMBUSTION/ HYDROLYSIS/  
METHANE/ PRETREATMENT

ABA: (Author)  
ABS: After analyzing the weaknesses of the conventional  
process to produce methane from the anaerobic  
digestion of municipal solid wastes, three  
pretreatment approaches are described and compared:  
alkali pretreatment, enzymatic hydrolysis, and acid  
hydrolysis. The major findings are that alkali  
pretreatment is effective and holds promise  
particularly for small-scale operations, and that  
recent advances in acid hydrolysis make it a  
significant and economically attractive technology for  
energy, chemical, and food production.

79N26527# ISSUE 17 PAGE 2284 CATEGORY 44 RPT#:  
CONF-7811109-4 CNT# W-7405-ENG-26 78/00/00 19  
PAGES UNCLASSIFIED DOCUMENT  
UTTL: Use of waste heat from nuclear power plants  
AUTH: A/OLSZEWSKI, M.  
CORP: Oak Ridge National Lab., Tenn. AVAIL NTIS SLP: HC  
A02/MF A01  
Presented at Environ. Control Symp., Wash., D. C., 28  
Nov. 1978  
MAJS: /\*ENERGY CONSERVATION/\*NUCLEAR POWER PLANTS/\*WASTE  
ENERGY UTILIZATION  
MINS: / ENVIRONMENT PROTECTION/ POLLUTION CONTROL/ RECYCLING  
/ THERMAL ENERGY  
ABA: DOE  
ABS: Utilization of power plant reject heat was studied. A  
brief description of the historical development of the  
program is given and results of recent studies are  
outlined to indicate the scope of present efforts. A  
description of a project assessing uses for reject  
heat from the Vermont Yankee Nuclear Station is also  
given.

GC  
380  
.S95  
1978  
Symposium on Methodology for Biomass Determinations and Microbial Activities in Sediments, Ft. Lauderdale, Fla., 1978.  
Methodology for biomass determinations and microbial activities in sediments ... c1979 (Card 3)  
for Testing and Materials. Committee D19 on Water. IV. Title. V. Series: American Society for Testing and Materials. Special technical publication ; 673.

TP  
360  
.C58  
1978  
Energy from biomass and wastes : symposium papers presented August 14-18, 1978, Washington, D.C. / symposium chairman, Donald L. Klass ; symposium director, Wendell W. Waterman ; sponsored by Institute of Gas Technology. -- Chicago : The Institute, c1978.  
viii, 868 p. : ill. ; 23 cm.  
Includes bibliographical references.  
\$60.00

POLLUTANTS FROM WASTE-TO-ENERGY CONVERSION SYSTEMS, by Harry Freeman  
Environmental Science & Technology, vol. 12, no. 12, November 1978, p. 1252-1256

*As more cities turn to these systems to supplement their energy supplies and reduce their solid waste management costs, the associated potential pollution problems need to be assessed*

CHEMICALS FROM WOOD WASTE  
A.E. Hokanson and R. Katzen  
CEP  
Vol. 74, no. 1, January 1978,  
p. 67-71.

Waste wood or forest residue represents a potential feedstock for the production of methanol, ethanol, furfural, and phenolics. Investment requirements and operating costs have been developed for commercial size installations employing known engineering technology to produce methanol and ethanol using waste wood as a feedstock. This article compares these costs with plants producing the same chemicals from conventional raw materials.

MARKETING BIOMASS, by William Black  
Chemtech, vol. 8, no. 10, October 1978, p. 606-608

The credit side of the ledger spells biomass. On the debit-side we read fuel. So what we need are means to get the biomass from production to conversion plants. In this paper I will identify the alternatives of business organizations and marketing arrangements that might be developed to accomplish such a transfer.

NASA CP-2042

EMERGING ENERGY ALTERNATIVES FOR THE SOUTHEASTERN STATES. Elias K. Stefanakos, ed. (Symposium sponsored by DOE, LARC and NCA&TSU. Held NCA&TSU, Mar. 31, 1978). June 1978. 152p.

Department of Energy,  
Washington, D.C.

NASA,

Langley Research Center  
North Carolina Agricultural and Technical

THE IMPACT OF MUNICIPAL REFUSE UTILIZATION ON ENERGY AND OUR ENVIRONMENT . . . p. 95 . . . . .  
H. L. Greene

543 5-1-78

78A24751 ISSUE 8 PAGE 1418 CATEGORY 44  
77/00/00 493 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy technology IV; Proceedings of the Fourth Conference, Washington, D.C., March 14-16, 1977

AUTH: A/HILL, R. F. PAT: A/(ED.) SAP: \$25  
Washington, D.C., Government Institutes, Inc., 1977.  
493 p (For individual items see A78-24752 to A78-24764)

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*CONFERENCES/\*ENERGY TECHNOLOGY/\*NATURAL GAS/\*NUCLEAR ELECTRIC POWER GENERATION/\*SOLAR ENERGY CONVERSION

MINS: / COAL UTILIZATION/ COST EFFECTIVENESS/ DESULFURIZING/ DOMESTIC ENERGY/ ENERGY SOURCES/ SOLAR COOLING/ SOLAR HEATING/ SOLAR HOUSES/ WASTE ENERGY UTILIZATION

ABA: J.M.B.

ABS: Solar heating and cooling, natural gas and petroleum technology, nuclear power development, and the conversion of biomass and municipal solid waste to energy are discussed. Topics of the papers include the solar energy research sponsored by ERDA, economic and environmental constraints on coal-burning power plants, magnetic fusion power plant schemes, builders' and developers' reactions to the solar energy industry, solar heating and/or cooling for residences, schools and offices, flue gas desulfurization to limit

SO2 emissions from coal-burning power plants, and the production of methane from cattle feedlot residues.

77A21545 ISSUE 8 PAGE 1321 CATEGORY 85  
77/01/00 7 PAGES In GERMAN UNCLASSIFIED DOCUMENT

UTTL: wide-range control of a thermal interconnection network --- waste incineration utilization supplying pipelined steam heat

AUTH: A/GLATTFELDER, A. H.; B/GROSS, L. PAA:  
B/(Eidgenoessische Technische Hochschule, Zurich, Switzerland)  
Brennstoff-Waerme-Kraft, vol. 29, Jan. 1977, p. 27-33.  
In German.

MAJS: /\*ENERGY TECHNOLOGY/\*MODULAR INTEGRATED UTILITY SYSTEM /\*POLLUTION CONTROL/\*WASTE ENERGY UTILIZATION

MINS: / AIR POLLUTION/ DOMESTIC ENERGY/ FUEL CONSUMPTION/ HEAT TRANSFER/ OPTIMIZATION/ PIPELINES/ STEAM FLOW/ URBAN RESEARCH

ABA: G.P.

ABS: The urban refuse incineration plant of Zurich in Switzerland was connected with an existing long-distance heat supply network by means of a long-carrying pipeline. This procedure made it possible to reduce by one half the fuel oil consumption for the heating power station connected with the network. The environmental air pollution effects produced by the heating power station were, therefore, correspondingly reduced. There were, however, a number of operational difficulties. A description is given of approaches which made it possible to overcome these difficulties with the aid of appropriate control measures.

**N78-11506#** Energy Research and Development Administration, Washington, D.C. Div. of Solar Energy  
**SOLAR PROGRAM ASSESSMENT: ENVIRONMENTAL FACTORS. FUEL FROM BIOMASS**  
Mar 1977 144 p refs

(ERDA-77-47/7) Avail: NTIS HC A07/MF A01

The major environmental issues associated with the further development of biomass production and biomass conversion systems are presented and evaluated with respect to priority. The basic concepts of the technology are reviewed, as are resource requirements. The potential effects of this technology on the full range of environmental concerns (i.e., air and water quality, biosystems, safety, social/institutional structures, etc.) are then discussed in terms of both their relative significance and possible solutions. Only those impacts unique to the solar portion of the technology are discussed in depth. An environmental work plan is presented, listing research and development proposals and a NEPA work plan, which might help clarify and/or alleviate specific environmental problems.

ERA

78A11139 ISSUE 1 PAGE 84 CATEGORY 45 77/00/00  
18 PAGES UNCLASSIFIED DOCUMENT

UTTL: Environmental impact of solid waste and biomass conversion-to-energy processes  
AUTH: A/GAGE, S. J.; B/CHAPMAN, R. A. PAA: A/(U.S. Environmental Protection Agency, Office of Energy, Minerals, and Industry, Washington, D.C.); B/(U.S. Environmental Protection Agency, Industrial Environmental Research Laboratory, Cincinnati, Ohio)  
In: Clean fuels from biomass and wastes: Proceedings of the Second Symposium, Orlando, Fla., January 25-28, 1977. (A78-11120 01-44) Chicago, Ill., Institute of Gas Technology, 1977. p. 465-482.  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENVIRONMENT POLLUTION/\* SOLID WASTES/\*WASTE UTILIZATION  
MINS: / AIR POLLUTION/ COAL UTILIZATION/ ENERGY TECHNOLOGY/ WATER POLLUTION  
ABA: (Author)  
ABS: This paper presents a brief summary of the supply and demand outlook for solid waste and biomass-derived fuels through the year 2020. The majority of the paper is devoted to discussing the potential air, solid, and liquid emissions of environmental consequence from selected systems that are currently commercially available or in the final development stages for the production of useful energy from solid waste. Collectively, these systems are capable of producing steam, electricity, oil, and gas from solid waste or biomass. EPA's program in the 'Waste-as-Fuel' technology development and environment assessment area is also discussed.

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**Intersociety Energy Conversion Engineering  
Conference, 12th, Washington, 1977.  
Proceedings ...c1977**

- 779014 — **Solid Fuels From Biomass: Some Environmental and Economic Considerations**, J. F. Henry, C. W. Vail, *InterTechnology* ..... 90  
779015 — **The Prospects for Fuels from Biomass**, E. S. Lipinsky, *Battelle Columbus Lab.*, Columbus, O. .... 94

**ENERGY AND RESOURCE RECOVERY FROM INDUSTRIAL AND MUNICIPAL SOLID WASTES.**

G.F. Kroneberger, Ed.  
AICHE Symposium Ser., v.73, no.162, 1977.

Sections with articles on Municipal wastes, Preparation types, Pyrolysis types, Power production, Industrial wastes, and Feed lot wastes.

**CORROSION AND DEPOSITS FROM COMBUSTION OF SOLID WASTE**

H. K. Krause, D. A. Vaughan and W. K. Boyd  
J. Of Engineering Power  
Vol. 99 no. 3 July 1977  
p. 449-459

*The utilization of municipal refuse as a supplementary fuel in a coal-fired power-generating plant has been investigated. The preparation of the solid waste consisted of shredding, ferrous metal separation, and size classification. Probes inserted in the superheater section of the stoker-fired boiler were used to collect deposits and to measure the extent of corrosion. The corrosion rates found for refuse-coal mixtures containing up to 42 weight percent refuse approximated those found with the coals and were about an order of magnitude less than those found with refuse alone. The flue gas temperatures were found to be important factors in corrosion. Sulfur oxide emissions of the high-sulfur coal were reduced both by dilution with the refuse and by the action of the alkaline components of the refuse.*

**STACK EMISSION FROM REFUSE-DERIVED FUEL ADMIX TO BOILER COAL.**

J.W. Jackson and J.O. Ledbetter.  
J. Environ. Sci. Health, v.12, no.9, 1977, p.465-73.

Emissions tests were run on a boiler fueled with coal and admixtures of fuel pellets prepared from solid wastes. The tests showed that use of the admixtures significantly lowered the sulfur dioxide and hydrocarbons in the stack gas while raising the lead emissions manyfold.

77A12323# ISSUE 2 PAGE 224 CATEGORY 43  
76/06/00 10 PAGES In RUSSIAN UNCLASSIFIED  
DOCUMENT

UTTL: Some aspects of determining the biomass of pasture areas in deserts and agricultural crops from aircraft and satellites

AUTH: A/RACHKULIK, V. I.; B/SITNIKOVA, M. V. PAA:  
B/(Sredneazlatskii Regional'nyi  
Nauchno-Issledovatel'skii Gidrometeorologicheskii  
Institut, Tashkent, Kazakh SSR)  
Meteorologiya i Gidrologiya, June 1976, p. R2-91. In  
Russian.

MAJS: /\*AGRICULTURE/\*CROP IDENTIFICATION/\*SATELLITE-BORNE  
PHOTOGRAPHY/\*VEGETATION GROWTH

MINS: / BIOMASS ENERGY PRODUCTION/ DESERTS/ GRASSLANDS/  
SPECTRAL SIGNATURES

ABA: S.N.

ABS: The influence of various factors on the spectral luminance factor (SLF) of landscape and vegetation objects and on the color of their photographic image is examined. The influence of the anisotropy of reflected light on the tone of images is studied. Particular attention is given to the effect of the atmosphere on the measurements of the soil's SLF. It is shown that the influence of such factors can complicate significantly the determination of characteristics of vegetation objects from aircraft and satellites. The use of reflection spectra for identifying vegetation types is discussed.

CN-142,177

1976  
REPORT OF THE MIT SOLAR ENERGY WORKING GROUP.  
Feb. 1976. 82p.

Massachusetts Inst. of Tech.  
Working Group on Solar Energy

1975

Power sources, Solar  
Power sources, Wind  
Fuels, Biomass/wastes  
Fuels - Synthesis

TJ Energy development II ... cl976. (Card 2)  
153 covering papers presented at the National  
.E4733 Power Engineering Society meetings."  
pt.2 1. Power resources—Congresses. 2.  
Electric power—Congresses. I. IEEE  
Power Engineering Society. IEEE Power  
Generation Committee. Energy Development  
Subcommittee. II. Series.

Energy From Solid Waste: Appraisal of Alternatives, by Robert C. Sheehan...

77A12233 ISSUE 2 PAGE 228 CATEGORY 44 76/06/00  
9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Photosynthesis as a resource for energy and materials  
AUTH: A/CALVIN, M. PAA: A/(California, University,  
Berkeley, Calif.)

American Scientist, vol. 64, May-June 1976, p.  
270-278. ERDA-supported research.

MAJS: /\*ENERGY SOURCES/\*PHOTOCHEMICAL REACTIONS/\*  
PHOTOSYNTHESIS/\*PLANTS (BOTANY)

MINS: / BIOMASS ENERGY PRODUCTION/ ENERGY CONVERSION/  
INSOLATION/ MEMBRANE STRUCTURES/ SOLAR ENERGY

ABA: S.N.

ABS: Possible ways of using the natural photosynthetic mechanisms in some plants to construct large-scale synthetic systems serving as renewable sources of materials (plastics, fibers) and fuel are examined. The processes of photosynthetic quantum collection in green plants are discussed with special attention to the photosynthetic potential of such plants as sugarcane, kelp, and the rubber tree. The possibilities of controlling natural processes in these plants and improving their energetic efficiency are analyzed. The photochemical quantum conversion in synthetic systems is then considered as a promising mechanism for direct fuel production (H<sub>2</sub>, CH<sub>4</sub>, etc). Recent studies concerning catalysts for these processes are reviewed. Particular attention is given to the problem of creating photochemical cell-membrane, in which hydrogen might be evolved on one side of the membrane and oxygen on the other. A conceptual design of such a membrane analogous to the natural chloroplast membranes is proposed.

78A10623 ISSUE 1 PAGE 42 CATEGORY 44 76/00/00  
872 PAGES UNCLASSIFIED DOCUMENT

UTTL: Conference on Capturing the Sun Through Bioconversion,  
Washington, D.C., March 10-12, 1976. Proceedings  
SAP: \$18

Conference sponsored by ERDA, EPA, U.S. Department of  
Agriculture, FEA, Council on Environmental Quality,  
NSF, U.S. Department of Commerce, DOD, DI, U.S.  
Department of State, et al. Washington, D.C.,  
Bio-Energy Council, 1976. 872 p

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*CONFERENCES/\*ENERGY  
TECHNOLOGY/\*SOLAR ENERGY CONVERSION

MINS: / CHEMICAL FUELS/ DIGESTING/ ECONOMIC FACTORS/  
ENVIRONMENT EFFECTS/ FARM CROPS/ FERTILIZERS/ GASEOUS  
FUELS/ INDUSTRIAL WASTES/ INTERNATIONAL COOPERATION/  
ORGANIC WASTES (FUEL CONVERSION)/ SOCIAL FACTORS/  
TECHNOLOGY ASSESSMENT/ WASTE DISPOSAL

ABA: M.L.

ABS: Several subjects relevant to solar energy  
bioconversion are discussed. General surveys of the  
gas deficit, the ecolog. of bioconversion, and  
congressional perspective are presented. Biomass  
sources are considered with attention to urban and  
industry wastes, agricultural and forestry wastes,  
land and fresh water energy farming, and ocean  
farming. Bioconversion processes and products are  
examined in terms of gaseous fuels, liquid fuels,  
solid fuels, related products, and long-range  
concepts. Overall impacts are analyzed from the  
viewpoint of technology assessment, economic/social  
impacts, environmental impacts, and international  
aspects.

TJ  
310  
.B46  
1977

Berenv, Justin A.

Survey of the emerging solar energy in-  
dustry / compiled and written by Justin A.  
Berenv ; edited by Francis deWinter. --  
1977 ed. -- San Mateo, Calif. : Solar  
Energy Information Services, c1977.  
xi, 405 p. : ill. ; 2° cm.  
Bibliography: p. 362-377.

XII. BIOCONVERSION TO FUELS ..... P200-213.....

77A37668 ISSUE 17 PAGE 2907 CATEGORY 44  
76/00/00 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: EPA's program in environmental research in  
wastes-as-fuel

AUTH: A/HUFFMAN, G. L. PAA: A/(U.S. Environmental  
Protection Agency, Industrial Environmental Research  
Laboratory, Cincinnati, Ohio)  
In: Clean fuels from biomass, sewage, urban refuse,  
agricultural wastes: Proceedings of the Symposium,  
Orlando, Fla., January 27-30, 1976. (A77-37652 17-44)  
Chicago, Institute of Gas Technology, 1976, p.  
397-412.

MAJS: /\*ENERGY POLICY/\*ENVIRONMENT PROTECTION/\*SOLID WASTES  
/\*WASTE UTILIZATION

MINS: / BIOMASS ENERGY PRODUCTION/ ENERGY REQUIREMENTS/  
ENVIRONMENT POLLUTION/ MATERIALS RECOVERY/ RESEARCH  
AND DEVELOPMENT

ABA: M.L.

ABS: The EPA research program concerning wastes as fuel is  
discussed. The four main components of the program  
involve: (1) technical, economic, and environmental  
assessments, (2) waste co-firing with coal, oil, or  
industrial waste, (3) waste co-combustion with sewage  
sludge, and (4) pyrolysis and bioconversion processes.  
It is estimated that the 570 million tons of dry  
combustible solid waste discarded each year by  
municipalities, agriculture, and industry represent an  
energy loss of about 12 per cent of the U.S. energy  
requirement. Due to the geographical dispersion of  
much of this waste, it is thought that perhaps only  
1.5 to 3.0 per cent of the total energy requirement (1  
to 2 quads, i.e., 1 to 2 quadrillion Btu/yr) is  
potentially recoverable, although this percentage  
might increase if fuel prices increase substantially.  
Research projects are described.

77449910 ISSUE 23 PAGE 3996 CATEGORY 44

76/00/00 3967 PAGES UNCLASSIFIED DOCUMENT

UTTL: Sharing the sun: Solar technology in the seventies; Proceedings of the Joint Conference, Winnipeg, Canada, August 15-20, 1976. Volumes 1-10

AUTH: A/BOEER, K. W. PAA: A/(Delaware, University; SES, Inc., Newark, Del.) PAT: A/(ED.) SAP: PRICE OF TEN VOLUMES, \$250.

Conference sponsored by the International Solar Energy Society and Solar Energy Society of Canada Cape Canaveral, Fla., International Solar Energy Society,

1976. Vol. 1, 402 p.; vol. 2, 404 p.; vol. 3, 417 p.; vol. 4, 436 p.; vol. 5, 561 p.; vol. 6, 360 p.; vol. 7, 403 p.; vol. 8, 381 p.; vol. 9, 322 p.; vol. 10, 281 p. (For individual items see A77-48911 to A77-49159)

MAJS: /\*CONFERENCES/\*ENERGY POLICY/\*ENERGY TECHNOLOGY/\*SOLAR ENERGY/\*TECHNOLOGY ASSESSMENT

MINS: / BIOMASS ENERGY PRODUCTION/ COST EFFECTIVENESS/ DOMESTIC ENERGY/ HEAT PUMPS/ HEAT STORAGE/ PHOTOVOLTAIC CONVERSION/ SOLAR COOLING/ SOLAR ENRGY CONVERSION/ SOLAR HEATING/ SOLAR HOUSES

ABA: B.J.

ABS: Attention is given to the roles of international and intergovernmental agencies and ERDA in developing solar energy technologies and policies. Solar energy technology is discussed with consideration of focusing and flat plate collectors, heating and cooling methods, heat pumps, passive systems, retrofit systems, simulation studies, design methods, low, intermediate, and high temperature thermal energy systems, and ocean thermal energy. Photovoltaic conversion, solar energy materials, bioconversion, wind power, agricultural and industrial process applications, solar storage, chemical storage, and solar heating of buildings are also examined. The socio-economic, cultural, and commercial implications of solar energy are discussed.

TA Institute of Environmental Sciences,  
1 Technical division proceedings including  
.I39813 career guidance forum notes. Mt. Prospect,  
1975 Ill., IES [1975]  
v.1 xx, 184 p. illus. 28 cm.

"21st annual  
Calif., April:  
Vol. 2 of 2



ENERGY CONSERVATION THROUGH UTILIZATION OF DOMESTIC WASTES AS FUEL IN HOUSING  
By A. S. Deshpande . . . . . P. 235 . . . . .

CN-141,691

1975  
SOLAR ENERGY FOR EARTH. Harrison J. Killian,  
Gordon L. Dugger, and Jerry Grey, eds.  
(Sponsored by the AIAA Technical Committee on  
Electric Power Systems.) Apr. 21, 1975. 112p.

American Inst. of Aeronautics and  
Astronautics, New York

Power sources, solar  
Insolation  
Power sources, wind  
Power sources, ocean  
Fuels, Biomass/wastes

H-11-13-75

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796  
.A43  
1974

American Society of Mechanical  
Engineers. Research Committee on  
Industrial and Municipal Wastes.  
1974 Combustion fundamentals for waste  
incineration / sponsored by the ASME  
Research Committee on Industrial and  
Municipal Wastes. New York : American  
Society of Mechanical Engineers, c1974.  
xi, 212 p. : graphs ; 29 cm.  
Includes bibliographies and index.  
1. Incineration -- Tables. 2.

TA Institute of Environmental Sciences.  
1 Technical division proceedings including  
.I39813 career guidance forum notes...[1975]  
1975 (Card 2)  
v.1

etc. 2. Vibration. 3. Reliability engi-  
neering. 4. Shock mechanics. 5. Elec-  
tronics. I. Title.

ENERGY RECOVERY FROM MUNICIPAL REFUSE: THE TECHNOLOGY AND ITS RELATIONSHIP TO  
SOCIO-ECONOMIC ENVIRONMENTS  
By C. G. Ganotis . . . . . P223 . . . . .

**A69-13442**

WASTE UTILIZATION FOR PROPULSION ON MANNED SPACE

MISSIONS.

C. David Good, James E. Mars, and Eckart W. Schmidt (Rocket Research Corp., Seattle, Wash.).

Society of Automotive Engineers, Aeronautic and Space Engineering and Manufacturing Meeting, Los Angeles, Calif., Oct. 7-11, 1968, Paper 680717, 8 p.

Members, \$0.75; nonmembers, \$1.00.

Description of the Integrated Waste Management/Rocket Propulsion System. This concept has demonstrated that human waste products can form a useful propellant ingredient, and provides an effective means of removing and sterilizing spacecraft waste. The propellant investigated is formed primarily from raw feces, a metal powder, and a water-soluble oxidizer. The system provides a more sanitary spacecraft environment, since waste will not have to be stored on board the spacecraft, and presents additional performance capability. Since the feasibility of the basic concept has been demonstrated, the next step should be to perform a system study.

ORGANIC WASTES/BIO MASS - DIRECT BURNING

**A79-43574** Gasification of solid waste - Potential and application of co-current moving bed gasifiers. M. J. Groeneveld and W. P. M. van Swaaij (Twente, Technische Hogeschool Enschede, Netherlands). *Applied Energy*, vol. 5, July 1979, p. 165-178. 14 refs.

A review is given of gasification processes for solid fuels with special emphasis on waste gasification. Although the co-current moving bed gasifier has not been under consideration for a long time, it offers interesting possibilities for waste gasification. Some operational data are given. Two potential applications are discussed - gasification of agricultural waste (maize cobs) in the rural areas of Tanzania and municipal waste gasification. (Author)

**A79-44580** Photosynthetic pathway and biomass energy production. D. L. Marzola and D. P. Bartholomew (Hawaii, University, Honolulu, Hawaii). *Science*, vol. 205, Aug. 10, 1979, p. 555-559. 61 refs.

Three plant species are compared in their photosynthetic abilities to provide useful energy in the form of alcohol when grown in a tropical environment. An evaluation of growing requirements, photosynthetic productivity, water use efficiency, energy requirements for production and yields of fermentable substrates is presented for cassava, sugar cane and pineapple. Production records for sugar cane and pineapple grown under a high level of management in Hawaii and cassava grown experimentally in Costa Rica and Jamaica reveal that carbohydrate production per hectare per month decreases from pineapple to sugar cane to cassava. It is pointed out that pineapple is well adapted to the subhumid or semiarid tropics and thus the growing of pineapple for energy conversion is particularly well suited to the exploitation of large areas not currently under cultivation. A.L.W.

**N80-10667#** New Mexico Univ. Albuquerque  
**WASTE UTILIZATION AS AN ENERGY SOURCE. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Jul. 1979**  
Gerald F. Zollars Jul 1979 55 p  
(NTIS/PS-79/0765/2) Avail. NTIS HC \$28.00/MF \$28.00 CSCL 21D

Articles from the international literature concerning the processing of solid and organic wastes for use as an energy source are cited. Industrial, agricultural, and residential wastes are considered as sources of both gaseous and liquid fuels such as methane, methanol, ethanol, and synthane. This bibliography contains 219 entries. GRA

**A79-33233 #** Energy recovery from urban solid waste. G. M. Savage (Cal Recovery Systems, Inc., Richmond, Calif.). In: Brazilian Conference on Energy, 1st, Rio de Janeiro, Brazil, December 12-14, 1978, Proceedings. Volume A. (A79-33212 13-44) Rio de Janeiro, Universidade Federal do Rio de Janeiro, 1979, p. 301-312. 6 refs.

This paper presents the processing techniques that are necessary for the successful recovery and utilization of a low sulfur fuel of medium heating value, namely refuse-derived fuel. Also discussed is a method of upgrading the properties of refuse-derived fuel such that the heating value, moisture content, and ash content are 19,000 KJ/Kg, 17%, and 11%, respectively. (Author)

**A79-32593** Fuel gas production from animal residue. I - Technical perspective. R. L. Wentworth, E. Ashare, and D. L. Wise (Dynatech R/D Co., Cambridge, Mass.). *Resource Recovery and Conservation*, vol. 3, Mar. 1979, p. 343-358. 203 refs. Contract No. EY-76-C-02-2991.

The technology of fuel gas production by anaerobic digestion, has only recently been recognized as a potential alternate energy source. An application which shows promise to furnish energy is the digestion of animal residues. The objective of this review is to develop a detailed technical perspective of the scope of the anaerobic digestion process and the problems and prospects for exploitation to produce methane from animal residues. It is concluded that the technology of anaerobic digestion and the economics of this technology make fuel gas production from selected animal residues meritorious for development. (Author)

**A79-32594** Fuel gas production from animal residue. II - An economic assessment. E. Ashare, R. L. Wentworth, and D. L. Wise (Dynatech R/D Co., Cambridge, Mass.). *Resource Recovery and Conservation*, vol. 3, Mar. 1979, p. 359-386. 20 refs. Contract No. EY-76-C-02-2991.

A mathematical model is used to determine the optimum process conditions and economics for the production of fuel gas by anaerobic digestion of animal residues. In the situation considered, a slurry of animal residues (manure) from a 10,000 head beef feedlot is fed to a digester where anaerobic microorganisms convert the organic matter to methane and carbon dioxide. The feedlot was calculated to produce 8500 cu m/day of methane at a cost of \$4.90/GJ or \$0.183/cu m, with a total capital requirement of \$1,165,000, a total capital investment of \$694,000 and an average annual net operating cost of \$370,000. An analysis of the sensitivity of the unit gas cost to feedlot size and type, digester type and operating conditions, and economic input data indicates areas in the anaerobic digestion system design where reasonable improvements may be expected in order to produce gas at a more economically feasible cost. A.L.W.

79N78399# CATEGORY 2B RPT#: DOE/CS/01015-2 CNT#: EG-77-S-09-1015 79/03/00 20 PAGES UNCLASSIFIED DOCUMENT

UTTL: Increasing the biomass production of short rotation coppice forests TISP: Progress Report  
AUTH: A/STEINBECK, K.; B/BROWN, C. L.  
CORP: Georgia Univ., Athens. CSS: (School of Forest Resources.) AVAIL:NTIS  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*FORESTS/\*GENETICS/\*TREES (PLANTS)  
MINS: / BOTANY/ CALORIC REQUIREMENTS/ PLANT ROOTS/ SEEDS

## CHEMOSYNTHETIC PRODUCTION OF BIOMASS: AN IDEA FROM A RECENT OCEANOGRAPHIC DISCOVERY. H. W. Jannasch.

*Oceanus*, vol 22, no 4, Winter 1979/80, p. 59-63.

The generation of biomass from carbon dioxide (CO<sub>2</sub>) is called "primary production" because it is the first, fundamental step in turning inorganic material into organic compounds and cell constituents. This "photosynthetic" reduction of CO<sub>2</sub> is carried out by plants that use light as the source of energy. All life depends on this primary production and is thus maintained by solar energy. In turn, the formation of animal biomass from plant materials is termed "secondary production." It is, however, rather a conversion, whereby some of the organic matter is oxidized back to CO<sub>2</sub> to provide the necessary energy. Chemosynthesis is another type of primary production of organic matter.

## METHANE PRODUCTION FROM BIOMASS AND AGRICULTURAL RESIDUES, Donald L. Wise, Ralph L. Wentworth and Edward Ashare

*Industrial & Eng. Chem., Prod. R&D*, v.18, no.2, June 1979, p.150

## EFFICIENCY IMPROVEMENTS IN BIOENERGY CONVERSION SYSTEMS. C. W. Lewis.

*Energy Conversion and International Journal*, vol 19, no 3, 1979, p. 125-131.

**Abstract**—A discussion of the main bioenergy conversion systems is presented, including their respective efficiencies and how these are being improved. The concept of net energy analysis is also introduced as a guideline for determining system efficiencies and process selection.

Combustion remains the most efficient conversion method for dry organic matter, with anaerobic digestion and ethanolic fermentations preferred for biomass containing a high percentage of water. The efficiencies of gasification, pyrolysis and the longer term proposition of biophotolysis are also covered.

While most of the data presented accrues from industrialized, intensive systems it is envisaged that bioenergy will make its greatest impact within the nations of the Third World.

High-Grade Fuels from Biomass Farming: Potentials and Constraints. by P.B. Weisz & J.F. Marshall

Science, Vol. 206, No. 4444, 5 October 1979, p. 24-29

*Summary.* The key parameters controlling the productivity and the cost of net high-grade fuel from a system for biomass agriculture and conversion are analyzed. Performance depends sensitively on a "symbiotic" interaction between agronomy and technology. The conditions for obtaining net productivity and costs are explored for U.S. grain alcohol as a reference point. Currently practiced technology consumes more high-grade fuel than it generates. Some potentials and constraints for future systems, including use of other plant species and conversion systems, are explored.

BIOMASS: THE SELF-REPLACING ENERGY RESOURCE.  
Gene Bylinsky.

Fortune, vol 100, no 6, September 24, 1979.  
p. 78-79, 81

Trees, kelp, and other forms of organic matter can provide heat—or be transformed into gas, oil, or alcohol. Wood has the most immediate promise.

BIOMASS REFINERY TURNS CROP WASTES INTO FUEL, by  
William C. Mann Sr.  
Popular Science, vol. 214, no. 4, April 1979, p.78-80.

**There may be a cheap, easy  
way to tap the solar energy  
locked up in plant cellulose**

5429 (CONF-771175—, pp 1.3.1-1.3.18) Use of ethanol from biomass as an alternative fuel in Brazil. Heiland, H.; Czaczkie, H.W.; Pinto, N. (Volkswagen do Brasil, Sao Paulo) Jul 1978. From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol

Present results from shown that ethanol is an attractive solution to the fuel problem in the future of Brazil. At this time, ethanol is industrially produced from produce on a broad basis. Sugar can and manioc are the self-regenerating energy sources with optimum utilization and of the inexhaustible solar radiation. However, further improvements are necessary to provide for energy balance of the individual process steps.

5430 (HCP/T4101—03) Biomass-based alcohol fuels: the near-term potential for use with gasoline. Park, W.; Price, G.; Salo, D. (Mare Corp., McLean, VA (USA) METREK Div.) Aug 1978. Contract EG-77-C-01-4101. 84p. Dep NTIS. PC A05/MF A01.

This report serves as an introduction to the requirements and prospects for a nationwide alcohol-gasoline fuel system based on alcohols derived from biomass resources. Technological and economic factors of the production and use of biomass-based methanol and ethanol fuels are evaluated relative to achieving 5 or 10 percent alcohol-gasoline blends by 1990. It is concluded the maximum attainable is a nationwide 5 percent methanol or ethanol-gasoline system replacing gasoline by 1990. Relative to existing gasoline systems, costs of alcohol-gasoline systems will be substantial.

ENERGY FROM AGRICULTURE, by Leon G. Mears.

Environment, vol. 20, no. 10, December 1978, p.17-20.

BRAZIL'S NATIONAL ALCOHOL PROGRAM ("Alcohol is solar energy in liquid form") has evolved into a major government-industry effort aimed at replacing a large share of the country's petroleum imports with alcohol produced from sugarcane, manioc, and other plants. This comprehensive program has been given a boost by low world sugar prices that recently resulted in the Brazilian government's decision to allocate the sugarcane equivalent of 2.1 million metric tons of sugar to the manufacture of alcohol between June 1, 1978, and May 31, 1979.

BIOMASS IS BIG- BUT COULD BE BIGGER, by Dr. Christopher Lewis.

New Scientist, vol. 181, no. 1140, February 1979, p.316-318.

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There is nothing new in man extracting energy from biological processes and even now in many Third World countries biomass is essential for people's transport, comfort and cooking. But the world's concern with efficient use of resources and recycling of waste could give biomass a comeback—  
even in Britain

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AIChE Symposium Series, v.74, no.181. 1978

BIOCHEMICAL ENGINEERING: RENEWABLE SOURCES OF ENERGY AND CHEMICAL FEEDSTOCKS. John H. Nystrom and Stanley N. Barnett, eds. (Papers presented at Symposium on Biochemical Sources of Energy held at 2nd Pacific Chemical Engineering Congress, Denver, Colo., Aug.1977 and Symposium on Biological Sources of Energy & Chemical Feedstocks held at 80th National AIChE Meeting, Atlanta, Ga., Feb.1978).

American Institute of Chemical Engineers  
Symposium on Biochemical Sources  
of Energy Aug.  
Symposium on Biological Sources  
of Energy & Chemical Feedstocks Feb.  
1977  
1978

A79-46311 Small scale gasification of biomass - The case of corn cob gasifiers. O. C. Doering, III, T. J. O'Hare, and R. M. Peart (Purdue University, West Lafayette, Ind.). (University of Illinois and U.S. Department of Energy, Midwest Energy Conference, Chicago, Ill., Nov. 19-21, 1978.) Energy (UK), vol. 4, Apr. 1979, p. 235-248. 7 refs.

TJ Energy Technology Conference, 5th, Washington, D.C., 1978.  
153  
.E4787 Energy technology V : challenges to  
1978 technology : proceedings of the fifth Energy Technology Conference, February 27-March 1, 1978, Washington, D.C. / edited by Richard P. Hill. -- Washington : Government Institutes, 1978.  
xiii, 1063 p. : ill.

PETROLEUM PLANTATIONS

Melvin Calvin, Associate Director, Laboratory of Chemical Biodynamics

p. 687

ADVANCED PROCESSES FOR MORE EFFICIENT USE OF FOREST PRODUCTS RESIDUAL MATERIAL

Delmar R. Raymond, Manager, Energy Department, Fiber Products R&D, Weyerhaeuser Company

p. 907

MODERN TECHNOLOGY FOR RECOVERING ENERGY AND MATERIALS FROM URBAN WASTES--ITS APPLICABILITY IN DEVELOPING COUNTRIES, by M.A. Connor.

Conservation & Recycling, vol. 2, no. 1, 1978, p.85-93.

Abstract — Three developing countries, Kenya, India and South Africa, very different as far as population density, degree of urbanization, extent of industrialization and availability of domestic energy resources are concerned, were selected for particular study. For each of these countries the energy supply, use and distribution patterns, as well as current refuse disposal practices are described. The future use of various refuse treatment methods, particularly those involving energy recovery, in each of these countries is examined. The conclusions drawn for the above three countries are generalised and applied to developing countries as a group. It is concluded that the applicability of modern refuse treatment technology in such countries is limited.

NASA-CP-2036 pt. 2

N78-29063\*# National Aeronautics and Space Administration  
Langley Research Center, Langley Station, Va  
PROGRESS ON COAL-DERIVED FUELS FOR AVIATION  
SYSTEMS c28

Robert D. Witcofski In its CTOL Transport Technol. 1978 1978  
p 927-950 refs (For primary document see N78-29046 20-01)  
Avail NTIS HC A18/MF A01 CSCL 21D

The results of engineering studies of coal-derived aviation fuels and their potential application to the air transportation system are presented. Synthetic aviation kerosene (SYN JET-A), liquid methane (LCH4) and liquid hydrogen (LH2) appear to be the most promising coal-derived fuels. Aircraft configurations fueled with LH2, their fuel systems, and their ground requirements at the airport are identified. Energy efficiency, transportation hazards, and costs are among the factors considered. It is indicated that LCH4 is the most energy efficient to produce, and provides the most efficient utilization of coal resources and the least expensive ticket as well. JMS

## FUELS FROM BIOMASS: INTEGRATION WITH FOOD AND MATERIALS SYSTEMS

E. S. Lipinsky

Science

Vol. 199 no. 4329 February 10, 1978

p. 644-650

*Summary.* The development of fuels from biomass can lead naturally to dispersed facilities that incorporate food or materials production (or both) with fuel production, forming adaptive systems that can be modified to meet evolving needs and constraints. The technology that is appropriate to each system needs to be worked out, taking into account associated food and materials opportunities in order to decrease the ultimate cost of energy delivered to the consumer. I analyze possible systems based on sugarcane, corn, and guayule.

## BIOMASS: A GROWING ENERGY SOURCE

Philip M. Kohn

Chemical Engineering

Vol. 85, no. 3, January 30, 1978,

p. 58-62.

Crops, as well as agricultural and animal wastes, promise to become increasingly important fuel sources.

The materials may provide energy supplies via chemical conversion, anaerobic digestion and combustion.

AIChE Symposium Series, 7.74, no.172 1978

Fuels, Biomass/wastes

FOOD, PHARMACEUTICAL AND BIOENGINEERING - 1976/87

George I. Tsao, ed.

American Inst. of Chemical Engineers

- ANNUAL CROPS: A RESOURCE FROM SOLAR ENERGY. p.73.....Dw  
PRODUCT INHIBITION OF TRICHODERMA VIRIDE CELLULASE p.77.....  
..... M. Mangat and  
ENZYMATIC HYDROLYSIS OF CELLULOSIC WASTE: THE STATUS OF THE PRC  
NOLOGY AND AN ECONOMIC ASSESSMENT ..... p.82.....  
..... John M. Nystrom, Robert K. Andren, and A  
ENZYMATIC HYDROLYSIS OF CELLULOSIC WASTE MATERIALS p.89.....  
..... Pertti Markkanen, Matti Linko, and P  
ENZYME APPLICATIONS IN FOOD, PHARMACEUTICALS, AND OTHER INDUSTR  
TRIAL APPLICATIONS OF CELLULOSE ..... p.93..... H  
FERMENTATION OF BARLEY STRAW BY TRICHODERMA VIRIDE: RECOVERY,  
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..... p.110... E. C. Clausen, O. C. Sitton, an  
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OF SINGLE-CELL PROTEIN FROM WOOD. p.126.....  
IMPROVEMENT OF SCP PRODUCTION BY PRETREATMENT OF MESQUITE WOOL  
..... p.136..... David U. Wilson and

SOLID WASTE AS A REPLACEMENT ENERGY SOURCE.

A. William Morgenroth

ASHRAE Journal, Vol. 20, No. 6, June 1978,

p. 44-46.

*With natural gas shortages, the rising costs of electricity and oil, and the disadvantages associated with coal, the use of solid waste as fuel should be given serious consideration. The author describes his company's experience investigating and actually using pyrolytic heat recovery.*

## FUEL CROP BREEDING

F. Thomas Ledig and Daniel I. H. Linzer

Chemtech

Vol. 8, no. 1, January 1978,  
p. 18-27.

The best way to store sunshine is in plants. When are we going to decide to breed them for that specific purpose? Ledig and Linzer provide needed background.

## SEEKING "SUPER HYACINTHS"

T.N. Cooley and D.F. Martin.

J. Environ. Sci. Health, v. A13, no. 7, 1978, p. 469-79.

Three ecotypes, based on size, of water hyacinth, *Eichhorina crassipes* (Mart.) Solms, a serious, persistent aquatic weed, were used to evaluate its possible utilization as sewage treatment plant and as a fuel precursor. Rates of removal of nitrogen and phosphorus for normal water hyacinths have been reported in the past to be 3.4 and 0.43 kg/ha/day, respectively. Metal content of the plant is reported for iron, copper, cobalt, potassium, magnesium and calcium and the metal distribution between pseudolamina, petioles, and roots has been shown to be negatively correlated with  $-\log K_{sp}$  for the metal carbonate for small and medium-sized plants but not correlated for the super-hyacinths. The concentration of iron appears to be correlated with plant ecotype which occur in the environment at different dissolved oxygen concentrations. The use of the super-hyacinth, as opposed to the normal-sized plant, is discussed as a future fuel source by means of anaerobic digestion.

79A40390# ISSUE 17 PAGE 3327 CATEGORY 85  
78/00/00 15 PAGES UNCLASSIFIED DOCUMENT

- UTTL: Considerations in the design of a shredded municipal refuse burning and heat recovery system
- AUTH: A/ROCHFORD, R. S.; B/WITKOWSKI, S. J. PAA:  
B/(Badcock and Wilcox Co., North Canton, Ohio)  
In: Energy Conservation through waste utilization;  
Proceedings of the Eighth Biennial National Waste  
Processing Conference, Chicago, Ill., May 7-10, 1978.  
(A79-40386 17-85) New York, American Society of  
Mechanical Engineers, 1978, p. 45-56; Discussion, p.  
57, 58; Authors' Reply, p. 58, 59.
- MAJS: /\*ENERGY SOURCES/\*RECYCLING/\*SOLID WASTES/\*SYSTEMS  
ENGINEERING/\*THERMAL ENERGY/\*WASTE DISPOSAL/\*WASTE  
ENERGY UTILIZATION
- MINS: / BOILERS/ CHEMICAL ANALYSIS/ COMBUSTION PRODUCTS/  
COST EFFECTIVENESS/ ENERGY TECHNOLOGY/ SHREDDING  
C.K.D.
- ABA: C.K.D.
- ABS: Factors affecting the design of a system to burn  
shredded municipal solid waste (MSW) and recover its  
heat values are discussed. A system based on a modern  
spreader stoker fired boiler burning refuse derived  
fuel (RDF) as a primary fuel is considered. The  
influence of refuse analysis on the size and  
performance of refuse burning equipment is discussed.  
Special attention is given to selection of refuse feed  
systems and optimization of steam generating  
equipment. Factors affecting the selection and  
installation of electrostatic precipitators are  
considered, and systems for handling bottom ash and  
fly ash are described.

## SOLAR ENERGY: UNSUNG POTENTIAL FOR WIND AND BIOMASS W.D.M.

Science, vol. 200, no. 4342, May 12, 1978, p. 636

Government-sponsored studies seem to be converging toward the conclusions that solar power could supply substantially more than 1 to 2 percent of the country's energy by 2000, and that the most promising types of solar energy are ones that have been largely unheralded.

REFUSED-DERIVED FUEL WINS OUT OVER OIL AND COAL AT  
NEW INDUSTRIAL POWER PLANT

Bob Schwieger

Power, vol 122, no. 5, May 1978, p. 33-38

Hooker Chemical Corp took a precedent-setting step for US industry last month when it formally began construction of a refuse-fired power plant to replace aging oil- and coal-burning boilers at its Niagara Falls (NY) manufacturing complex (Figs 1, 2). Though many industrial companies have recognized for years that they could burn municipal and commercial refuse to produce process steam and electricity, up to now they have all shied away.

78A4181B ISSUE 18 PAGE 2291 CATEGORY 44  
78/00/00 21 PAGES UNCLASSIFIED DOCUMENT

UTTL: Crop residues as energy sources - Assessing the cost and energy feasibility of direct firing

AUTH: A/STARR, P. J.; B/FINN-CAPLSON, D. W.; C/NACHTSHEIM, C. J. PAA: A/(Minnesota, University, Minneapolis, Minn.)

Energy Sources, vol. 3, no. 3-4, 1978, p. 353-373.  
Research sponsored by the Minnesota Pollution Control Agency and University of Minnesota.

MAJS: /BIOMASS ENERGY PRODUCTION/ FARM CROPS/ FEASIBILITY ANALYSIS/ WASTE UTILIZATION

MINS: / COAL UTILIZATION/ COST ESTIMATES/ DEMAND (ECONOMICS) / ENERGY TECHNOLOGY/ MINNESOTA

ABA: J.M.B.

ABS: The collection, shipping and preparation of crop residues for direct firing in currently operational coal-fired utility boilers may provide a significant energy source in some areas of the U.S. In particular, it is estimated that crop residues could supply more than 40% of the state of Minnesota's energy demand. For typical power plants, a low-cost strategy would incur an expense of \$0.34 per million Btus for delivered residue and an overall system operation cost of \$0.57 per million Btus. These cost figures compare well with the expenses involved in coal firing of the boilers.

79N24468# ISSUE 15 PAGE 2003 CATEGORY 44 RPT#:  
CSIR-SR-WAT-54 ISBN-0-7588-1399-7 78/00/00 34 PAGES  
UNCLASSIFIED DOCUMENT DCAF F012830

UTTL: Energy recovery from domestic refuse by means of incineration and pyrolysis

AUTH: A/NELL, J. H.

CORP: National Inst. for Water Research, Pretoria (South Africa). AVAIL.NTI5 SAP: HC A03/MF A01

MAJS: /\*INCINERATORS/\*PYROLYSIS/\*SOLID WASTES/\*TECHNOLOGY ASSESSMENT/\*WASTE ENERGY UTILIZATION

MINS: / AIR POLLUTION/ COSTS/ MATERIALS RECOVERY/ POLLUTION CONTROL/ TECHNOLOGY UTILIZATION/ WASTE DISPOSAL

ABA: Author

ABS: The present status of energy recovery from domestic refuse by means of incineration and pyrolysis is reviewed. Technological and cost aspects are discussed, while examples of plants presently in operation are given. It is concluded that energy recovery from domestic refuse has certain advantages over conventional disposal methods with respect to land requirements, pollution control, recycling of valuable materials, recovery of energy and costs. However, the disadvantages, especially the high capital expenditure required to comply with strict air pollution regulations, necessitate an observation period of five to eight years in order to assess the applicability of the process for local conditions.

TJ Energy Technology Conference, 5th, Washington, D.C., 1978.

153  
.E4787  
1978

Energy technology V : challenges to technology : proceedings of the fifth Energy Technology Conference, February 27-March 1, 1978, Washington, D.C. / edited by Richard F. Hill. -- Washington : Government Institutes, 1978.

xiii, 1063 p. : ill.

1. Power (Mechanics)—Congresses.

NEW CONCEPTS IN WASTE UTILIZATION AND BIOMASS  
Paul F. Bente, Executive Director, The Bio-Energy Council

p. 196

INDUSTRIAL WASTES TO ENERGY

Dr. Jerome F. Collins, Chief, Alternative Materials, Utilization Branch, Department of Energy

ENERGY FROM URBAN WASTE

J. F. Bernheisel, Manager, Demonstration Programs, National Center for Resource Recovery, Inc.

**A79-47072 European technology for obtaining energy from solid waste.** Edited by D. J. De Renzo. Park Ridge, N.J., Noyes Data Corp. (Energy Technology Review, No. 34; Pollution Technology Review, No. 54), 1978. 299 p. \$39.

Western Europe is definitely the leader in the field of energy recovery from the combustion of municipal solid waste. For each country a national overview is given, followed by a description of particularly significant developments and case histories: household sorting and collection methods, combustors, furnaces, incinerators, air pollution control, latest plant designs, operation and economics. The case studies concern Toulouse-Le Mirail, France; Geneva-Cheneviers, Switzerland; Korsor, Denmark; Munich, Germany; and Brive, France. A summary of key findings is included along with maps and a tabulation of the European systems. S.D.

**A79-40744 # Potential for biomass utilization in Canada.** R. Overend (Department of Energy, Mines and Resources, Renewable Energy Resources Branch, Ottawa, Canada). In: Chemistry for energy: Proceedings of the Symposium, Winnipeg, Manitoba, Canada, June 5-7, 1978. (A79-40736 17-44) Washington, D.C., American Chemical Society, 1979, p. 165-182. 25 refs.

A biomass technology and resource assessment chart is presented and discussed. The chart consists of five problem areas: resource, harvest and transport, conversion technology, transport, and end use. The present state of knowledge of some of the items in the problem areas are discussed in order to illustrate some of the R&D opportunities in biomass energy. Resources are examined relative to forestry, agriculture, and agro-forestry. Extensive effort is required to improve biomass harvesting and transportation. Conversions technologies and possible developments in biomass energy are considered, along with biomass and the CO<sub>2</sub> problem. Since there is a large biomass resource available in the Canadian forest, biomass will play a vital role complementary to other resources. S.D.

**A78-37172 Waste pyrolysis - Alternative fuel source.** L. M. Puce. *Power*, vol. 122, June 1978, p. 101-103.

Four means for producing alternative fuel sources via waste pyrolysis are considered. In the first, low-Btu gas is produced by waste pyrolysis in a refractory-lined rotary kiln. The second is based on solid waste passing through a gasifier, and then through stages of drying, pyrolysis, and combustion. This also yields a low-Btu gas. The third method produces a medium-Btu gas by using oxygen reacting with char residue to produce hot gases which pyrolyze incoming waste. In the fourth technique, a flash-pyrolysis process produces a high-Btu liquid fuel. S.C.S.

UTTL: The Garrett Energy Research biomass gasification process

AUTH: A/MIKESSELL, R. D.; B/HOANG, D. C.; C/GARRETT, D. E.  
PAA: C/(Garrett Energy Research and Engineering Co., Inc., Ojai, Calif.)

In: Intersociety Energy Conversion Engineering Conference, 13th, San Diego, Calif., August 20-25, 1978. Proceedings, Volume 1. (A79-10001 01-44)

Warrendale, Pa., Society of Automotive Engineers, Inc., 1978, p. 239-244.

WAJS: /\*BIOMASS ENERGY PRODUCTION/\*FURNACES/\*GASIFICATION/\*ORGANIC WASTES (FUEL CONVERSION)

MINS: / ENERGY TECHNOLOGY/ FECS/ HEARTH/ MOISTURE CONTENT/ PILOT PLANTS/ PYROLYSIS

ABA: (Author)

ABS: A multiple hearth furnace is used for the gasification of biomass materials. Drying, pyrolysis, steam/char gasification, and combustion steps are carried out, each on its own hearth. Partially dry biomass feed is contacted on the top hearth of the furnace with hot flue gas from the combustion stage. The steam contained in the flue gas leaving the top hearth is condensed in the jacket of a vacuum pre-dryer. The nearly dry feed material on the top hearth is dropped onto the pyrolysis hearth where it is pyrolyzed in the absence of oxygen at about 750 C. The pyrolysis gas is passed through a condenser which removes the steam and tar. Some of the pyrolytic carbon is steam-gasified at about 850 C in an external lift tube, while the remainder is burned on the combustion hearth. The ash drops onto the ash cooling hearth where it exchanges heat with the incoming combustion air.

WASTE PYROLYSIS: ALTERNATIVE FUEL SOURCE.

Leslie M. Puce

Power, Vol. 122, No. 6, June 1978, p.101-103

With landfill-disposal and fossil-fuel costs rising, and stricter pollution standards being implemented, pyrolysis processes may be one of the answers to the problem of what to do with our solid waste

A79-46312

Farm-scale generation of bio-gas. P. R. Goodrich, R. J. Gustafson, K. L. Hauer (Minnesota, University, St. Paul, Minn.), and V. Larson. (University of Illinois and U.S. Department of Energy, Midwest Energy Conference, Chicago, Ill., Nov. 19-21, 1978.) *Energy* (UK), vol. 4, Apr. 1979, p. 249-261.

A farm-scale research and demonstration digester has been constructed, operated and monitored on a private medium-sized swine farm. Materials handling problems have been studied. Bio-gas from the digester is used in a motor generator set to be integrated into the farmstead energy system. The digester has been monitored to determine operational characteristics, amount of energy produced and efficiency of energy production. (Author)

ENERGY SAVINGS FROM SOLID URBAN WASTE DISPOSAL SYSTEMS IN ITALY

Angelo Saullo

*Energy*, Vol. 3, no. 2, April 1978, p. 219-234

Abstract—The economical recovery of solid urban waste has been made more urgent by the growing scarcity of energy and raw materials resources. Some of the systems used to dispose of urban waste allow, directly or indirectly, the recovery of energy. We examine these technologies with reference to Italy.

NASA CP-2042 Fuels, Biomass/wastes 1978

EMERGING ENERGY ALTERNATIVES FOR THE SOUTHEASTERN STATES. Elias K. Stefanakos, ed. (Symposium sponsored by DOE, LARC and NCA&TSU. Held NCA&TSU, Mar. 31, 1978). June 1978. 152p.

Department of Energy,  
Washington, D.C.

NASA,

Langley Research Center  
North Carolina Agricultural and Technical  
State Univ., Greensboro, N.C.

WOOD ENERGY - COMMERCIAL APPLICATIONS OUTSIDE THE WOOD INDUSTRY  
Robert P. Kennel p. 27

IP  
762  
.D47

De Renzo, D. J.

Energy from bioconversion of waste materials / Dorothy J. De Renzo. Park Ridge, N.J. : Noyes Data Corp., 1977.

ix, 223 p. : ill. ; 25 cm. (Energy technology review ; no. 11) (Pollution technology review ; no. 33) \$32.00

Includes index. Bibliography: p. 222-223.

1. Gas-producers. 2. Methane. I. Title. II. Series.

TD  
794.5  
.E53

Energy and resource recovery from industrial and municipal solid wastes / G. F.

Kroneberger, editor. — New York : American Institute of Chemical Engineers, 1977.

223 p. : ill. ; 28 cm. — (AIChE symposium series ; no. 162, v. 73, 1977)

1. Recycling (Waste, etc.)—Addresses, essays, lectures. 2. Waste products as fuel—Addresses, essays, lectures. 3. Refuse as fuel—Addresses, essays, lectures.

TH  
7140  
.Y38

Yaverbaum, Lee

Fluidized bed combustion of coal and waste materials / Lee Yaverbaum. — Park Ridge, N.J. : Noyes Data Corporation, 1977.

xii, 268 p. : ill. ; 25 cm. — (Pollution technology review ; no. 35) (Energy technology review ; no. 15)

Bibliography: p. 263-267.

ISBN 0-8155-0671-6

1. Combustion. 2. Coal. 3. Fluidized-bed furnace. I. Title. II. Series. III. Series: Energy technology review ; no. 15. 621.4025

TJ 163.2 .S96 1977 **Symposium on Fuels and Energy from Renewable Resources, Chicago, 1977.**  
**Fuels and energy from renewable resources / Symposium on Fuels and Energy from Renewable Resources, 174th national meeting of the American Chemical Society, Chicago, August 1977 ; edited by David A. Tillman, Kyosti V. Sarkanen, Larry L. Anderson. New York : Academic Press, c1977.**  
 x, 342 p. : ill. ; 24 cm.

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- How Much Energy Do We Really Need 1  
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- Uncounted Energy: The Present Contribution of Renewable Resources 23  
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- Thermal Analysis of Forest Fuels 93  
*Fred Shafizadeh and William F. DeGroot*
- Conversion of Stagnated Timber Stands to Productive Sites and Use of Noncommercial Material for Fuel 115  
*John I. Zerbe*
- The Pyrolysis-Gasification-Combustion Process: Energy Effectiveness Using Oxygen vs. Air with Wood-Fueled Systems 141  
*David L. Brink, George W. Faltico, and Jerome F. Thomas*
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- Prospects for Co-Generation of Steam and Power in the Forest Products Industry 197  
*L. N. Johanson and K. V. Sarkanen*

- Feasibility of Utilizing Crop, Forestry, and Manure Residues to Produce Energy 213  
*J. A. Alich, Jr., F. A. Schooley, R. K. Ernest, K. A. Miller, B. M. Louks, T. C. Veblen, J. G. Witwer, and R. H. Hamilton*
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- Bagasse as a Renewable Energy Source 249  
*William Arlington*
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*William F. Lalor*
- The Design of a Large-Scale Manure/Methane Facility 275  
*Frederick T. Varani, John Burford, and Richard P. Arber*
- Energy Recovery from Municipal Wastes 289  
*James R. Greco*
- Energy from Waste Materials—1977 Overview 303  
*M. D. Schlesinger*
- Discussion of Critical Issues 333  
*The Editors*

#### GARBAGE - REFUSE OR RESOURCE? Mort LaBreque

Popular Science, vol. 210, no. 6, June 1977,  
 page 95-98, 166-167

Our national trashpile could be a rich source of precious materials, plus fuel for power generation.

78A24763 ISSUE 8 PAGE 1419 CATEGORY 44  
77/00/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy from municipal refuse  
AUTH: A/SCHULZ, H. W. FAA: A/Dyneecology, Inc.; Columbia University, New York, N.Y.  
In: Energy technology IV: Proceedings of the Fourth Conference, Washington, D.C., March 14-16, 1977. (A78-2475) (08-44) Washington, D.C., Government Institutes, Inc., 1977. p. 427-433.  
MAJS: /\*PYROLYSIS/\*RECYCLING/\*SOLID WASTES/\*WASTE UTILIZATION  
MINS: / BIOCHEMISTRY/ BIOMASS ENERGY PRODUCTION/ ECONOMIC ANALYSIS/ ENERGY SOURCES/ ENERGY TECHNOLOGY/ ETHYL ALCOHOL  
ABA: J.M.B.  
ABS: Techniques for recovering energy and recycling materials from municipal solid waste are discussed. Although such recovery schemes are generally capital intensive, the rising cost of landfills and fuel price increases may make them economically attractive in the near future. Emphasis is placed on waterwall incinerators (producing steam) and the development of refuse-derived fuel (RDF). Air-classified RDF products, for example, have been employed with coal in existing plants, a concept which involves low capital investment. RDF production based on paper-making technology is also mentioned. In addition, attention is given to flash pyrolysis of waste to yield combustible liquids, and biochemical conversion processes to yield animal feed or ethyl alcohol.

### REGIONAL ENERGY AVAILABILITY FROM CONVERSION OF SOLID WASTES.

Donald Garofalo and Kenneth R. Martin

Photogrammetric Engineering and Remote Sensing, vol. 43, no. 6, June 1977, pp. 727-738

Remote sensing delineates urban and rural solid organic wastes, which can be used to generate electricity.

78A10624 ISSUE 1 PAGE 42 CATEGORY 44 77/00/00  
164 PAGES UNCLASSIFIED DOCUMENT

UTTL: European Seminar on Biological Solar Energy Conversion Systems, Grenoble, France, May 9-12, 1977. Proceedings SAP: \$11.00  
Seminar sponsored by CNRS, COMES, CEA, DGRST, and INRA, London. International Solar Energy Society, 1977. 164 p.  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*CONFERENCES/\*SOLAR ENERGY CONVERSION  
MINS: / AGRICULTURE/ ALGAE/ BIOCHEMISTRY/ ENERGY CONVERSION EFFICIENCY/ GENETICS/ HYDROGEN PRODUCTION/ NITROGEN/ ORGANIC WASTES (FUEL CONVERSION)/ PHOTOSYNTHESIS/ SEWAGE TREATMENT/ WASTE DISPOSAL  
ABA: W.L.  
ABS: Agriculture and plant biochemistry topics relevant to biological solar energy conversion systems are discussed. Besides several studies of photosynthesis, research investigations on plant protein, nitrogenase, glycerol production, hydrogen production, methane fermentation, lignocellulose degradation, and electron transfer are reported. Other research deals with plant selection, silvicultural biomass plantations, the use of plant residues to produce energy, and algae characteristics. Also reported are the design of a solar greenhouse, an analysis of post-agricultural energy, a study of village and farm energy systems, and a study of an ocean food and energy farm project.

CN-150,487

1977

TOWARD ENERGY INDEPENDENCE. Blake W. Corson, Jr., LARC.

Virginia Engineer, v.27,  
no.8, p.15-18.

Aug.  
1977

Fuels, Biomass & wastes

Methanol

Fuels, Alternative

78A18674 ISSUE 5 PAGE 827 CATEGORY 44 77/12/00  
7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Constraining the energy gobler --- Industrial waste heat recovery techniques  
AUTH: A/KAPLAN, G.  
IEEE Spectrum, vol. 14, Dec. 1977, p. 26-32.  
MAJS: /\*COMBUSTION CONTROL/\*ENERGY CONSERVATION/\*FUEL CELLS  
/\*INDUSTRIAL WASTES/\*WASTE ENERGY UTILIZATION  
MINS: / CLEAN ENERGY/ ELECTRIC GENERATORS/ ENERGY CONVERSION  
EFFICIENCY/ ENERGY TECHNOLOGY/ INDUCTION HEATING/  
SYSTEMS ENGINEERING/ THERMAL ENERGY  
ABA: J.M.B.  
ABS: Techniques for recovering industrial waste heat are reviewed; precisely controlled combustion processors, the use of a single system to generate both electric power and process heat, surveillance of energy consumption in industrial plants, the improvement of motors and inductive heating equipment, and applications of the fuel-cell energy conversion process are considered. Precise, durable oxygen sensing devices to facilitate combustion control are described, and the costs of energy management schemes involving personal surveillance, minicomputers, or full-scale monitoring systems are compared. Series-parallel combinations of a large number of fuel cells are suggested as a nonpolluting on-site industrial power- and heat-generating option for the future.

ORIGINAL PAGE IS  
OF POOR QUALITY

1977  
CN-142,745  
TRACE ELEMENT FRACTIONATION IN AEROSOLS EMITTED FROM MUNICIPAL INCINERATORS. Jag J. Singh, LaRC. (Presented at Fall Meeting of American Physical Society held at Miami Beach, Fla., Nov.21-21,1977). 1977. 9p.& illus. (Preprint).

NASA,  
Langley Research Center  
American Physical Society

Aerosols  
Incinerators

Air pollution  
Fuels, Biomass/wastes

77A48712 ISSUE 23 PAGE 3980 CATEGORY 44  
77/00/00 4 PAGES UNCLASSIFIED DOCUMENT

UTTL: Solid fuels from biomass - Some environmental and economic considerations  
AUTH: A/VAIL, C. W.; B/HENRY, J.-F. PAA:  
B/(InterTechnology/Solar Corp., Warrenton, Va.)  
In: Intersociety Energy Conversion Engineering Conference, 12th, Washington, D.C., August 28-September 2, 1977, Proceedings, Volume 1. (A77-48701 23-44) La Grange Park, Ill., American Nuclear Society, Inc., 1977, p. 99-93.  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*COST ANALYSIS/\*ENERGY TECHNOLOGY/\*ENVIRONMENT EFFECTS/\*SYNTHETIC FUELS  
MINS: / ARKANSAS/ ECONOMIC FACTORS/ FEASIBILITY ANALYSIS/ LAND USE/ LOUISIANA/ SITES/ SOIL EROSION  
ABA: P.T.H.  
ABS: A hypothetical woody biomass plantation with a given operating schedule was analyzed in terms of the universal soil loss equation in order to estimate the average amount of soil lost to erosion over an extended period of plantation operation. It is shown that such an energy plantation culture is less intense than traditional agriculture. Thus, lands classified as marginally fit for agriculture can be used to produce biomass crops on a renewable basis. The cost of producing fuel with the required conservation measures is estimated to be slightly more than \$1.20 per million Btu.

Technical Note - SOLAR ENERGY AND INDUSTRIAL ALGEOLOGY  
Herbert Schaim

Solar Energy, vol. 19, no. 4, 1977, p. 407 - 410

Cultivation of algae on an industrial scale as a source of food, chemical products or fuel by conversion is a very difficult biological-engineering process.

Its optimization calls for a thorough study of the interaction between light intensity, temperature and nutrient concentration and afterwards prediction of their optimal interaction every season.

77A33124 ISSUE 14 PAGE 2370 CATEGORY 44  
77/05/00 4 PAGES UNCLASSIFIED DOCUMENT

UTTL: The Impact of the new energy technologies  
AUTH: A/DECKER, G. L. PAA: A/(Dow Chemical Co., Midland,  
Mich.)

MAJS: Mechanical Engineering, vol. 99, May 1977, p. 24-27.  
/\*COAL UTILIZATION/\*CONTROLLED FUSION/\*ENERGY  
TECHNOLOGY/\*HYDROGEN-BASED ENERGY/\*SOLAR ENERGY  
CONVERSION/\*TECHNOLOGICAL FORECASTING

MINS: / BIOMASS ENERGY PRODUCTION/ CHEMICAL ENERGY/ COAL  
GASIFICATION/ COAL LIQUEFACTION/ ENERGY CONSERVATION/

ENERGY SOURCES/ NUCLEAR ENERGY/ REACTOR TECHNOLOGY  
R.D.V.

ABS: Contributions of various forms of energy deemed  
commercially practicable by the end of the century are  
projected to meet an energy demand of 185 quads  
(quadrillions BTU). All contributing sources are  
charted for comparison, with the burnt bones by clean  
burning of coal, improved nuclear technology, coal  
liquefaction, coal gasification, and savings through  
some modes of conservation. Fusion and hydrogen  
technologies do not figure, being judged not  
commercially practicable by the turn of the century.  
Little contribution is expected from such novel  
sources as solar power, biomass combustion, geothermal  
energy, or breeder reactors. No one source is credited  
with more than 15% of the total coverage of energy  
needs by the year 2000.

QH Biological solar energy conversion / edited by  
91.8 Akira Mitsui ... [et al.]. — New York :  
.P7 Academic Press, 1977.  
D56 xiii, 454 p. : ill. ; 24 cm.

Papers presented at a conference held at  
the Rosenstiel School of Marine and Atmos-  
pheric Science, University of Miami, Nov.  
15-18, 1976, under the sponsorship of the  
United States-Japan Cooperative Science Pro-  
gram, U.S. National Science Foundation, and  
the Japanese Society for Promotion

Energy, v.2, 1977, p.441-55.

## MOBILIZATION AND IMPACTS OF BIO-GAS TECHNOLOGIES

JYOTI K. PARIKH and KIRIT S. PARIKH

International Institute for Applied Systems Analysis, A-2361 Laxenburg, Austria

(Received 23 November 1976)

**Abstract**—At present, energy and fertilizer requirements of many of the developing countries are largely met by locally available, non-commercial sources, such as firewood and farm wastes. Extensive use of firewood is one of the factors that can lead to deforestation. When organic farm wastes are burnt, soil nutrients, which should return to soil, are lost and this can severely affect agricultural production. The problem of efficient utilization of these locally available resources, therefore, needs to be studied in a systematic manner. As an option for efficient utilization of local resources, bio-gas plants are considered, taking India as a case study. In these plants, animal dung and agricultural by-pro. acts are utilized to obtain both methane and fertilizer through anaerobic fermentation. This is an example of appropriate technology for rural environments, which requires low investment, which does not need highly skilled labor and which can be operated with local materials and self help in the 576,000 villages of India. The economic benefits to a family using a bio-gas plant and the impact of its widespread acceptance on a national scale are evaluated. It is felt, however, that the scope of such individual family bio-gas plants is likely to be limited for a number of reasons. To realize the potential of bio-gas fully, village plants of about 200 m<sup>3</sup> capacity for approx. 100 families are needed.

The introduction of such seemingly sensible new technologies has failed in the past for want of appropriate management and organizational structures and, consequently, for want of social participation by persons of various income groups in the successful operation of such community plants. To remedy this, a pricing policy for purchase of farmwastes and distribution of gas and fertilizer has been suggested as an essential tool to ensure that no-one is worse off by the introduction of bio-gas plants and thus to motivate the required participation in the scheme. Given a different organizational set-up, the idea could also be tried out for providing energy and sanitation in urban areas.

The impact of full-scale adoption could mean that, by 2000 AD, almost 90% of the rural energy requirements of the domestic sector could be met; at present, this accounts for about 45% of the total energy consumption in India. The consequent reduction in firewood consumption would help to prevent deforestation. In addition, organic manure containing two million tons of additional nitrogen would be available every year to enhance soil nutrients, hence boosting food production and helping to solve the problem of sanitation at the same time.

## THE SUNNY SIDE OF THE FUTURE Melvin Calvin

Chemtech, June 1977, vol. 7, no. 6, p. 352-  
363

Petroleum plants are more the job of botanists,  
biochemists, and geneticists than engineers.

TJ  
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1976  
v.7  
Agriculture, biomass, wind, new developments  
: joint conference, American Section,  
International Solar Energy Society and  
Solar Energy Society of Canada, inc.,  
August 15-20, 1976, Winnipeg / editor, K.  
W. Boer. — Cape Canaveral, Fla. : American  
Section of the International Solar Energy  
Society, c1976.  
v. 391 n. : ill. : 28 cm. — (Sharing  
- BIOCONVERSION)

METHANE PRODUCTION THROUGH BIOCONVERSION 119  
OF AGRICULTURAL RESIDUES

(over)

A FEASIBILITY STUDY OF BIO-GAS PRODUCTION 129  
IN INDIVIDUAL FARMS IN SOUTHWESTERN  
ONTARIO

AGRICULTURAL AND FORESTRY WASTES AS AN 146  
ENERGY RESOURCE

PERPETUALLY RENEWABLE BIOMASS PROSPECTS 157

ENERGY FROM WOOD WASTES.

Paul N. Cheremisinoff and Angelo C. Morresi.  
Environment, v.19, no.4, May 1977, p.35-31.

Small steam-generating plants are powered by wood  
wastes at certain factories, particularly in the  
wood-processing and paper making industry .  
Most of the residues from wood processing are  
burned just to get rid of them, however, and a  
modest but significant source of energy is thereby  
lost.

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Fuels from waste / edited by Larry L.  
Anderson, David A. Tillman. — New York :  
Academic Press, 1977.  
xiv, 230 p. : ill. ; 24 cm.  
Includes bibliographical references and  
index.

This book addresses the following questions: How much waste is being  
generated? Which systems are presently available to produce fuels from  
waste? Which technologies are being developed for converting municipal,  
agricultural, silvicultural, and industrial solid wastes into fuels? Which  
nontechnical problems must be solved if residues are to become a more sig-  
nificant energy source?

The volume focuses on the production of fuels rather than energy. That  
distinction is important. The fuel product desired determines the nature of  
the waste utilization technology. The character of any specific fuel  
determines its potential market and its market potential. The chemical  
composition of any fuel determines its synergy with existing fossil fuels—  
hence its degree of user acceptance. While the problems of market potential  
and user acceptance appear to be nontechnical in orientation, they can be  
solved only by technology.

TP  
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.H38  
1977  
Hawaii Biomass Energy Study Team.  
Biomass energy for Hawaii / edited  
by Andrea Gill ... [et al.] ; prepared  
by the Hawaii Biomass Energy Study  
Team of Stanford University and the  
University of Hawaii for the Stanford  
University Institute for Energy  
Studies and the Hawaii Natural Energy  
Institute. Stanford, Calif. :  
Institute for Energy Studies, Stanford  
University, 1977.

## SOLID WASTE AS REFUSE-DERIVED FUEL.

R.F. Rolsten, et al.

Nuc. Technology, v.36, Mid-Dec.1977, p.314-327.

*Europe and the Far East have been using refuse-to-energy plants to power turbine generators in the production of electricity. If the U.S. would convert the total municipal refuse to energy at normal efficiency, 6% of the total U.S. electric production could be produced. Pelletized solid waste [refuse-derived fuel (RDF)] can be mixed with coal and burned in existing industrial spreader stoker-fired boilers. An RDF-to-coal volume ratio of 1:1 corresponding to a weight ratio of 40:60 and an energy ratio of 23:77 was burned in a completely unmodified steam plant without unusual variations in equipment operation for a 24-h period. In addition, there was significant reduction in both SO<sub>2</sub> and HC emissions compared to low-sulfur coal. Difficulties were experienced with an RDF-to-coal volume ratio of 2:1. Control data were established for comparative purposes by burning coal for a 24-h period.*

## FUELS FROM BIOMASS—ENERGY OUTLAY VERSUS ENERGY RETURNS: A CRITICAL APPRAISAL

CHRISTOPHER W. LEWIS

Energy Analysis Unit, University of Strathclyde, 100 Montrose Street, Glasgow, G4 0LZ, Scotland

(Received 2 November 1976)

**Abstract**—The concept of fuel production by the microbial conversion of biomass is discussed with particular emphasis upon the energy implications involved. Both the energy requirements and energy returns for a number of selected systems are assessed in the light of current technology, while areas for future improvements are also mentioned.

The general trend of such biological energy systems is that energy gains made via plant photosynthesis using intensive systems are subsequently more than lost in the conversion of biomass energy content into storable, high-energy fuels such as ethanol and methane. Of the operations under investigation, the growth of sugarcane and its fermentation to ethanol is considered to be the most favourable as a marginal net energy production process.

## PHOTOSYNTHETIC SOLAR ENERGY: REDISCOVERING BIOMASS FUELS.

A.L. Hammond.

Science, v.197, Aug.19,1977, p.745-46.

Firewood is still a familiar fuel in much of the United States, but somehow it does not come up in discussions of national energy policy very often. Yet wood was the primary U.S. fuel only a century ago and is still the main source of energy in most of the developing world. As recently as World War II, Sweden, cut off from oil imports, derived virtually all its fuel from wood. Since the Arab oil embargo there has been renewed attention in many countries to the energy potential of diverse forms of biomass—wood, sugarcane, algae, and even material produced by artificial photosynthetic processes.

## MUNICIPAL SOLID WASTE: PROBLEM OR OPPORTUNITY?

EPRI Journal, no.9, Nov.1977, p.6-13.

Resource recovery systems require inter-institutional cooperation and commercial contracts to operate economically.

NA	Davis, Albert J.
2542.3	Alternative natural energy sources in
.D38	building design / Davis & Schubert. — New
1977	EIGHT ORGANIC FUELS..... 165 77], cl974.
8.1	Alternative waste disposal systems... 165 energy
8.2	Anaerobic digestion for methane gas.... 170 uses and
8.3	The process and requirements..... 173
8.4	Digester design.... 177
8.5	Fuel cell utilization..... 182 n card 2)
8.6	Wood utilization... 183

Environment, v.19, no.7, Oct.1977.

### ENERGY SOLUTION IN CHINA

27

Vaclav Smil

Simple technology in widespread use in China converts organic wastes into high-quality fuel and fertilizer.

### WASTES AROUND THE WORLD

32

Patricia De Joie

The U.S. is by no means alone in the difficulty it has with wastes. The industrialized world has not yet discovered a way to throw away wastes, let alone reuse them.

TJ  
153  
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Energy development III / sponsored by the IEEF  
Energy Development Subcommittee of the IEEF  
Power Generation Committee of the IEEF Power  
Engineering Society. — New York : Institute  
of Electrical and Electronics Engineers,  
c1977.  
170 p. : ill. ; 28 cm. — (IEEF Power  
Engineering Society Papers ; 3)  
"77CH1215-3-PWR"

The Energy Plantation™ as an Alternative Source of Fuels, by  
M. D. Fraser, J. F. Henry and C. W. Vail.....p.166.....

### ENERGY PRODUCTION BY MICROBIAL PHOTOSYNTHESIS

John R. Benemann, Joseph C. Weissman, Ben L.  
Koopman, and William J. Oswald

Nature, vol. 268, no. 5615, July 7, 1977, p.  
19 - 23

78A10635 ISSUE 1 PAGE 43 CATEGORY 44 77/00/00  
6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Prospects of energy recovery from the incineration of  
chemical plant wastes  
AUTH: A/NOVAK, R. G.; B/CUDAHY, J. J. PAA:  
B/(Hydroscience Associates, Inc., Knoxville, Tenn.)  
In: Present status and research needs in energy  
recovery from wastes; Proceedings of the Conference,  
Oxford, Ohio, September 19-24, 1976. (A78-10626 01-44)  
New York, American Society of Mechanical Engineers,  
1977, p. 365-370.  
WAJS: /\*EXHAUST GASES/\*INDUSTRIAL WASTES/\*STEAM/\*WASTE  
DISPOSAL/\*WASTE ENERGY UTILIZATION  
MINS: / AIR POLLUTION/ CHEMICAL ATTACK/ HYDROGEN CHLORIDES/  
SLAGS

BIOCONVERSION: HARVEST TIME FOR ENERGY CROPS.  
Machine Design, v.49, no.24, Oct.20,1977, p.20-27.

Once a stepchild to high-  
technology systems like  
solar devices and wind  
turbines, bioconversion is  
rapidly gaining support in  
the energy scenario.  
Millions of tons of unused

farm, forest, and marine  
products can be converted  
to efficient fuels. Proto-  
type processing plants are  
already in operation. Huge  
commercial facilities are  
being designed.

### PLANT CROPS AS A SOURCE OF FUEL AND HYDROCARBON-LIKE MATERIALS.

P.E. Nielsen, et al.

Science, v.198, Dec.2,1977, p.942-44.

Abstract. Chemical analyses have been made of a number of plant species in order  
to assess their suitability as renewable sources of hydrocarbon-like photosynthetic  
products. Yields of rubber and wax, glycerides, isoprenoids, and other terpenoids  
were estimated. Individual sterols were identified in latex from some species.

TJ Energy development III / sponsored by the IEEF  
153 Energy Development Subcommittee of the IEEF  
.E47R3 Power Generation Committee of the IEEF Power  
pt.3 Engineering Society. -- New York : Institute  
of Electrical and Electronics Engineers,  
cl977.  
170 p. : ill. ; 28 cm. -- (IEEF Power  
Engineering Society Papers ; 3)  
"77CH1215-3-PWR"

The Utilization of Solid Wastes for the Generation of Electric Power,  
by Sheldon Meyers and David B. Sussman..... p. 30..

## FUELS VIA BIOCONVERSION

J. D. Keenan

Energy Conversion, 1977, vol. 16, no. 3,  
p. 95-103

**Abstract**—The potential mechanisms for fuels production by biochemical means are reviewed within the context of the principal metabolic pathways. Engineering options for bioconversion of fuels include the direct use of photosynthetic materials, the photosynthetic production of hydrogen and the fermentation of organic matter. It is concluded that, although biological processing is a feasible renewable energy source, process economics prevent the present-day use of such systems. This problem will be overcome by improving conversion efficiencies and by reducing the costs of harvesting. The application of biochemical engineering techniques to these problems is discussed.

Mechanical Engineering, v.99, no.12, Dec.1977.

### 24 A SOLID WASTE PACKAGE DEAL—ENERGY AND MATERIALS FROM GARBAGE .....

Nancy Rueth

An unusual, some say controversial, approach to recovering energy and materials from municipal solid waste has been developed. Does the system work? How does it fit into U.S. waste-energy-recovery operations?

## COMBUSTABLE RENEWABLE RESOURCES.

D.A. TILLMAN.

Chemtech, v.7, no.10, Oct.1977, p.611-615.

Combustible, renewable resources presently supply as much energy to the economy as the nuclear industry. Yet they are consistently *ignored* by government statistics.

Renewable materials provided by forestry (silviculture), agriculture, animal husbandry, and industry, have emerged as one of the most significant supplementary energy sources in the United States. The present contribution of 1.8 quads ( $1.8 \times 10^{15}$  Btu) per year supplies the economy with energy at a rate equivalent to over 75% of the flow of oil Alaska expected by the end of this year, or over 50% of that generated by all of the hydroelectric generating stations.

A78-21700 Biocconversion: Fuels from biomass. E. E. Robertson (Biomass Energy Institute, Inc., Winnipeg, Canada). Philadelphia, Pa., Franklin Institute Press, 1977. 72 p. 43 refs. \$6.50.

Topics related to the use of biomass for energy generation are surveyed. Urban and agricultural wastes as well as land and ocean farm products are common sources, while photosynthesis and anaerobic digestion are frequently used biocconversion processes. Subjects considered include the use of biomass to generate high temperatures, storing solar energy naturally, the biosphere's life support systems, the oxygen/carbon dioxide cycle, and self-reproducing machines and biomass. M.L.

18263 (CONF-7710156—, pp XXIX.1-XXIX.13) Ethanol for motor fuel from biomass. Wayman, M. (University of Toronto, Ontario). 1977.

From Forest and field fuels symposium; Winnipeg, Canada (12 Oct 1977).

Operating experience in Brazil has firmly established fermentation industrial alcohol (ethanol) as a satisfactory motor fuel, with advantages over gasoline in anti-knock and anti-pollution characteristics. Extensive under-utilized wood species in Canadian forests such as aspen and birch can supply about 20% of Canada's motor fuel requirements by this route. The technology is well-known and the economics show fermentation alcohol to be profitable now.

## AGRICULTURAL AND FORESTRY WASTES AS AN ENERGY RESOURCE.

John A. Alich, Jr. and Jeffrey G. Witwer.

Solar Energy.

Vol. 19 no. 6

1977

p. 625-629.

**Abstract**—The feasibility of converting agricultural and forestry residues to energy is evaluated based on a county-by-county inventory for the contiguous United States. The impact of this energy resource on the U.S. energy system is forecast using the SRI energy model.

**A77-46250** Biomass energy for Hawaii. Volume 1 - Summary and background. Volume 2 - Sugar operations. Volume 3 - Mixed municipal refuse. Volume 4 - Terrestrial and marine plantations. Edited by A. Gill, C. Beck, K. Salvesen, L. Chun, C. Yang, D. Murata, and M. Keller. Stanford, Calif., Stanford University, 1977. Vol. 1, 175 p.; vol. 2, 159 p.; vol. 3, 212 p.; vol. 4, 243 p. Price of four volumes, \$20.

The conversion of biomass resources into energy, fuels and by-products is discussed, with attention given to programs in Hawaii involving terrestrial and marine biomass plantations, energy recovery from municipal refuse treatment plants and uses for sugar cane harvesting wastes. Biomass conversion processes to increase the available energy supply in Hawaii, such as direct combustion, pyrolysis anaerobic digestion or fermentation, are described. In particular, the generation of electrical power from bagasse (sugar cane waste) and the production of ethanol fuel as a by-product of sugar refining are considered. Schemes for exploiting municipal refuse resources, including use of pyrolytic gases in power plants, are also treated. The reports emphasize an interdisciplinary approach to the energy problem, relying on legal and economic analyses as well as technical studies. J.M.B.

**35983** Present status and research needs in energy recovery from wastes. Matula, R.A. (ed.). New York, NY: American Society of Mechanical Engineers (1977). 451p. (CONF-7609197—).

From Conference on present status and research needs in energy recovery from wastes, Oxford, OH, USA (19 Sep 1976).

The proceedings contain 32 papers and eight session summaries presented at the conference. Session topics include emissions and pollution control in municipal-scale incinerators, corrosion in waste fired systems, waste separation and preprocessing, practical operating problems of energy recovery from municipal wastes, production of fuels from waste characterization and properties of industrial wastes, anticipated trends and needs in industrial waste utilization, and experience with energy release characteristics and controls. The session summaries included an identification of research needs in that area. Selected papers are indexed separately.

**A78-27801** Fuels from waste. Edited by L. L. Anderson (Utah, University, Salt Lake City, Utah) and D. A. Tillman (Materials Associates, Inc., Washington, D.C.). New York, Academic Press, Inc., 1977. 242 p. \$26.50. (For individual items see A78-27802 to A78-27813)

Transformation of manure, agricultural crop wastes, urban refuse, sewage solids, industrial process wastes and logging and wood manufacturing residues to fuels is discussed; technologies considered include pyrolysis systems, fluidized bed combustion, landfill gas extraction, anaerobic digestion and wood-waste liquefaction. Among the subjects of the papers are: a molten salt gasifier for production of low-Btu gas; hydrogasification of solid wastes; a mobile anaerobic digestion plant for methane production from feedlot residues; biomass conversion of aquatic and terrestrial plants; pyrolytic gasification of black liquors from the Kraft process; and fluidized-bed combustion of petrochemical wastes. J.M.B.

77A26078 ISSUE 10 PAGE 1671 CATEGORY 44  
76/00/00 16 PAGES UNCLASSIFIED DOCUMENT

**UTTL:** Recovery of energy from solid waste - An answer to some of Southern California's problems

**AUTH:** A/STUCKENBRUCK, L. C.; B/KING, C. F. PAA:  
A/(Southern California, University, Los Angeles, Calif.)

In: Energy LA: Tackling the crisis: Proceedings of the Second Greater Los Angeles Area Energy Symposium, Los Angeles, Calif., May 19, 1976. (A77-26076 10-44) North Hollywood, Calif., Western Periodicals Co., 1976. p. 18-33.

**MAJS:** /\*DOMESTIC ENERGY/\*ECONOMIC FACTORS/\*ENERGY TECHNOLOGY /\*ORGANIC WASTES (FUEL CONVERSION)/\*PYROLYSIS/\*SOLID WASTES

**MINS:** / BIOMASS ENERGY PRODUCTION/ COST ANALYSIS/ ENVIRONMENT EFFECTS/ POLITICS/ SOCIAL FACTORS/ SOUTHERN CALIFORNIA/ TABLES (DATA)

**ASA:** B.J.

**ABS:** The state of the art of energy recovery from solid waste is reviewed with attention given to direct combustion or incineration of unprepared solid waste, direct combustion of prepared solid waste, pyrolysis to gaseous or liquid fuel, and biomass conversion to fuel gas. The ten operating systems which come closest to being ready for rapid full-scale implementation are discussed. Sociological questions (public apathy, political aspects, economic factors, and environmental impact) are examined along with system cost considerations.

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ENERGY FROM SOLID WASTES.  
P.N. Cheremisinoff and A.C. Morresi.  
Marcel Dekker, Inc. 1976. 505p.

A book to furnish engineers, managers, and students with the possibilities of wastes as an energy source.

Over the past decade man has begun to consider the importance of his environment and his impact on it. Concern for the environment is not limited to detrimental effects of pollution but also includes recovery and utilization of resources now recognized as finite, namely fuels and energy. Tremendous savings can be realized by many industries, institutions and governments through the potential of converting their own solid wastes into energy. Methods are available or being developed that are highly engineered and environmentally clean. The energy locked up in trash in the United States alone amounts to over 900 trillion BTU annually. The purpose of this book is to offer the possibilities of varied wastes as energy sources. These include refuse, organic wastes, plastics recycling, waste oil, animal waste, sanitary landfills, wood wastes and sewage sludge. Varying processes are also described.

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360  
.C58

Clean fuels from biomass, sewage, urban refuse, agricultural wastes : symposium papers presented January 27-30, 1976 at Orlando, Florida / sponsored by Institute of Gas Technology ; produced by Jack W. White and Wilma McGrew. -- Chicago : Institute of Gas Technology, 1976.

vi, 459 p. : ill. : 23 cm.

Includes bibliographical references.

1. Waste products as fuel--Congresses.

TP  
360  
.M5

Microbial energy conversion : the proceedings of a seminar / sponsored by the UN Institute for Training and Research (UNITAR) and the Ministry for Research and Technology of the Federal Republic of Germany, held in Göttingen, October 1976 ; edited by H. G. Schlegel and J. Barnes. -- Oxford, Eng. ; New York : Pergamon Press, 1976.  
644 p. : ill. ; 24 cm.

#### Primary Production of Biomass

K. STEINBECK

Biomass production of intensively managed forest ecosystems . p.35 . . . . .

H.E. YOUNG

Biomass production in terrestrial ecosystems . . . . . p.45 . . . . .

C. J. SOEDER

Primary production of biomass in freshwater with respect to microbial energy conversion . . . . . p.59 . . . . .

O. A. ROELS, S. LAURENCE, M. W. FARMER and L. VAN HEMELRYCK

Organic production potential of artificial upwelling marine culture . p.69 .

W. R. FINNERTY

Comparison of primary products with respect to energy conversion . p.83.

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.I67  
1976

International Symposium on Materials and Energy from Refuse, 1st, Antwerp, 1976. Proceedings : 1st International Symposium [on] Materials and Energy from Refuse. -- Leiden : Spruyt, Van Mantgem & De Does, [1976?]  
190 p. : ill.

Attention is given to the Garrett pyrolysis process, the Andco-Torrax slagging pyrolysis solid waste conversion system, partial oxidation of refuse using the Purox system, and the prospects of materials and energy from refuse in India. Consideration is also given to methane production from wastes, the combination of refuse incineration with electric power production, combined refuse and sludge incineration, and refuse incineration with heat recovery. Metals from urban refuse, recycling of tin from secondary waste, and materials recovery from shredded junked cars are also discussed. B.J.

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TP  
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.P73

Present status and research needs in energy recovery from wastes ; proceedings of the 1976 conference presented at Hueston Woods State Park, Oxford, Ohio, September 19-24, 1976 / sponsored by the ASME Research Committee on Industrial and Municipal Wastes ... (et al.) ; edited by Richard A. Matula. — New York : American Society of Mechanical Engineers, 1977.  
xii, 440 p. : ill. ; 26 cm.  
Includes bibliographical references.

77N22016# ISSUE 12 PAGE 1665 CATEGORY 85 RPT#:  
PB-260633#3 NSF/IDOE-76-05 76/07/00 68 PAGES  
UNCLASSIFIED DOCUMENT

UTITL: Energy recovery from solid waste: A review of current technology TLSP: Final Report

AUTH: A/BLACK, D. O.

CORP: Illinois State Dept. of Business and Economic Development, Springfield. CSS: (Div. of Energy.)

AVAIL.NTIS SAP: HC A04/MF A01

WAUS: /\*ENERGY CONVERSION/\*ENERGY POLICY/\*RECLAMATION/\*SOLID WASTES/\*WASTE ENERGY UTILIZATION

MINS: / COST ANALYSIS/ INCINERATORS/ ORGANIC WASTES (FUEL CONVERSION)/ PYROLYSIS/ TECHNOLOGY ASSESSMENT

ABA: GRA

ABS: Processes for converting and utilizing energy from solid wastes are described along with the economic factors and relative advantages of each process.

AICHE Symposium Series, v.72, no.158 1976

BIOCHEMICAL ENGINEERING - ENERGY RENEWABLE RESOURCES AND NEW FOODS. S.M. Barnett, J.P. Clark and J.M. Nystrom, eds.

The energy plantation  
Farm energy from crops  
Some limitations of fuel farming  
Heat treatment of refuse for increasing anaerobic biodegradability  
Biochemical conversion of refuse to ethyl alcohol

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796.2  
.W44

Weinstein, N. J.  
Thermal processing of municipal solid waste for resource and energy recovery / Norman J. Weinstein, Richard F. Toro. Ann Arbor, Mich. : Ann Arbor Science Publishers, 1976.  
xix, 179 p. : ill. ; 24 cm.  
Includes bibliographical references and index.  
1. Incineration. 2. Refuse as fuel.  
I. Toro, Richard F., joint author .

TJ  
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.S48  
1976  
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Business, commercial, poster session, miscellaneous : joint conference, American Section, International Solar Energy Society and Solar Energy Society of Canada, inc., August 15-20, 1976, Winnipeg / editor, K. W. Boer. — Cape Canaveral, Fla. : American Section of the International Solar Energy Society, c1976.  
x, 269 p. : ill. ; 28 cm. — (Sharing the sun ; v. 10)

DESIGN, OPERATION AND ECONOMICS OF THE ENERGY PLANTATION 188

TJ  
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.S48  
1976  
v.1

International and U.S. programs, solar flux : joint conference, American Section, International Solar Energy Society and Solar Energy Society of Canada, inc., August 15-20, 1976, Winnipeg / editor, K. W. Boer. — Cape Canaveral, Fla. : American Section of the International Solar Energy Society, c1976.  
x, 388 p. : ill. ; 28 cm. — (Sharing the sun ; v. 1)  
"Contains section 20, 21, 22, 2."

RECENT CANADIAN ACTIVITIES IN BIOMASS 119

**PRELIMINARY ASSESSMENT OF SYSTEMS FOR DERIVING LIQUID AND GASEOUS FUELS FROM WASTE OR GROWN ORGANICS. Robert W. Graham, Thaine W. Reynolds, and Yih-Yun Hsu, LeRC. Feb. 1976. 41p.**

Impending shortages of petroleum and natural gas have motivated investigations of new, renewable sources of liquid and gaseous fuels. A possible option is the conversion of waste or grown organic matter to fuel by chemical conversion. The overall feasibility of such a system is considered from the technical, economic, and social viewpoints. Although there are a number of difficult problems to overcome, a preliminary study indicates that this option seems to hold considerable future promise as a significant fuel supply. An orderly program of development and demonstration, with periodic critical reviews, would be required to assess the viability of such a fuel source system.

**Fuel and Energy Production by Bioconversion of Waste Materials - State-of-the-Art.**

Silvia A. Ware.

Ebon Research Systems, Silver Springs, Md. Aug 76, 78p

EPA/600/2-76/148

PB-258 499/3WE Price code: PC A05/MF A01

This report is a state-of-the-art summary of biological processes for converting waste cellulosic materials (agricultural, municipal and lumbering wastes) to fuels. It indicates the locations and quantities of suitable wastes and discusses the status of the current processing schemes. The processes discussed are: Acid hydrolysis followed by fermentation; enzyme hydrolysis followed by fermentation; anaerobic digestion of manure and municipal solid waste; and, biophotolysis.

**ENERGY RECOVERY FROM MUNICIPAL AND INDUSTRIAL WASTE**

Conservation & Recycling

Vol. 1 no.1

1976

p. 71-81

**Abstract** - A detailed analysis is given of the economics of heat recovery and utilisation in the incineration of waste materials. Energy may be recovered as heat with or without electricity generation but, since electricity may be generated at little marginal cost, only the alternatives involving its production are considered. Detailed calculations are made for the economic implications of treating 140,000 tonnes of waste annually, and a net saving of 23 million m<sup>3</sup> of natural gas indicated.

It is not yet possible to compare incineration with pyrolysis since much information regarding the latter is still unavailable, but published figures indicate that an energy saving of 430 kWh per tonne of waste is attainable by combustion of fuels produced by pyrolysis in a utility power station. Incineration for steam production, followed by electricity generation, can save ca. 730 kWh per tonne of waste.

CN-141,762

1938

MOTOR FUELS FROM FARM PRODUCTS. P. Burke Jacobs and Harry P. Newton. Dec. 1938. 129p.

Department of Agriculture

Misc. Pub.  
327

Fuels, Biomass/Wastes

Fuels - Synthesis

Alcohols

TA Institute of Environmental Sciences.  
1 Technical division proceedings including  
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1975 (Card 2)  
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etc. 2. Vibration. 3. Reliability engineering. 4. Shock mechanics. 5. Electronics. I. Title.

CRITICAL ASSESSMENT OF WASTE CONVERSION TO ENERGY  
By H. A. Gorges and A. D. Thomas p.229.

18341 (TID-28552) Technical and economic assessment of methods for direct conversion of agricultural residue to usable energy. Final report. Baile, R. C. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 20 Oct 1976. 136p. Dep. NTIS, PC A07/MF A01.

Various methods for conversion of agricultural wastes to usable energy were evaluated for further consideration for user operated and commercially operated systems. Advantages and disadvantages of anaerobic digestion and low Btu gas pyrolysis, the only two alternatives that were considered to be worthy of evaluation for user operated systems, are discussed. Both systems were also considered feasible for use with commercially operated systems. In addition, two liquid product systems, hydrolysis and fermentation to ethanol and medium Btu gas pyrolysis followed by Fischer-Tropsch reaction to form a liquid product, were evaluated. (JGB)

N75-11463

Fuels, Biomass/Wastes

BIOCONVERSION. (Hearing before the Subcommittee on Energy of the Comm. on Science and Astronautics, U.S. House of Representatives, 93rd Congress, 2nd Session, June 13, 1974.)

93rd Congress, 2nd Session  
Committee on Science and  
Astronautics

NASA CR-2608

Fuels, Biomass/wastes

1975

GROWN ORGANIC MATTER AS A FUEL RAW MATERIAL RESOURCE  
Warren L. Roller, Harold M. Keener, Rochelle D. Kline, et al. (Final rept.). Oct. 1975. 132p.

Ohio Agricultural Research and  
Development Center  
NASA NGL-36-007-001

ORGANIC WASTES/BIOMASS - FUEL PRODUCTION

PRINT 06/2/1-759      TERMINAL=34

79A53918    ISSUE 24    PAGE 4555    CATEGORY 44  
79/09/11    14 PAGES    UNCLASSIFIED DOCUMENT

UTTL: Entropy changes in the energy bioconversion  
AUTH: A/COSTANZO, E.; B/RUBBINO, A.    PAA: A/(Catania,  
Universita, Catania, Italy); B/(Centro Siciliano di  
Fisica Nucleare e di Struttura della Materia, Catania,  
Italy)

Nuovo Cimento B, Serie 11, vol. 53B, Sept. 11, 1979,  
p. 45-58.

MAJS: /\*BIOCHEMISTRY/\*BIOMASS ENERGY PRODUCTION/\*ENERGY  
CONVERSION/\*ENTROPY

MINS: / CHEMICAL REACTIONS/ CONCENTRATION (COMPOSITION)/  
ENERGY STORAGE/ PHOTOSYNTHESIS/ QUANTITATIVE ANALYSIS/  
RESPIRATION/ SCHROEDINGER EQUATION

ABA: (Author)

ABS: A quantitative analysis is made in order to check,  
within the set of data available, the validity of  
Schroedinger's qualitative suggestion about the role  
of entropy in biosystems. Entropy changes  $\Delta\sigma$   
and free-energy changes  $\Delta\gamma$  are analysed for  
some whole sequences of biochemical reactions involved  
in such primary processes as photosynthesis and  
respiration. As a result, it is pointed out that (1)  
the formation of biological compounds obtained by  
photosynthesis seems to be selected on the basis of  
the induced entropy decrease within synthesizing  
biosystems, rather than on that of the energy contents  
of synthesized compounds; (2) the sign and the size of  
the ratio of the product of temperature and entropy  
change to the free energy change for ADP to ATP  
phosphorylations, suitably coupled to glucose  
oxidation, allow a negative change of entropy even in  
the primary overall biodegradation process of  
respiration. Effects of reactant concentration both in  
vegetal and in animal systems give further support to  
the validity of the suggestion taken into  
consideration.

**HIGH-GRADE FUELS FROM BIOMASS FARMING: POTENTIALS  
AND CONSTRAINTS. P. B. Weisz and J. F. Marshall.**

Science, vol 206, no 4414, October 5, 1979, p. 24-  
29.

*Summary.* The key parameters controlling the productivity and the cost of wet high-grade fuel from a system for biomass agriculture and conversion are analyzed. Performance depends sensitively on a "sybiotic" interaction between agronomy and technology. The conditions for obtaining net productivity and costs are analyzed for U.S. grain alcohol as a reference point. Currently practiced technology consumes more high-grade fuel than it generates. Some potentials and constraints for future systems, including use of other plant species and conversion systems, are explored.

79N32384#    ISSUE 23    PAGE 3070    CATEGORY 24    RPT#:  
SAN-0115-T3    79/01/00    179 PAGES    UNCLASSIFIED  
DOCUMENT

UTTL: Mission analysis for the federal fuels from biomass  
program. Volume 4: Thermochemical conversion of  
biomass to fuels and chemicals (LSP: Final Report

AUTH: A/KOHAN, S. M.; B/BARKHORDAR, P. M.  
CORP: SRI International Corp., Menlo Park, Calif.  
AVAIL:NTIS    SAP: HC A09/MF A01

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY CONVERSION/\*ENERGY  
POLICY/\*THERMOCHEMISTRY

MINS: / ENERGY TECHNOLOGY/ GASIFICATION/ PYROLYSIS/  
SYNTHETIC FUELS/ WOOD

ABA: DOE

ABS: The selection of the feedstock used in the analysis of  
thermochemical conversion technologies is discussed.  
Detailed technical and economic evaluation are  
presented of biomass conversion to electricity and  
steam by combustion, SNG by gasification and  
methanation, methanol by gasification and synthesis,  
oil by catalytic liquefaction, oil and char by  
pyrolysis, and ammonia by gasification and synthesis.

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79N31435# ISSUE 22 PAGE 2937 CATEGORY 28 RPT#:  
NTIS/PS-79/0547/4 NTIS/PS-78/0500 NTIS/PS-77/0113

79/06/00 63 PAGES UNCLASSIFIED DOCUMENT  
Supersedes NTIS/PS-78/0500 and NTIS/PS-77/0113

UTTL: Synthetic fuels from municipal, industrial and  
agricultural wastes, volume 2. Citations from the  
American Petroleum Institute data base TLSP:  
Progress Report, 1978 - Mar. 1979

AUTH: A/HUNDEMANN, A. S.

CORP: National Technical Information Service, Springfield,  
Va. AVAIL. NTIS SAP: HC \$28 GG/MF \$28.00

MAJS: /\*BIBLIOGRAPHIES/\*BIOMASS ENERGY PRODUCTION/\*SYNTHETIC  
FUELS/\*WASTE ENERGY UTILIZATION

MINS: / BIOMASS/ GARBAGE/ METABOLIC WASTES/ SEWAGE/ TIRES

ABA: GRA

ABS: The bibliography cites worldwide literature on the

production of fuels from waste materials such as  
animal manure, wood chips, sewage sludge, urban  
garbage, agricultural wastes, and old automobile  
tires. (This updated bibliography contains 57  
abstracts, all of which are new entries to the  
previous edition.)

79A35489 ISSUE 14 PAGE 2624 CATEGORY 44  
79/03/00 12 PAGES In FRENCH UNCLASSIFIED DOCUMENT

UTTL: Bioconversion - Energy and agriculture

AUTH: A/JAYET, P.-A. PAA: A/(Institut National de la  
Recherche Agronomique, Paris, France)

Revue de l'Energie, vol. 30, Mar. 1979, p. 267-278. In  
French.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY SOURCES

MINS: / AGRICULTURE/ ENERGY TECHNOLOGY/ GASIFICATION/  
INCINERATORS/ PHOTOSYNTHESIS/ PYROLYSIS/ TABLES (DATA)

ABA: J.M.B.

ABS: Incineration, gasification, anaerobic digestion,  
pyrolysis and hydrolysis are among the means of  
converting biomass into energy. A total of 65 million  
tons of biomass from agriculture and forestry is  
available for energy conversion in France yearly;  
straw represents a particularly attractive biomass  
resource because of ease of processing and transport.  
Boilers operating with various types of processed  
straw are in service in France and Denmark. Pyrolysis  
processes employing wood or municipal solid waste are  
also mentioned.

79A53724 ISSUE 24 PAGE 4554 CATEGORY 44  
79/00/00 147 PAGES UNCLASSIFIED DOCUMENT

UTTL: Gasohol: for energy production --- Book

AUTH: A/CHEREMISINOFF, N. P. PAA: A/(Exxon Research and  
Engineering Co., Florham Park; New Jersey Institute of  
Technology, Newark, N.J.) SAP: \$14.95  
Ann Arbor, Mich.: Ann Arbor Science Publishers, Inc.,  
1979. 147 p.

MAJS: /\*AUTOMOBILE FUELS/\*BIOMASS ENERGY PRODUCTION/\*ETHYL  
ALCOHOL/\*GASOHOL (FUEL)/\*GASOLINE/\*ETHYL ALCOHOLS

MINS: / CHEMICAL ENGINEERING/ ENERGY TECHNOLOGY/ GRAPHS  
(CHARTS)/ INDUSTRIAL MANAGEMENT/ TABLES (DATA)/  
THERMODYNAMIC EFFICIENCY

ABS: The book is an overview of the present state of the  
art as well as the potentials and uses of biomass as a  
source of alcohols and chemical feedstocks. Several  
topics are discussed, such as biomass as a source of  
energy, the chemistry of alcohols, methanol synthesis  
from synthesis gas and wood wastes, ethanol synthesis,  
and mass production of biomass for synthetic fuels.  
Also discussed are automotive uses of methanol,  
special uses and problems of alcohol fuels, and the  
development of a nationwide biomass-based  
alcohol-gasoline fuel system.

79A37842 ISSUE 15 PAGE 2788 CATEGORY 44  
79/00/00 460 PAGES UNCLASSIFIED DOCUMENT

UTTL: International Conference on Future Energy Concepts,  
London, England, January 30-February 1, 1979.  
Proceedings SAP: \$46

Conference sponsored by the Institution of Electrical  
Engineers, London, Institution of Electrical Engineers  
(IEE Conference Publication, No. 171), 1979. 460 p (For  
individual items see A79-37843 to A79-37918)

MAJS: /\*CONFERENCES/\*ENERGY TECHNOLOGY/\*TECHNOLOGICAL  
FORECASTING

MINS: / BIOMASS ENERGY PRODUCTION/ GEOTHERMAL ENERGY  
CONVERSION/ HYDROGEN-BASED ENERGY/ MAGNETOHYDRODYNAMIC  
GENERATORS/ SATELLITE SOLAR POWER STATIONS/ SOLAR  
ENERGY CONVERSION/ TIDE POWERED GENERATORS

ABA: B.J.

ABS: Papers are presented on solar energy utilization, wave  
power experiments, geothermal energy, tidal power, MHD  
power generation, wind energy systems, and hydrogen  
energy. Particular consideration is given to windpower  
generation on a large scale, the prospects of a  
biological-photochemical approach to the utilization  
of solar energy, tidal and river current energy  
systems, and satellite solar power stations.

79A32594 ISSUE 13 PAGE 2404 CATEGORY 44 CNT#:  
EY-76-C-02-2991 79/03/00 28 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Fuel gas production from animal residue. II - An economic assessment

AUTH: A/ASHARE, E.; B/WENTWORTH, R. L.; C/WISE, D. L.  
PAA: C/(Dynatech R/D Co., Cambridge, Mass.)  
Resource Recovery and Conservation, vol. 3, Mar. 1979,  
p. 359-386.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ECONOMIC ANALYSIS/\*  
GASEOUS FUELS/\*ORGANIC WASTES (FUEL CONVERSION)

MINS: / ANAEROBES/ ANIMALS/ CARBON DIOXIDE/ COST ESTIMATES/  
ENERGY BUDGETS/ MATHEMATICAL MODELS/ METHANE/ REACTION  
KINETICS/ SOLID WASTES/ WASTE ENERGY UTILIZATION

ABA: A.L.W.

ABS: A mathematical model is used to determine the optimum process conditions and economics for the production of fuel gas by anaerobic digestion of animal residues. In the situation considered, a slurry of animal residues (manure) from a 10,000 head beef feedlot is fed to a digester where anaerobic microorganisms convert the organic matter to methane and carbon dioxide. The feedlot was calculated to produce 8000 cu m/day of methane at a cost of \$4.90/GJ or \$0.183/cu m, with a total capital requirement of \$1,165,000, a total capital investment of \$694,000 and an average annual net operating cost of \$370,000. An analysis of the sensitivity of the unit gas cost to feedlot size and type, digester type and operating conditions, and economic input data indicates areas in the anaerobic digestion system design where reasonable improvements may be expected in order to produce gas at a more economically feasible cost.

79A46311 ISSUE 20 PAGE 3787 CATEGORY 44  
79/04/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Small scale gasification of biomass - The case of corn cob gasifiers

AUTH: A/DOERING, G. C., III; B/SHARE, T. J.; C/FHART, R. M.  
PAA: C/(Purdue University, West Lafayette, Ind.)  
(University of Illinois and U.S. Department of Energy, Midwest Energy Conference, Chicago, Ill., Nov. 19-21, 1978.) Energy (UK), vol. 4, Apr. 1979, p. 205-236.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*CORN/\*HYDROCARBON FUEL PRODUCTION

MINS: / COMPUTERIZED SIMULATION/ ECONOMIC FACTORS, ENERGY CONSERVATION/ ENERGY TECHNOLOGY/ FARM CROPS/ TABLES (DATA)

79A51194 ISSUE 23 PAGE 4365 CATEGORY 44  
79/10/05 6 PAGES UNCLASSIFIED DOCUMENT

UTTL: High-grade fuels from biomass farming - Potentials and constraints

AUTH: A/WELISZ, P. B.; B/MARSHALL, J. F. PAA: B/(Mobil Research and Development Corp., Central Research Div., Princeton, N.J.)  
Science, vol. 206, Oct. 5, 1979, p. 24-29.

MAJS: /\*AGRICULTURE/\*BIOMASS ENERGY PRODUCTION/\*DOMESTIC ENERGY/\*ENERGY TECHNOLOGY/\*HIGH ENERGY FUELS

MINS: / COSTS/ ETHYL ALCOHOL/ PRODUCTIVITY/ UNITED STATES OF AMERICA

ABA: (Author)

ABS: The use of biomass as a source of fuel is a topic of growing interest and debate. Here we present an analysis of the key technical and economic potentials and constraints of systems designed to use agricultural crops to displace nonrenewable hydrocarbon fuels, namely petroleum and natural gas. We first examine the controlling parameters and general behavior of such systems. We then examine the quantitative aspects of existing grain alcohol technology. This technology we use as a reference case for examining the potential for other biomass crops. It is our intent to provide a rigorous treatment and descriptive framework to aid in future research and development.

79A32593 ISSUE 13 PAGE 2403 CATEGORY 44 CNT#:  
EY-76-C-02-2991 79/03/00 16 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Fuel gas production from animal residue. I - Technical perspective

AUTH: A/WENTWORTH, R. L.; B/ASHARE, E.; C/WISE, D. L.  
PAA: C/(Dynatech R/D Co., Cambridge, Mass.)  
Resource Recovery and Conservation, vol. 3, Mar. 1979,  
p. 343-358.

ABA: (Author)

ABS: The technology of fuel gas production by anaerobic digestion, has only recently been recognized as a potential alternate energy source. An application which shows promise to furnish energy is the digestion of animal residues. The objective of this review is to develop a detailed technical perspective of the scope of the anaerobic digestion process and the problems and prospects for exploitation to produce methane from animal residues. It is concluded that the technology of anaerobic digestion and the economics of this technology make fuel gas production from selected animal residues meritorious for development.

79A44075 ISSUE 19 PAGE 3628 CATEGORY 45  
79/07/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Bacterial biomass, production and heterotrophic activity of the coastal seawater at Gravelines /France/

AUTH: A/DELATTRE, J. M.; B/DELESMONT, R.; C/CLABAUX, M.; D/OGER, C.; E/LECLERC, H. PAA: E/(Institut Pasteur, Gravelines, Nord, France)  
Oceanologica Acta, vol. 2, July 1979, p. 317-324.  
Research supported by Electricite de France and Centre National pour l'Exploitation des Oceans.

MAJS: /\*BIOMASS/\*COASTAL WATER/\*HETEROTROPHS/\*MARINE ENVIRONMENTS/\*SEA WATER

MINS: / BACTERIOLOGY/ FRANCE/ THERMAL POLLUTION

ABA: (Author)

ABS: Bacteriological investigations carried out since 1976 in the coastal environment of the future nuclear power station at Gravelines, Northern France, have included the measurement of bacterial heterotrophic activity and biomass. The total number of bacteria, determined by epifluorescence microscopy, varied between  $1.5 \times 10^6$  to the 5th and  $5.2 \times 10^6$  to the 7th/ml. As a rule, 90 percent of the cells showed a green fluorescence with acridine and were supposed alive, but only 2.3 percent, on average, were found 'viable' on seawater agar. The uptake of glucose generally followed the Michaelis-Menten kinetics, but on some occasions, results did not fit the typical saturation curve, especially during phytoplankton (Phaeocystis) blooms. Nevertheless, this measure remains suitable for the investigation of the effects of thermal pollution, because the heterotrophic potential varied widely (by three orders of magnitude) and was significantly linked to temperature. In an attempt to determine what part of the total bacterial production resulted from the heterotrophic activity, total production was measured from the increase of biomass, by epifluorescence, in diffusion chambers without predators. From a series of 24 experiments with untreated, heated or chlorinated seawaters, it appears that the total bacterial production averages up to 16 times the maximum net uptake of glucose-C.

79A50353 ISSUE 22 PAGE 4185 CATEGORY 44  
79/00/00 6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Bio-electrochemical conversion of refuse to energy  
AUTH: A/DENNO, K. PAA: A/(New Jersey Institute of Technology, Newark, N.J.)

In: Learning to use our environment: Proceedings of the Twenty-fifth Annual Technical Meeting, Seattle, Wash., April 30-May 2, 1979. (A79-50326 22-42) Mount Prospect, Ill., Institute of Environmental Sciences, 1979, p. 316-321. Research supported by the New Jersey Institute of Technology.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ELECTRIC GENERATORS/\*ORGANIC WASTES (FUEL CONVERSION)

MINS: / DYNAMIC MODELS/ ENERGY TECHNOLOGY/ FUEL CELLS

ABA: S.D.

ABS: The paper presents important results relevant to the processes of synthetic fuel extraction and direct use of the bio-organic fuel in a power cell. The information presented is purely theoretical and based on mathematical and physical concepts. The discussion focuses on the biofuel cell as a perfect electrochemical apparatus, and on the dynamics or bioconversion. This process involves the extraction of multigrade saturated and unsaturated hydrocarbons of the system  $C(n)H(2n+2)$  from refuse. This process is assumed to take place through the interaction of material reactants, viz. the refuse and the environment

79N31433# ISSUE 22 PAGE 2937 CATEGORY 28 RPT#:  
NTIS/PS-79/0545/8 NTIS/PS-78/0499 NTIS/PS-77/0112  
NTIS/PS-76/0795 NTIS/PS-75/655 79/06/00 172 PAGES  
UNCLASSIFIED DOCUMENT

Supersedes NTIS/PS-78/0499; NTIS/PS-77/0112;  
NTIS/PS-76/0795; NTIS/PS-75/655

UTTL: Synthetic fuels from municipal, industrial, and agricultural wastes. Citations from the NTIS data base TLSP: Report, 1964 - Apr. 1979

AUTH: A/HUNDEMANN, A. S.

CORP: National Technical Information Service, Springfield, Va. AVAIL NTIS SAP: HC \$28.00/MF \$28.00

WASTES/ WASTE DISPOSAL

ABA: GRA

ABS: This bibliography contains 164 citations on the production of gaseous and liquid synthetic fuels from solid wastes. Waste products used in the syntheses including manure, sewage, paper, and wood are included. Methane is the primary fuel produced, however, the production of oils, methanol, and ethanol is also discussed.

79A37912 ISSUE 15 PAGE 2794 CATEGORY 44  
79/00/00 4 PAGES UNCLASSIFIED DOCUMENT

UTTL: Use of low grade fuel derived from domestic and trade wastes  
AUTH: A/TOTTMAN, J. D.; B/TITTLE, K.; C/JONES, B. PAA: B/(Central Electricity Generating Board, North Western Region, England); C/(General Engineering Co., Ltd., Radcliffe, Lancs., England)  
In: International Conference on Future Energy Concepts, London, England, January 30-February 1, 1979. Proceedings. (A79-37842 15-44) London, Institution of Electrical Engineers, 1979. p. 381-384.  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*FUELS/\*ORGANIC WASTES (FUEL CONVERSION)/\*WASTE UTILIZATION  
MINS: / BOILERS/ ENERGY CONVERSION EFFICIENCY/ ENERGY TECHNOLOGY/ FUEL COMBUSTION  
ABA: B.J.

ABS: Tests have been performed in order to evaluate the possible use of fuels derived from domestic and industrial waste as supplementary fuels for firing in moving grate boilers. Mixtures of coal and EPR (enriched processed refuse, a low grade fuel produced from a mixture of domestic refuse and oil waste) have been fired in the boilers at Kearsley 'B' Power Station. Results of boiler efficiency tests indicate that a mixed fuel containing 40 wt% EPR would be burned with a minimal loss in boiler efficiency and with a slight drop in boiler load.

79N32385# ISSUE 23 PAGE 3070 CATEGORY 28 RPT#:  
SAN-0115-T2 CNT#: EY-76-C-03-0115-131 79/03/00 76  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Mission analysis for the Federal Fuels from biomass program. Volume 1: Summary and conclusions TLSP: Final Report, Dec. 1978  
AUTH: A/SCHOOLEY, F. A.; B/DICKENSON, R. L.; C/KOMAN, S. W.; D/JONES, J. L.  
CORP: SRI International Corp., Menlo Park, Calif.  
ABA: DOE

ABS: An overview report on biomass derived fuels likely to achieve future market penetration and commercialization for the DOE. Solar Energy Division. Fuels From Biomass System Branch is presented. Fifteen feedstock-to-product routes were studied in detail, and economic data were summarized for 53 missions. Using a market penetration model and assuming base case feedstock availability (without federal

incentives). It was determined that seven of the 53 missions studied penetrate the market in 1985, 15 missions penetrate in 2000, and 15 penetrate in 2020, producing about 0.7, 3.5, and 5.4 quadrillion Btu of useful fuel products, respectively, in each of the years.

79A51972 ISSUE 23 PAGE 4384 CATEGORY 44  
79/00/00 6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Novel approaches to industrial energy conservation in Georgia  
AUTH: A/MUZZY, J. D.; B/SOMMERFELD, J. T. PAA: B/(Georgia Institute of Technology, Atlanta, Ga.)  
In: Intersociety Energy Conversion Engineering Conference, 14th, Boston, Mass., August 5-10, 1979. Proceedings, Volume 2. (A79-51726 23-44) Washington, D.C., American Chemical Society, 1979. p. 1703-1708. Research supported by the Georgia Office of Energy Resources and U.S. Department of Energy.

ABA: A.L.W.  
ABS: The operation of the Georgia Industrial Energy Extension Service (IEES) is described, and IEES case studies involving novel approaches to industrial energy conservation are presented. IEES serves as a vehicle of energy conservation technology transfer, conducting plant surveys in the general industrial sector and making recommendations on the ways surveyed plants and similar operations can conserve energy. Approaches suggested by the IEES include the upgrading of low-level waste heat by means of a thermal compressor; the operation of an absorption chiller with dirty boiler exhaust steam; the use of vacuum slots in textile drying; the use of waste sawdust for steam generation; the use of liquified process gases in refrigeration and air conditioning and the development of waste heat or solar powered refrigeration systems.

79A46312 ISSUE 20 PAGE 3787 CATEGORY 44  
79/04/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Farm-scale generation of bio-gas  
AUTH: A/GOODRICH, P. R.; B/GUSTAFSON, R. J.; C/HAUER, K. L.; D/LARSON, V. PAA: C/(Minnesota, University, St. Paul, Minn.)  
(University of Illinois and U.S. Department of Energy, Midwest Energy Conference, Chicago, Ill., Nov. 19-21, 1978.) Energy (UK), vol. 4, Apr. 1979, p. 249-261.  
MAJS: /\*ANAEROBES/\*BIOMASS ENERGY PRODUCTION/\*FARM CROPS/\* METHANE

MINS: / CARBON DIOXIDE/ ENERGY TECHNOLOGY/ GRAPHS (CHARTS)/ HYDROCARBON FUEL PRODUCTION/ TABLES (DATA)/ WASTE UTILIZATION  
ABA: (Author)

ABS: A farm-scale research and demonstration digester has been constructed, operated and monitored on a private medium-sized swine farm. Materials handling problems have been studied. Bio-gas from the digester is used in a motor generator set to be integrated into the farmstead energy system. The digester has been monitored to determine operational characteristics, amount of energy produced and efficiency of energy production.

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79A46310 ISSUE 20 PAGE 3787 CATEGORY 44  
79/04/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fuels and chemicals from biomass

AUTH: A/LADISCH, M. R.; B/FLICKINGER, M. C.; C/TSAO, G. T.  
PAA: C/(Purdue University, West Lafayette, Ind.)  
(University of Illinois and U.S. Department of Energy,  
Midwest Energy Conference, Chicago, Ill., Nov. 19-21,  
1978.) Energy (UK), vol. 4, Apr. 1979, p. 263-275.

ABA: A.T.

ABS: Techniques of converting cellulosic materials in  
biomass to sugars and alcohol are reviewed. Biomass is  
a cellulosic material composed of alpha- and  
hemicellulose and lignin, is renewable and abundant,  
and is a reservoir of solar energy stored through  
photosynthesis. The yield of sugars from cellulose has  
been increased to 90% or greater by the Purdue process  
in which cellulosic material is solvent-pretreated to  
facilitate hydrolysis to sugars by acid or enzyme.  
History of cellulose conversion technology by acids  
and enzymes is given, and the Purdue process is  
described, noting the solvents used for pretreatment  
which produce the increased sugar and consequent  
alcohol yield. It is concluded that this process may  
alleviate the future fossil-fuel dependency of the  
chemical industry and that the availability, quality,  
and cost of glucose from the solvent pretreatment

process may compare favorably with glucose derived  
from starch.

79A40736 ISSUE 17 PAGE 3235 CATEGORY 44  
79/00/00 363 PAGES UNCLASSIFIED DOCUMENT

UTTL: Chemistry for energy: Proceedings of the Symposium,  
Winnipeg, Manitoba, Canada, June 5-7, 1978

AUTH: A/TOMLINSON, M. PAA: A/(Whiteshell Nuclear Research  
Establishment, Pinawa, Manitoba, Canada) PAT:  
A/(ED.) SAP: \$25

Symposium sponsored by the Chemical Institute of  
Canada, Alberta Energy Co., Department of Energy,  
Mines and Resources of Canada, et al Washington, D.C.,  
American Chemical Society (ACS Symposium Series, No.  
90), 1979, 363 p (For individual items see A79-40737  
to A79-40750)

MAJS: /\*CHEMICAL ENGINEERING/\*CONFERENCES/\*ENERGY SOURCES/\*  
ENERGY TECHNOLOGY

MINS: / BIOMASS ENERGY PRODUCTION/ CANADA/ CHEMICAL ENERGY/  
COAL GASIFICATION/ COAL UTILIZATION/ ELECTROCHEMISTRY/  
ENERGY CONVERSION EFFICIENCY/ ENERGY POLICY/ ENERGY  
STORAGE/ FOSSIL FUELS/ FUEL CELLS/ HYDROCARBON FUEL  
PRODUCTION/ HYDROGEN PRODUCTION/ ORGANIC WASTES (FUEL  
CONVERSION)/ PHOTOCHEMICAL REACTIONS

ABA: S.D.

ABS: The chemistry of various sectors of energy production  
from Canadian sources is reviewed, and important R&D  
areas are identified. This 20-chapter book is divided  
into three main sections: fossil fuels, perpetual and  
renewable sources, and electricity production and  
storage. The fossil fuel section covers coal  
conversion, oil sands, sulfurization, peat, and the  
Canadian government's R&D program as well as Canada's  
fossil fuel resources. Under renewable resources, the  
potential of biomass is discussed, with emphasis on  
the most energy-efficient and least costly use of  
biomass, the direct burning of wood. The uses of  
anaerobic bacterial systems for conversion of animal  
manure into methane are examined along with the  
interaction of photosynthetic and sulfate-reducing  
bacteria in a membrane-separated anaerobic culture.  
Some of the chemical problems encountered during  
nuclear generation of electricity are considered.  
Solar energy is related to the thermodynamic and  
kinetic limits on its conversion and storage.

79A44590 ISSUE 19 PAGE 3624 CATEGORY 44  
79/08/10 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Photosynthetic pathway and biomass energy production

AUTH: A/MARZOLA, D. L.; B/BARTHOLOMEW, D. P. PAA:  
B/(Hawaii, University, Honolulu, Hawaii)  
Science, vol. 205, Aug. 10, 1979, p. 555-559.

MAJS: /\*ALCOHOLS/\*BIOMASS ENERGY PRODUCTION/\*CROP GROWTH/\*  
FERMENTATION/\*PHOTOSYNTHESIS

MINS: / SOLAR ENERGY CONVERSION/ STARCHES/ SUGAR CANE/  
SUGARS/ TABLES (DATA)/ TROPICAL REGIONS/ WATER

ABA: A.L.W.

ABS: Three plant species are compared in their  
photosynthetic abilities to provide useful energy in  
the form of alcohol when grown in a tropical  
environment. An evaluation of growing requirements,  
photosynthetic productivity, water use efficiency,  
energy requirements for production and yields of  
fermentable substrates is presented for cassava, sugar  
cane and pineapple. Production records for sugar cane  
and pineapple grown under a high level of management  
in Hawaii and cassava grown experimentally in Costa  
Rica and Jamaica reveal that carbohydrate production  
per hectare per month decreases from pineapple to  
sugar cane to cassava. It is pointed out that  
pineapple is well adapted to the subhumid or semiarid  
tropics and thus the growing of pineapple for energy  
conversion is particularly well suited to the  
exploitation of large areas not currently under  
cultivation.

79A51726 ISSUE 23 PAGE 4365 CATEGORY 44

79/00/00 2396 PAGES UNCLASSIFIED DOCUMENT

UTTL: Intersociety Energy Conversion Engineering Conference, 14th, Boston, Mass., August 5-10, 1979, Proceedings, Volumes 1 & 2 SAP: PRICE OF TWO VOLUMES, \$52.50  
Conference sponsored by ACS, AIChE, AIAA, ANS, ASME, IEEE, and SAE, Washington, D.C., American Chemical Society, 1979, Vol. 1, 1219 p.; vol. 2, 1179 p. (For individual items see A79-51727 to A79-52014)  
B.J.

ABA:

ABS:

Consideration is given to such topics as solar collectors, solar ponds, solar thermal systems, solar thermal components, OTEC systems, photovoltaic systems, wind power, desiccant cooling, biomass conversion, flywheel energy storage, compressed air energy storage technology, and thermal and magnetic energy storage. Papers are also presented on thermal energy storage for building space conditioning, fuel cells, electric vehicle systems, batteries for electric vehicles, hydrogen energy, coal liquifaction and gasification, fluidized bed processing for energy conversion systems, in situ oil shale and gas technology, geothermal energy, heat engines, and Stirling engine analysis. Finally, attention is also given to space power system requirements, satellite solar arrays, aircraft power systems, space nuclear reactor/isotope power systems, controlled fusion, thermoelectrics, thermionics, and magnetohydrodynamics.

79A52000 ISSUE 23 PAGE 4365 CATEGORY 44

79/00/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Increasing gas turbine efficiency through the use of a waste heat methanol reactor

AUTH: A/JAHES, C. W. PAA: A/(California Energy Commission, Sacramento, Calif.)

In: Intersociety Energy Conversion Engineering Conference, 14th, Boston, Mass., August 5-10, 1979, Proceedings, Volume 2, (A79-51726 23-44) Washington, D.C., American Chemical Society, 1979, p. 1968-1972, V.1.

ABA:

ABS:

The paper discusses generating of additional power from the exhaust heat of a gas turbine through the use of a waste-heat methanol reactor. With the advent of methanol as an available turbine fuel, waste heat can be recuperated as chemical energy by means of endothermic reactions and redeemed as high grade thermal energy in a combustor. The modification of a simple-cycle gas turbine by the addition of a catalytic waste-heat methanol reformer shows the 23% decrease in fuel cost. An overall coal-to-methanol-to-electricity conversion efficiency of 42% in the near term appears attainable.

79A46301 ISSUE 20 PAGE 3786 CATEGORY 44

79/04/00 239 PAGES UNCLASSIFIED DOCUMENT

UTTL: Midwest Energy Conference, Chicago, Ill., November 19-21, 1978, Proceedings

AUTH: A/HARTNETT, J. P. PAA: A/(Illinois, University, Chicago, Ill.) PAT: A/(ED.)

Conference sponsored by the University of Illinois and U.S. Department of Energy (UK), vol. 4, Apr. 1979, 239 p. (for individual items see A79-46302 to A79-46321)

MAJS: /\*CONFERENCES/\*ENERGY CONSERVATION/\*ENERGY CONVERSION /\*ENERGY STORAGE/\*ENERGY TECHNOLOGY

MINS: / BIOMASS ENERGY PRODUCTION/ CONTROLLED FUSION/ ELECTROCHEMICAL CELLS/ ENERGY CONVERSION EFFICIENCY/ MAGNETIC FIELD CONFIGURATIONS/ REACTOR DESIGN/ SOLAR COLLECTORS/ SUPERCONDUCTING MAGNETS/ SUPERCONDUCTIVITY / THERMAL INSULATION/ UTILITIES/ WASTE ENERGY UTILIZATION/ WASTE UTILIZATION/ WATERWAVE ENERGY

ABA:

ABS:

The conference focused on nuclear energy, energy storage and conservation, alternate energy sources, and coal. Specifically, papers were presented on the characteristics of the high power density tokamak reactor, advanced-fuel pellet approaches to inertial fusion, thermal storage efficiencies, effects of modifying heat transfer properties of indigenous sandstones, design of compressed air energy storage systems, superconductive magnetic energy storage, electronegative chemical reactors, biomass gasification, fuels and chemicals from biomass, study of a wave energy device, and a steam process for coal gasification.

79N28766# ISSUE 19 PAGE 2577 CATEGORY 44 RPT#:

TID-29391 CNT#: EY-76-C-03-1241 78/00/00 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: Thermochemical conversion: Biomass gasification

AUTH: A/GARRETT, D. E.

CORP: Garrett Energy Research and Engineering Co., Ojai, Calif. AVAIL NTIS SAP: HC A02/MF A01

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*WASTE ENERGY UTILIZATION

MINS: / GASIFICATION/ HYDROCARBONS/ PRODUCTION ENGINEERING

ABA: DOE

ABS: The thermal conversion of biomass into medium Btu gas is being studied in process development units of the multiple hearth type. The operation of the PDU is described and a process description is given. Significant findings with respect to the steam-carbon reaction rates, stability of the hydrocarbon gases, and direct contact drying of manure are summarized.

79N30825# ISSUE 21 PAGE 2852 CATEGORY 44 RPT#:  
DOE/TIC-10072 CNT#: EV-78-C-01-6388 78/11/10 42  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy from urban wastes: Report on a focus group discussion  
AUTH: A/NICHOLSON, W. E.  
CORP: Matnemtica, Inc., Princeton, N. J. AVAIL.NTIS  
SAP: HC A03/MF A01  
MAJS: /\*CITIES/\*ENERGY CONVERSION/\*ENERGY POLICY/\*ENERGY  
TECHNOLOGY/\*WASTE ENERGY UTILIZATION/\*WASTE  
UTILIZATION  
MINS: / COST ESTIMATES/ ECONOMIC FACTORS/ ENVIRONMENTAL  
QUALITY/ GARBAGE/ THERMAL ENERGY/ WASTE DISPOSAL  
ABA: DOE  
ABS: A qualitative assessment of the opinion concerning the  
commercialization potential of urban waste  
technologies is presented. Barriers to the  
commercialization of the urban waste energy production  
systems that were discussed include problems in  
serving long-term contracts, uncertainty about  
environmental laws, problems with the supply of  
refuse, disposal and use of residue, uncertainties  
about future tax laws, legal barriers, technical  
reliability, and citizen dissent.

79N29605# ISSUE 20 PAGE 2691 CATEGORY 44 RPT#:  
HCP/M2103-0006 CNT#: EC-77-C-01-2103 78/09/00 45  
PAGES UNCLASSIFIED DOCUMENT

UTTL: European waste-to-energy systems: Case study of  
Rennes, France  
CORP: Resource Planning Associates, Inc., Washington, D. C.  
AVAIL.NTIS SAP: HC A03/MF A01  
MAJS: /\*ENERGY CONVERSION/\*ENERGY TECHNOLOGY/\*FRANCE/\*WASTE  
ENERGY UTILIZATION  
MINS: / COSTS/ EUROPE/ HEATING/ SOLID WASTES/ SYSTEMS  
ENGINEERING  
ABA: R.E.S.  
ABS: The Rennes waste-to-energy unit is described. The  
unit, which burns the municipal solid waste of the  
city and 26 surrounding small communities, is  
connected to the district heating network. Along with  
an oil-fired heating plant, the Rennes combustion unit  
provides space heating and domestic hot water for  
nearly 5,000 housing units, hospital buildings,  
university dormitories, and other institutional and  
commercial buildings. The sale of energy recovered  
from municipal solid waste more than pays for the  
operation of the combustion unit. The collection of  
waste, the design and operation of the system, and the  
cost of the system are discussed in detail.

78N33598# ISSUE 24 PAGE 3242 CATEGORY 44 RPT#:  
HCP/T0285-02 CNT#: EG-77-X-10-0285 78/03/00 57  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Biomass energy success stories: A portfolio  
illustrating current economic uses of renewable  
biomass energy  
CORP: Biomass Energy Inst., Inc., Winnipeg (Manitoba).  
AVAIL.NTIS SAP: HC A04/MF A01  
MAJS: /\*BIBLIOGRAPHIES/\*BIOMASS/\*ECONOMIC FACTORS/\*ENERGY  
POLICY/\*INDUSTRIAL ENERGY  
MINS: / ENERGY CONSERVATION/ ENERGY TECHNOLOGY/ WASTE ENERGY  
UTILIZATION  
ABA: ERA  
ABS: Twenty-one illustrations of the use of energy from  
biomass by the sugar, pulp and paper, manufacturing,  
and wood products industries and for space heating of  
residences and institutional buildings are presented.

Uses include the combustion of wood wastes and  
sugarcane residues for production of industrial  
electric power needs, steam production for bleaching  
and dyeing operations, heat for industrial drying, and  
space heating. The six appendices give information on  
the overall availability of biomass and biomass  
residues in the U.S. and Canada.

78N32555# ISSUE 23 PAGE 3100 CATEGORY 44 RPT#:  
AD-A055452 AFLEC-TR-78-4 CNT#: F08635-77-C-0026  
78/05/00 212 PAGES UNCLASSIFIED DOCUMENT

UTTL: Waste energy recovery study TLSP: Final Report, Apr.  
- Dec. 1977  
AUTH: A/GOLOBIC, R. A.; B/MRKVICKA, D. A.; C/SCHLICHT, H.  
C.  
CORP: Research, Analysis and Development Corp., Colorado  
Springs, Colo. AVAIL.NTIS SAP: HC A10/MF A01  
MAJS: /\*ENERGY TRANSFER/\*WASTE ENERGY UTILIZATION  
MINS: / COST EFFECTIVENESS/ ENERGY CONSUMPTION/ HEAT  
EXCHANGERS/ SYSTEMS ANALYSIS/ TEST FACILITIES  
ABA: GRA  
ABS: Part 1 of this report outlines the techniques used for  
determining appropriate schemes for energy recovery.  
Both thermodynamic and economic considerations are  
presented. Part 2 contains rejected-energy recovery  
studies for facilities, which are typical at most  
installations. Part 3 is primarily concerned with  
special industrial recovery systems and most examples  
are a result of the Tinker AFB, OK, survey.  
Wright-Patterson AFB, OH, was also surveyed during  
this study.

79N15207# ISSUE 6 PAGE 716 CATEGORY 28 RPT#:  
PB-287868/4 MITSG-78-11 OPPORTUNITY-BRIEF-11  
NOAA-78090601 INDEX-78-711-ZLG 78/05/00 34 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: The economics and engineering of large-scale algae biomass energy systems

AUTH: A/DOELLING, N.

CORP: Massachusetts Inst. of Tech., Cambridge, CSS: ( Marine Industry Advisory Services.) AVAIL.NTIS  
SAP: HC A03/MF A01

Sponsored by NOAA, Rockville, Md.

MAJS: /\*ALGAE/\*BIOMASS ENERGY PRODUCTION/\*COST EFFECTIVENESS  
/\*SYSTEMS ENGINEERING/\*TECHNOLOGY ASSESSMENT  
MINS: / ANAEROBES/ ENERGY REQUIREMENTS/ FILTRATION/ METHANE/  
SEAWEEDES/ SOLAR ENERGY CONVERSION

ABA: GRA

ABS: The current state of the art and the potential of aquatic plant biomass systems over the next three to five years is outlined to suggest industrial development and research opportunities. Giant kelp (*Macrocystis*) capable of prodigious absolute growth rates (but low percentage growth rates), is recognized as a choice source of biomass for energy. The major unsolved problem in algal farms is harvesting the algae in a way that does not consume more energy than it produces. Centrifuging and drying require so much energy as to be prohibitive. Some form of filtering and concentration of the algae, by means of induced settling, floatation, or filtering, followed by anaerobic digestion of the algae medium to produce methane is the most probable technique.

78N32562# ISSUE 23 PAGE 3102 CATEGORY 44 RPT#:  
IID-28393 CNT#: W-31-109-ENG-38 78/02/00 36 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Department of Energy programs and objectives: Fluid waste heat recovery and utilization --- conference

CORP: Washington Scientific Marketing, Inc., Washington, D. C. AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /\*CONFERENCES/\*ENERGY POLICY/\*HEAT SOURCES/\*INDUSTRIAL ENERGY/\*WASTE ENERGY UTILIZATION

MINS: / ENERGY CONSERVATION/ ENERGY CONVERSION EFFICIENCY/  
INDUSTRIAL WASTES/ REUSE

ABA: ERA

ABS: The primary objective of the Division of Industrial Energy Conservation is to improve technology that will make industry and agriculture more energy-efficient. Work to remove technological and economic barriers to enhance industrial implementation of energy-efficient processes and technology is reported. Subprograms to carry out the Division's goals are described. These are waste energy reduction; alternate materials utilization; advanced cogeneration-industrial process efficiency, and agricultural and food process efficiency.

79N29375# ISSUE 20 PAGE 2661 CATEGORY 28 RPT#:  
TID-29091 CNT#: LY-76-C-03-0115-131 78/12/00 69  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Mission analysis for the federal fuels from biomass program. Volume 2: Mission selection, market penetration modeling, and economic evaluation (LSP: Final Report

AUTH: A/SCHODLEY, F. A.; B/MILLER, K. A.; C/MEAGHER, P. C.;  
D/CROOKS, G.; E/GRILL, C.; F/DICKENSON, R. L.

CORP: SRI International Corp., Menlo Park, Calif.  
AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*CHEMICAL FUELS/\*ECONOMIC ANALYSIS/\*MARKET RESEARCH/\*SYNTHETIC FUELS

MINS: / COMMERCIAL ENERGY/ ENERGY CONVERSION/ ENERGY TECHNOLOGY/ WASTE ENERGY UTILIZATION

ABA: DOE

ABS: The market penetration model is described and the procedure used in selecting for analysis missions with potential for commercialization is identified. The inputs to the market penetration model are discussed, except for feedstock availability data. The model inputs include conventional fuel prices and demands and mission conversion economics.

79N24180# ISSUE 15 PAGE 1064 CATEGORY 28 RPT#:  
SERI-35 CNT#: EG-77-C-01-4042 78/07/00 44 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Densified biomass: A new form of solid fuel

AUTH: A/REED, T.; B/BYRANT, B.

CORP: Midwest Research Inst., Golden, Colo. CSS: (Solar Energy Research Inst.) AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /\*BIOMASS/\*DENSIFICATION/\*FUELS/\*SOLID PROPELLANTS

MINS: / COST ANALYSIS/ ECONOMIC ANALYSIS/ ENERGY TECHNOLOGY/  
WASTE UTILIZATION

ABA: DOE

ABS: Biomass is an economically and environmentally attractive fuel, but it is often difficult to collect, store, ship, and use. Densifying biomass to a specific gravity of 1.0 eliminates most of these fundamental problems and produces a uniform, clean, stable fuel: densified biomass fuel or DBF. Before conversion to DBF, raw biomass residues generally require preparation: the separation of noncombustibles from combustibles, especially for solid municipal waste; milling; and drying. About 5% of the energy content in raw biomass can be expended in preparation and 11 to 3% in densification. In its densified form, biomass can be burned in standard equipment with reduced emissions and increased heat release and thermal efficiency.

79A45231 ISSUE 15 PAGE 3627 CATEGORY 44  
78/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Biomass conversion potential in the Southeast  
AUTH: A/SAHA, H. PAA: A/(Alabama A & M University,  
Huntsville, Ala.)

In: Application of solar energy; Proceedings of the  
Third Southeastern Conference, Huntsville, Ala., April  
17-19, 1978. (A79-45201 19-44) Huntsville, Ala., UAH  
Press, 1978, p. 481-488.

MAJS: /\*BIOELECTRIC POTENTIAL/\*BIOMASS ENERGY PRODUCTION/\*  
ENERGY CONVERSION EFFICIENCY

MINS: / AGRICULTURE/ ENERGY TECHNOLOGY/ GASIFICATION/  
HYDROGEN FUELS/ LIQUEFACTION/ ORGANIC WASTES (FUEL  
CONVERSION)/ PHOTOLYSIS/ THERMOCHEMISTRY/ WASTE ENERGY  
UTILIZATION

ABA: C.F.W.

ABS: The biomass production and conversion potential of the  
southeastern U.S., with its large forest land and wood  
residue, long coastal areas, abundance of water, large  
amounts of readily collectable agricultural, urban and  
industrial waste materials, longer rainfall and  
fertile soil, is examined. Various types of biomass  
production and conversion methods, including  
terrestrial and silvicultural biomass as well as  
herbaceous, aquatic and organic waste biomass, are  
evaluated. A result of a silvicultural biomass  
production found that its productivity under  
closed-space, short-rotation conditions could yield  
annual dry-ton-equivalents of 5 to 13 tons per acre.  
It was also determined that the most promising  
production of large quantities of biomass in the SE  
U.S. would be the establishment of intensively-managed  
energy farms, using woody and herbaceous species,  
including forest and crop residues, high-yield crops,  
and animal manure. Special attention is given to  
diagrams that describe biomass conversions, such as  
terrestrial biomass and domestic residue, and to a  
description of the basic steps in ethanol production  
from farm products.

ORIGINAL PAGE 1  
OF POOR QUALITY

79N19450\*# ISSUE 10 PAGE 1297 CATEGORY 44  
RPT#: NASA-CR-158228 JPL-PUB-79-9 CNT#: NAS7-100  
76/11/15 124 PAGES UNCLASSIFIED DOCUMENT

UTTL: Bioconversion study conducted by JPL

AUTH: A/KALVINSKAS, J.

CORP: Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.  
AVAILNTIS S&P: HC A06/MF A01

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY CONVERSION/\*ENERGY  
REQUIREMENTS/\*ENERGY STORAGE

MINS: / ACTIVITY (BIOLOGY)/ BIOCHEMISTRY/ BIOMASS/ FUELS/  
RECOMMENDATIONS/ TECHNOLOGY ASSESSMENT/  
THERMOCHEMISTRY

ABA: Author

ABS: The Jet Propulsion Laboratory (JPL) of Caltech  
conducted a study of bioconversion as a means of  
identifying the role of biomass for meeting the  
national energy fuel and chemical requirements and the  
role and means for JPL-Caltech involvement in  
bioconversion. The bioconversion study included the  
following categories; biomass sources, chemicals from  
biomass, thermochemical conversion of biomass to  
fuels, biological conversion of biomass to fuels and  
chemicals, and basic bioconversion sciences. A  
detailed review is included of the bioconversion  
fields cited with specific conclusions and  
recommendations given for future research and  
development and overall biomass system engineering and  
economic studies.

79A22273 ISSUE 7 PAGE 1235 CATEGORY 44  
78/12/00 5 PAGES In FRENCH UNCLASSIFIED DOCUMENT

UTTL: Electrochemical use of biomass

AUTH: A/GILLET, I. PAA: A/(Liege, Universite, Liege,  
Belgium)

Cooperation Mediterranee pour l'Energie Solaire,  
Revue Internationale d'Heliotechnique, 2nd Semester,  
1978, p. 46-50. In French.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ELECTRIC GENERATORS/\*  
ELECTROCHEMICAL CELLS/\*FUEL COMBUSTION

MINS: / ENERGY TECHNOLOGY/ GLUCOSE/ GLYCEROLS/ HYDROGEN  
FUELS/ SOLAR ENERGY CONVERSION

ABA: W.L.

ABS: Electrochemical oxidation studies of glucose and  
glycerine, which are substances derived from plant  
biomass, are reported. It is suggested that these  
substances serve as solar energy storage systems. The  
results of preliminary experiments are considered with  
reference to the determination of parameters that  
would enable the design of solar energy storage  
systems which use substances obtained from plant  
biomass.

79A13876# ISSUE 3 PAGE 416 CATEGORY 44 RPT#:  
AIAA PAPER 78-1781 CNT# EY-76-5-02-2982 78/11/00  
5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Liquid fuels from biomass

AUTH: A/KUESTER, J. L. PAA: A/(Arizona State University,  
Tempe, Ariz.)

American Institute of Aeronautics and Astronautics and  
Arizona Solar Energy Research Commission, Conference  
on Solar Energy: Technology Status, Phoenix, Ariz.,  
Nov. 27-29, 1978, AIAA 5 p. Research supported by the  
Arizona Solar Energy Research Commission.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*HYDROCARBON FUEL  
PRODUCTION/\*ORGANIC WASTES (FUEL CONVERSION)

MINS: / ENERGY TECHNOLOGY/ LIQUID PHASES/ PYROLYSIS/ SLUDGE/  
SLUDGE/ WASTE UTILIZATION

ABA: (Author)

ABS: A project is described with the objective of  
converting cellulosic (biomass) and waste polymer  
materials to liquid fuel equivalents of current  
commercial products (kerosene, diesel fuel, high  
octane gasoline). A thermal conversion approach is  
utilized. Quality products have been produced with  
expected yields in the 20-100 gals fuel/ton feedstock

depending on the type of feedstock processed.

78N30404# ISSUE 21 PAGE 2797 CATEGORY 28  
78/02/00 6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Alcohols and gaseous fuels from biomass

AUTH: A/MCCALLUM, P. W.

CORP: Mueller Associates, Inc., Baltimore, Md. AVAIL.NTIS  
SAP: HC A22/MF A01

In NATO Proc. of the 4th Intern. Symp. on Automotive  
Propulsion Systems, Vol. 2 p 789-795 (SEE N78-30370  
21-31)

MAJS: /\*ALCOHOLS/\*BIOMASS ENERGY PRODUCTION/\*GASEOUS FUELS/\*  
WASTE UTILIZATION

MINS: / ENERGY CONVERSION/ ENERGY TECHNOLOGY/ FERMENTATION/  
METHANE/ TRANSPORTATION ENERGY/ WASTE ENERGY  
UTILIZATION

ABA: G.Y.

ABS: Bioconversion processes for the production of alcohols  
and gaseous fuels from biomass or organic plant and  
animal matter are discussed. An anaerobic digestion  
(fermentation) scheme is presented for the production  
of methane and ethanol from complex organics and  
organic starches, respectively. The implications of  
the utilization of alcohols and gaseous fuels for  
transportation are discussed.

79N10528# ISSUE 1 PAGE 70 CATEGORY 44 78/03/31  
199 PAGES UNCLASSIFIED DOCUMENT

UTTL: An evaluation of wood-waste energy conversion systems

AUTH: A/LEVELTON, B. H.

CORP: Levelton (B. H.) and Associates Ltd., Vancouver  
(British Columbia). AVAIL.NTIS SAP: HC A09/MF A01  
Environ. Canada Western Forest Products Lab.

MAJS: /\*ENERGY CONVERSION/\*WASTE ENERGY UTILIZATION/\*WOOD

MINS: / BOILERS/ FLUIDIZED BED PROCESSORS/ FUELS/  
GASIFICATION/ INDUSTRIES/ MATERIALS RECOVERY/ SYSTEMS  
ANALYSIS/ TECHNOLOGY UTILIZATION

ABA: G.Y.

ABS: The British Columbia Wood Waste Energy Co-ordinating  
Commission was formed to evaluate the potential  
increased use of wood waste as an energy source in  
British Columbia. As part of this program, the  
committee commissioned a study of the technology  
available for recovering energy from wood waste and  
evaluation of the merits of various systems available  
for energy recovery. The terms of reference of the  
study may be summarized as follows: (1) identify  
potential applications in the forest-products industry  
for wood-waste fuels to replace fossil fuels; (2)  
identify and assess the relative merits of the various  
classes of systems for wood energy conversion; and (3)  
identify and evaluate specific existing commercial and  
pilot-scale systems for wood-energy conversion with  
emphasis on all possible end uses of each system.

79A38617 ISSUE 16 PAGE 3027 CATEGORY 44

78/00/00 10 PAGES In FRENCH UNCLASSIFIED DOCUMENT

UTTL: Practical aspects and applications of bioconversion

AUTH: A/HASDENTEUFEL, J. B. PAA: W/(Nice, Universite,  
Nice, France)

In: International Solar Forum, 2nd, Hamburg, West  
Germany, July 12-14, 1978, Reports, Volume 2,  
(A79-38576 16-44) Munich, Deutsche Gesellschaft fuer  
Sonnenergie, 1978, p. 17-26. In French.

MAJS: /\*ALGAE/\*BIOMASS ENERGY PRODUCTION/\*FOOD/\*  
PHOTOSYNTHESIS

MINS: / ENERGY TECHNOLOGY/ HYDROCARBON FUEL PRODUCTION/  
METHANE/ PROTEINS

ABA: P.T.H.

ABS: The paper discusses the harnessing of the basic  
reactions of photosynthesis and microorganism activity  
for the purpose of industrial production or high  
energy materials that are easily stored. Some of the  
processes mentioned include photolysis of water  
constituents and hydrogen production at low  
temperature, algae cultivation on lagoon surfaces and  
reefs, the transformation of these algae into methane  
by bacterial fermentation, and the production of  
protein food rich in essential amino acids.

79A17220 ISSUE 5 PAGE 838 CATEGORY 44 78/CO/00  
4 PAGES UNCLASSIFIED DOCUMENT

UTTL: Urban wastes as an energy source

AUTH: A/KUESTER, J. L. PAA: A/(Arizona State University,  
Tempe, Ariz.)

In: Energy systems: An analysis for engineers and  
policy makers. New York, Marcel Dekker, Inc., 1978, p.  
75-78.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY SOURCES/\*ORGANIC  
WASTES (FUEL CONVERSION)/\*WASTE UTILIZATION

MINS: / CELLULOSE/ ECONOMIC FACTORS/ ENERGY CONVERSION/  
ENERGY TECHNOLOGY/ HYDROCARBON FUEL PRODUCTION/  
METABOLIC WASTES/ METHANE

ABA: G.R.

ABS: The main ingredient of urban refuse that is  
convertible to energy forms is cellulose. Available  
cellulose type material in urban refuse is limited,  
i.e., only about 2-5 percent of the U.S. energy needs  
could be fulfilled utilizing waste municipal sources.  
If one considers agricultural and forest wastes as  
well as 'energy farms', the supply becomes virtually  
unlimited. Thus the use of cellulose as an energy  
source would appear to depend on availability of  
reliable conversion processes with attractive  
economics. Several options exist for useful conversion  
of cellulosic type materials for energy purposes.  
Methane gas recovery from existing landfills is a  
possibility for 'suitable' sites with relatively  
simple technology. Suitable sites are limited,  
however. Biological processes are capable of producing  
methane, compost, and glucose. Attention is also given  
to refuse characteristics, a list of resource recovery  
systems, economics, markets, and environmental  
considerations.

**A79-40743 # Potential of biomass to substitute for petro-  
leum in Canada.** C. R. Phillips, D. L. Granatstein, and M. A. Wheatley  
(Toronto, University, Toronto, Canada). In: Chemistry for energy;  
Proceedings of the Symposium, Winnipeg, Manitoba, Canada, June  
5-7, 1978. (A79-40736 17-44) Washington, D.C., American Chemical  
Society, 1979, p. 133-164. 25 refs.

The potential for production of liquid fuels from biomass in  
Canada is assessed. To this end, the availability and cost of wood  
wastes, surplus roundwood, bush residues, energy plantation trees,  
and municipal solid wastes (mostly cellulosic) are examined. Promis-  
ing thermal, chemical and biochemical conversion processes are  
discussed. The main competitive options of Canada for long-term  
liquid fuel supply are shown in tabular form. S.D.

79A41803 ISSUE 17 PAGE 3259 CATEGORY 44  
78/00/00 14 PAGES In FRENCH UNCLASSIFIED DOCUMENT

UTTL: Bioconversion of solar energy

AUTH: A/CHARTIER, P. PAA: A/(Institut National de la  
Recherche Agronomique, Versailles, France)  
In: INOVA: Industrial innovation; Conference, Paris,  
France, June 13-17, 1977. Proceedings, Volume 2.  
(A79-41801 17-44) Paris, Ministere de l'Industrie,  
1978, p. 84-97. In French.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*PHOTOSYNTHESIS/\*SOLAR  
ENERGY CONVERSION

MINS: / AGRICULTURE/ CORN/ ENERGY CONVERSION EFFICIENCY/  
ENERGY TECHNOLOGY/ FOSSIL FUELS/ FRANCE/ LAND USE/  
PHOTOCHEMICAL REACTIONS

ABA: B.J.

ABS: The paper describes biomass production through  
photosynthesis and compares biomass energy yield with  
yields from incident solar radiation and from  
conventional fossil fuel sources. The areas of land  
that will have to be devoted to biomass production in  
order to make this energy source worthwhile are  
examined and consideration is given to the modes of  
biomass utilization as an energy source, including the  
meeting of decentralized energy requirements and the  
distribution on a massive scale of solid, liquid or  
gaseous combustibles. The perspectives of biological  
solar energy conversion systems are considered.

79A41816 ISSUE 17 PAGE 3260 CATEGORY 44  
78/00/00 7 PAGES In FRENCH UNCLASSIFIED DOCUMENT

UTTL: Energy evaluation of agricultural waste products

AUTH: A/BOUCHET, R.-J. PAA: A/(Institut National de la  
Recherche Agronomique, Paris, France)  
In: INOVA: Industrial innovation; Conference, Paris,  
France, June 13-17, 1977. Proceedings, Volume 2.  
(A79-41801 17-44) Paris, Ministere de l'Industrie,  
1978, p. 174-180. In French.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*HYDROCARBON FUEL  
PRODUCTION/\*WASTE UTILIZATION

MINS: / AGRICULTURE/ CARBONIZATION/ COMBUSTION/ FERMENTATION  
/ METHANE/ METHYL ALCOHOLS/ PYROLYSIS

ABA: B.J.

ABS: Some results in France on the energy evaluation of  
biomass wastes are presented. Four methods of biomass  
energy production are briefly reviewed: (1) methane  
production through fermentation, (2) alcohol  
production through fermentation, (3) combustion, and  
(4) carbonization and pyrolysis.

79N30393 ISSUE 21 PAGE 2796 CATEGORY 28 RPT#:  
GPO-37-136 78/00/00 409 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Bioconversion  
CORP: Committee on Science and Technology (U. S. House).  
SAP: Avail: Subcomm. on Advanced Energy Technologies  
and Energy Conservation Res., Development and  
Demonstration  
Washington GPO Hearings before the Subcomm. on  
Advanced Energy Technologies and Energy Conservation  
Res., Development and Demonstration of the Comm. on  
Sci. and Technol., 95th Congr., 2d Sess., 15 Jul. and  
5 Aug. 1978  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*CONGRESSIONAL REPORTS/\*  
ENERGY TECHNOLOGY/\*UNITED STATES OF AMERICA  
MINS: / ENERGY CONSERVATION/ ENERGY CONVERSION/ SYNTHETIC  
FUELS/ WASTE ENERGY UTILIZATION  
ABA: R.E.S.  
ABS: Testimony and statements on issues and priorities  
surrounding the development of bioconversion (biomass  
energy conversion) in the different geographical  
regions of the United States are presented.

79N11481\*# ISSUE 2 PAGE 200 CATEGORY 44 RPT#:  
NASA-TM-78994 E-9777 DOE/NASA/1034-79/3 CNT#:  
EC-77-A-31-1034 78/00/00 14 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Thermal storage for industrial process and reject heat  
AUTH: A/DUSCHA, R. A.; B/MASICA, W. J.  
CORP: National Aeronautics and Space Administration, Lewis  
Research Center, Cleveland, Ohio. AVAIL.NTIS SAP:  
HC 402/MF A01  
Presented at the 2d Conf. on Waste Heat Management and  
Util., Miami Beach, Fla., 4-6 Dec. 1978  
MAJS: /\*ENERGY POLICY/\*HEAT STORAGE/\*INDUSTRIAL ENERGY/\*  
WASTE ENERGY UTILIZATION  
MINS: / CEMENTS/ ENERGY CONSERVATION/ FOSSIL FUELS/ PAPER  
(MATERIAL)/ STEELS  
ABA: S.B.S.  
ABS: Industrial production uses about 40 percent of the  
total energy consumed in the United States. The major  
share of this is derived from fossil fuel. Potential  
savings of scarce fuel is possible through the use of  
thermal energy storage (TES) of reject or process heat  
for subsequent use. Three especially significant  
industries where high temperature TES appears  
attractive - paper and pulp, iron and steel, and  
cement are discussed. Potential annual fuel savings,  
with large scale implementation of near-term TES  
systems for these three industries, is nearly  
9,000,000 bbl of oil.

79A17367 ISSUE 5 PAGE 846 CATEGORY 44 78/00/00  
6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy through solar aided bio-gas systems  
AUTH: A/GUPTA, S. C. PAA: A/(Allahabad Agricultural  
Institute, Allahabad, India)  
In: Sun: Mankind's future source of energy;  
Proceedings of the International Solar Energy  
Congress, New Delhi, India, January 16-21, 1978.  
Volume 2. (A79-17276 (5-44) Elmsford, N. Y., Pergamon  
Press, Inc., 1978, p. 791-796.  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY TECHNOLOGY/\*  
GASEOUS FUELS/\*ORGANIC WASTES (FUEL CONVERSION)/\*SOLAR  
ENERGY  
MINS: / ANAEROBES/ FERMENTATION/ SOLAR HEATING  
ABA: (Author)  
ABS: Solar energy can effectively be utilized to accelerate  
the anaerobic fermentation of organic matter by  
heating the slurry in the digester to the optimum  
temperature during cold winters. Gas production rate  
can further be improved by adding some catalytic  
agents. A flat plate solar water heater has been  
coupled to a spiral heat exchanger embedded in the  
digester slurry of a bio-gas plant. Effects on gas  
production rate and on waste retention period in  
presence of different additives are studied at  
different temperatures. An analysis of the techniques  
to improve the quality of produced gas is also  
discussed.

78A50147 ISSUE 22 PAGE 4035 CATEGORY 44  
78/00/00 4 PAGES UNCLASSIFIED DOCUMENT

UTTL: Survey of pyroconversion processes for biomass  
AUTH: A/REED, T. B. PAA: A/(Synthetic Fuel Research  
Center, Concord, Mass.)  
In: Pacific Chemical Engineering Congress, 2nd,  
Denver, Colo., August 28-31, 1977. Proceedings, Volume  
2. (A78-50126 22-45) New York, American Institute of  
Chemical Engineers, 1978, p. 765-768.  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY CONVERSION/\*  
PYROLYSIS  
MINS: / CHARCOAL/ CHEMICAL REACTIONS/ COAL UTILIZATION/  
ENERGY TECHNOLOGY/ FUEL COMBUSTION/ GASIFICATION/  
HYDROGENATION/ THERMODYNAMICS  
ABA: B.J.  
ABS: The chemistry, thermodynamics, and process steps of  
the pyroconversion of biomass are described.  
Consideration is given to chemical reactions of  
biomass, char reactions and charcoal production,  
pyrolytic oil production, and gasification,  
hydrogenation, and combustion of biomass. The biomass  
can be burned directly for heat, or it can be  
converted to solid, liquid or gaseous synthetic fuels.

78A2986B ISSUE 11 PAGE 2002 CATEGORY 44  
78/03/00 19 PAGES UNCLASSIFIED DOCUMENT

UTTL: Multi-stage digestion of municipal solid waste to fuel gas

AUTH: A/WISE, D. L.; B/WENTWORTH, R. L.; C/AUGENSTEIN, D. C.; D/COONEY, C. L. PAA: C/(Dynatech R/D Co., Cambridge, Mass.); D/MIT, Cambridge, Mass.)  
Resource Recovery and Conservation, vol. 3, Mar. 1978, p. 41-59. Research supported by the Consolidated Natural Gas Service Co.

MAJS: /\*ANAEROBES/\*BIOMASS ENERGY PRODUCTION/\*HYDROCARBON FUEL PRODUCTION/\*WASTE UTILIZATION

MINS: / ACETIC ACID/ ENERGY CONVERSION/ GARBAGE/ METHANE/ MICROORGANISMS/ WASTE DISPOSAL

ABA: D.M.W.

ABS: The paper presents a study of municipal waste recovery in which acid formers in the waste material were separated from methane formers. A plug flow digesting system consisting of ten individual jars of 3.8 l each was constructed to suppress methane production, while solubilizing cellulosic material into organic breakdown products. The organics were then fed to an 83 l CSIR (continuous stirred tank reactor) for the generation of methane gas. Later, the same experiment was tried on a larger scale (2080 l total working volume, followed by a 2270 l CSIR). The combined system was found effective in reducing the need for gas scrubbing. Attention is given to acetic acid inhibition of acid forming microorganisms (which limit the solubilization in the plug flow unit). It is suggested that future research in this area focus on the development of microorganism populations which will tolerate higher levels of acetic acid.

79N31404# ISSUE 22 PAGE 2933 CATEGORY 28 RPT#  
GPO-32-317 78/00/00 163 PAGES UNCLASSIFIED DOCUMENT

UTTL: Biomass conversion --- congressional reports agriculture technology assessment

CORP: Committee on Government Operations (U. S. House).  
SAP: Avail: Comm. on Government Operations  
Washington GPO Hearing before a Subcomm. of the Comm. on Government Operations, 95th Congr., 2d Sess 14 Apr. 1978

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*CONGRESSIONAL REPORTS/\* ECONOMIC FACTORS/\*ENERGY POLICY

MINS: / ALCOHOLS/ CITIES/ SOLID WASTES

ABA: M.M.M.

ABS: Testimony was given and arguments were heard on the economics and the technical viability of producing alcohol fuels and chemical feedstocks from agricultural products and wastes and urban organic wastes.

78A41815 ISSUE 18 PAGE 3291 CATEGORY 44  
78/00/00 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy for agriculture and the gasification of crop residues

AUTH: A/HORSFIELD, B.; B/WILLIAMS, R. O. PAA:  
B/(California, University, Davis, Calif.)  
Energy Sources, vol. 3, no. 3-4, 1978, p. 277-292.

MAJS: /\*AGRICULTURE/\*BIOMASS ENERGY PRODUCTION/\*FARM CROPS/\* WASTE UTILIZATION

MINS: / COMMERCIAL ENERGY/ HYDROCARBON FUEL PRODUCTION/ LOW COST/ RESIDUES

ABA: J.M.B.

ABS: Conversion of crop residues from corn, wheat, soybeans, sugar cane, cotton, rice and other products may provide the U.S. with up to 6.4 times 10 to the 15th power Btu per year. If suitable collection and processing facilities can be developed. Extraction of a combustible gas from crop residues by burning in a fixed bed with limited air supplies is proposed as the most efficient means for exploiting the residues. Updraft, downdraft and crossdraft gas producers are described, and applications of the gas producers to lumber milling, heating, cotton ginning and pumping irrigation water are mentioned.

79N27335# ISSUE 18 PAGE 2390 CATEGORY 28 RPT#:  
HCP/ET-2854 CNT#: ET-78-C-01-2854 78/09/00 140 PAGES UNCLASSIFIED DOCUMENT

UTTL: Comparative economic assessment of ethanol from biomass

CORP: Mitre Corp., McLean, Va. CSS: (METREK Div.)  
AVAILNTIS SAP: HC A07/MF A01

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ECONOMIC ANALYSIS/\*ETHYL ALCOHOL/\*LIFE CYCLE COSTS

MINS: / INDUSTRIAL PLANTS/ MATHEMATICAL MODELS/ PRODUCTION ENGINEERING

ABA: DOE

ABS: Fourteen studies and reports in which the economic aspects of producing ethanol from various biomass feed-stocks were evaluated. These studies presented 28 ethanol plant configurations. The major assumptions made and the financial and cost/performance parameters used for each configuration were identified. This information was used to compute life cycle costs of ethanol production using the full life cycle cost model and the systems to project the utilization of renewable resources model. The differences between ethanol selling prices given in the studies reviewed and those obtained with the models are discussed. Life cycle costs were also calculated using a common set of financial parameters for all ethanol configurations.

79A50886 ISSUE 22 PAGE 4193 CATEGORY 45 CNT#:  
NOAA-04-7-158-44104 78/00/00 15 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Primary impacts of growing aquatic plants for energy  
AUTH: A/HRUBY, T. PAA: A/(Woods Hole Oceanographic  
Institution, Woods Hole, Mass.)  
In: Conference on Environmental Aspects of  
Non-Conventional Energy Resources - II, Denver, Colo.,  
September 26-29, 1978, Proceedings. (A79-50876 22-45)  
La Grange Park, Ill., American Nuclear Society, 1978,  
p. 22-1, 22-3 to 22-16. Research supported by the Pew  
Memorial Trust and Woods Hole Oceanographic  
Institution;  
MAJS: /\*AQUICULTURE/\*BIOMASS ENERGY PRODUCTION/\*ENVIRONMENT  
EFFECTS/\*OFFSHORE ENERGY SOURCES/\*PLANTS (BOTANY)  
MINS: / ALGAE/ ENERGY TECHNOLOGY/ MASSACHUSETTS/ NEARSHORE  
WATER  
ABA: V.T.  
ABS: The environmental impacts of systems proposed for the  
large-scale culture of algae or other aquatic plants  
on the open ocean, in shallow coastal waters, or in  
ponds on land are considered. All systems are found to  
be potentially dangerous for the natural and human  
environments, but those for the land-based farms are  
more dependent on the exact design of the ponds and  
their processing units than either the open-ocean or  
near-shore systems. Therefore, if environmental  
impacts are used as criteria in the choice of a  
system, aquatic plants grown in ponds are better  
suited for development as biomass sources than those  
cultured on the open ocean or near the shore.

A79-46313 Fuels and chemicals from biomass. M. R.  
Ladisch, M. C. Flickinger, and G. T. Tsao (Purdue University, West  
Lafayette, Ind.). (University of Illinois and U.S. Department of  
Energy, Midwest Energy Conference, Chicago, Ill., Nov. 19-21,  
1978.) Energy (UK), vol. 4, Apr. 1979, p. 263-275. 75 refs.

Techniques of converting cellulosic materials in biomass to  
sugars and alcohol are reviewed. Biomass is a cellulosic material  
composed of alpha- and hemicellulose and lignin, is renewable and  
abundant, and is a reservoir of solar energy stored through  
photosynthesis. The yield of sugars from cellulose has been increased  
to 90% or greater by the Purdue process in which cellulosic material  
is solvent-pretreated to facilitate hydrolysis to sugars by acid or  
enzyme. History of cellulose conversion technology by acids and  
enzymes is given, and the Purdue process is described, noting the  
solvents used for pretreatment which produce the increased sugar  
and consequent alcohol yield. It is concluded that this process may  
alleviate the future fossil-fuel dependency of the chemical industry  
and that the availability, quality, and cost of glucose from the  
solvent pretreatment process may compare favorably with glucose  
derived from starch. A.T.

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79A17373 ISSUE 5 PAGE B47 CATEGORY 44 78/00/00  
5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Bio-mass energy for rural areas  
AUTH: A/GOPALAKRISHNAN, K. V.; B/MURTHY, B. S. PAA:  
B/(Indian Institute of Technology, Madras, India)  
In: Sun: Mankind's future source of energy;  
Proceedings of the International Solar Energy  
Congress, New Delhi, India, January 16-21, 1978.  
Volume 2. (A79-17276 (5-44) Elmsford, N.Y., Pergamon  
Press, Inc., 1978, p. B24-B28.  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*DEVELOPING NATIONS/\*  
ELECTRIC POWER/\*ENERGY TECHNOLOGY/\*RURAL AREAS  
MINS: / COST ANALYSIS/ ELECTRIC POWER PLANTS/ ENERGY  
CONVERSION EFFICIENCY  
ABA: (Author)

ABS: This paper presents the case for the adoption of  
Biomass Energy System for supplying electrical energy  
to the rural areas of developing countries. Its  
advantages as against conventional generating systems  
and other methods of solar energy utilization are  
presented. The various aspects of this system are  
discussed. The problem areas in the system requiring  
research and development are identified. Finally, the  
research efforts under way in the authors' institution  
to solve some of these problems is reported.

78N33259# ISSUE 24 PAGE 3198 CATEGORY 28 RPT#:  
TID-28191 OR-3 CNT#: W-7405-ENG-92-077 78/01/31  
89 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fuels from sugar crops TLSP: Quarterly Report  
AUTH: A/LIPINSKY, E. S.; B/KRESOVICH, S.; C/MCCLURE, T. A.  
; D/LAWHON, W. T.  
CORP: Battelle Columbus Labs., Ohio. AVAIL NTIS SAP: HC  
A05/MF A01  
ABA: ERA  
ABS: Substantial progress was made on both the agricultural  
and the processing aspects of these fuels from biomass  
research program. Harvesting operations were performed  
at all locations for both sugarcane and sweet sorghum.  
Although final yield data were not statistically  
analyzed, it is apparent that large gains in total  
biomass were achieved through the introduction of  
narrow row spacing. An agronomic demonstration of  
sweet sorghum production in the Midwest was carried  
out. The information collected indicated sweet sorghum  
showed considerable potential in the Midwest, provided  
that short season processing problems can be overcome.  
Total biomass yields reached values of 25.6 metric  
tons per hectare on a dry weight basis. Under  
nonirrigated conditions, it appeared that sweet  
sorghum was energy self-sufficient. Laboratory work on  
bagasse drying rates was initiated.

79N28361# ISSUE 19 PAGE 2530 CATEGORY 28 RPT#:  
TID-29093-VOL-5 CNT#: EY-76-C-G3-C015-131 78/12/00  
203 PAGES UNCLASSIFIED DOCUMENT

UTTL: Mission analysis for the federal fuels from biomass program, Volume 5: Biochemical conversion of biomass to fuels and chemicals

AUTH: A/JONES, J. L.; B/FONG, W. S.; C/SCHOOLEY, F. A.; D/DICKENSON, R. L.

CORP: SRI International Corp., Menlo Park, Calif.  
AVAIL NTIS SAP: HC A10/MF A01

ABA: DOE

ABS: In the analysis of the anaerobic digestion options, specific feedstocks, including animal manure, wheat straw, and marine algae (giant kelp), are considered on a case basis. The processes are described, investment and operating costs estimated, and the availability and reliability of the technology and environmental considerations briefly discussed. The analysis of the fermentation of biomass feedstocks to ethanol from sugars and the actual production of the sugars are described. After describing the process for fermentation of sugars to alcohol, estimating investment and operating costs, and commenting on the availability and reliability of the technology and environmental considerations, a number of alternative feedstocks and processes for producing the fermentable sugar solutions are examined. These processes for producing the sugar solutions are examined in a manner comparable with that mentioned above. The feedstocks included in the analysis are sugar cane, wheat straw, and aquatic biomass.

78A26967 ISSUE 10 PAGE 1789 CATEGORY 44  
78/03/10 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Solar biomass energy - An overview of U.S. potential  
AUTH: A/BURWELL, C. C. PAA: A/(Oak Ridge National Laboratory, Oak Ridge, Tenn.)  
Science, vol. 199, Mar. 10, 1978, p. 1041-1048.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*DOMESTIC ENERGY/\*ENERGY REQUIREMENTS/\*LAND USE/\*SOLAR ENERGY

WINS: / CITIES/ ENERGY CONSUMPTION/ ENVIRONMENT MANAGEMENT/ FARMLANDS/ FOREST MANAGEMENT/ LIVESTOCK/ PHOTOSYNTHESIS/ UNITED STATES OF AMERICA/ WASTE ENERGY UTILIZATION

ABA: S.C.S.

ABS: The article reviews the U.S. potential for using solar biomass energy, noting individual land use projects in terms of potential contributions to biomass fuel. These include cropland and forest land production, urban areas, noncommercial forests, pastures and ranges, and idle cropland. Estimates are made for gross and collectible net energy yields. The concept of intensive tree farming and the role of specialty crops in energy production are discussed. Current agricultural markets for cropland production are identified, and consideration is given to exports and livestock production. Various environmental considerations relating to the production and use of biomass energy are outlined such as stream pollution, loss of productive lands, and atmospheric pollution. Possibilities for increasing photosynthesis efficiency are proposed.

78A50128 ISSUE 22 PAGE 4034 CATEGORY 44  
78/00/00 4 PAGES UNCLASSIFIED DOCUMENT

UTTL: Potential and economics of energy production by bioconversion

AUTH: A/CLAUSEN, E. C.; B/SITTON, O. C.; C/GADDY, J. L.  
PAA: C/(Missouri-Rolla, University, Rolla, Mo.)  
In: Pacific Chemical Engineering Congress, 2nd, Denver, Colo., August 28-31, 1977, Proceedings, Volume 1. (A78-50128 22-45) New York, American Institute of Chemical Engineers, 1978, p. 183-186.

ABA: B.J.

ABS: It is estimated that approximately one-fourth of the total energy requirement of the United States could be met by using present farming techniques on idle lands to produce biomass and by utilizing biomass from agricultural wastes. Conversion of biomass to methane can be accomplished through the process of anaerobic digestion. It is concluded that bioconversion of plant matter to methane is economically attractive at today's fossil fuel prices. Based on present technology, a reasonable return could be expected with a gas price of \$2/MSCF.

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OF POOR QUALITY

79A17276 ISSUE 5 PAGE 83B CATEGORY 44 78/00/00  
2219 PAGES UNCLASSIFIED DOCUMENT

UTTL: Sun: Mankind's future source of energy: Proceedings of  
the International Solar Energy Congress, New Delhi,  
India, January 16-21, 1978. Volumes 1, 2 & 3

AUTH: A/DE WINTER, F.; B/COX, M. PAA: B/(Atlas Corp.,  
Santa Cruz, Calif.) PAT: A/(ED.) SAP: PRICE OF  
THREE VOLUMES, \$150

6- Congress sponsored by the International Solar Energy  
Society and UNESCO Elmsford, N.Y., Pergamon Press,  
Inc., 1978. Vol. 1, 619 p.; Vol. 2, 775 p.; Vol. 3,  
825 p. (For individual items see A79-17277 to  
A79-17525)

ABA: B.J.

ABS: The volumes examine such topics as international and  
national solar energy programs, economic aspects of  
solar energy utilization, and policy, social, and  
implementation aspects of solar energy. Consideration  
is given to such technical aspects of solar energy  
utilization as solar radiation characteristics, energy  
storage, photovoltaics (including space power),  
photochemistry and photobiology, flat plate collectors  
(including solar ponds and selective surfaces),  
concentrating systems, solar heating and cooling,  
solar thermal power systems (including ocean thermal  
gradient systems), wind power, and agricultural and  
industrial applications of solar energy.

**A79-45231 Biomass conversion potential in the Southeast.**

H. Saha (Alabama A & M University, Huntsville, Ala.). In:  
Application of solar energy: Proceedings of the Third Southeastern  
Conference, Huntsville, Ala., April 17-19, 1978. (A79-45201 19-44)  
Huntsville, Ala., UAH Press, 1978, p. 481-488. 8 refs.

The biomass production and conversion potential of the  
southeastern U.S., with its large forest land and wood residue, long  
coastal areas, abundance of water, large amounts of readily col-  
lectable agricultural, urban and industrial waste materials, longer  
rainfall and fertile soil, is examined. Various types of biomass  
production and conversion methods, including terrestrial and silvicultural  
biomass as well as herbaceous, aquatic and organic waste  
biomass, are evaluated. A result of a silvicultural biomass production  
found that its productivity under closed-space, short rotation conditions  
could yield annual dry-ton-equivalents of 5 to 13 tons per acre.  
It was also determined that the most promising production of large  
quantities of biomass in the SE U.S. would be the establishment of  
intensively-managed energy farms, using woody and herbaceous  
species, including forest and crop residues, high-yield crops, and  
animal manure. Special attention is given to diagrams that describe  
biomass conversions, such as terrestrial biomass and domestic  
residue, and to a description of the basic steps in ethanol production  
from farm products. C.F.W.

79A15068# ISSUE 4 PAGE 643 CATEGORY 44  
78/04/00 28 PAGES UNCLASSIFIED DOCUMENT

UTTL: Biomass and wastes as energy resources - 1977 update  
AUTH: A/KLASS, D. L. PAA: A/(Institute of Gas Technology,  
Chicago, Ill.)

INSTITUTE OF GAS TECHNOLOGY, Energy from the Sun:  
Symposium, Chicago, Ill., Apr. 3-7, 1978. Paper, 28 p.  
WAJS: /BIOMASS ENERGY PRODUCTION/ORGANIC WASTES (FUEL  
CONVERSION)/SYNTHETIC FUELS/WASTE UTILIZATION  
MINS: / AGRICULTURE/ ECONOMIC ANALYSIS/ ENERGY CONVERSION  
EFFICIENCY/ ENERGY TECHNOLOGY/ LAND USE/ RESEARCH AND  
DEVELOPMENT/ TECHNOLOGY ASSESSMENT/ WASTE DISPOSAL/  
WOOD

ABA: (Author)

ABS: Work is continuing to develop processes and systems  
for the production of synfuels and energy-intensive  
products from renewable biomass and wastes. An update  
of the subject is presented in this paper, and  
selected recent research and commercial developments  
are summarized. Waste disposal represents an immediate  
problem and wastes are here now, so combined waste  
disposal-energy recovery processes are currently  
receiving the most attention. Biomass production  
directed specifically to energy applications has not  
yet been optimized for large-scale systems, and is in  
the initial development stages. In the long term,  
wastes offer a small but continuing supply of energy  
products and synfuels, and biomass can ultimately  
serve as a major source of supply. The primary problem  
today is to develop practical, economic system designs  
and to adapt known conversion processes to particular  
raw materials. Presuming that the work in progress  
will successfully achieve this goal, a long-term  
source of organic fuels as we know and accept them  
will be assured. There is no apparent reason why this  
effort should not succeed.

79N27327# ISSUE 18 PAGE 2389 CATEGORY 28 RPT#:  
CONF-7809125-1 CNT#; LY-76-C-06-1830 78/00/00 34  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Investigation of gasification of biomass in the presence of catalysis  
AUTH: A/MUDGE, L. K.; B/SEALOCK, L. J., JR.; C/ROBERTUS, R. J.; D/MITCHELL, D. H.; E/BAKER, E. G.; F/WALKUP, P. C.  
CORP: Battelle Pacific Northwest Labs., Richland, Wash.  
AVAIL.NTIS SAP: HC A03/MF A01  
Presented at 5th Biomass Thermochem. Conversion Coordination Meeting, Richland, Wash., 19-20 Sep. 1978  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*CATALYSTS/\*ENERGY POLICY /\*GASIFICATION  
MINS: / BIOMASS/ ENERGY TECHNOLOGY/ FEASIBILITY ANALYSIS  
ABA: DOE  
ABS: The technical and economic feasibility of catalyzed biomass gasification to produce the specific products methane, hydrogen, carbon monoxide, or synthesis gas for generation of ammonia, methanol, or hydrocarbons are reported. The work in the current reporting period was centered on laboratory studies to determine the relative activity of Na<sub>2</sub>CO<sub>3</sub> and iron and 3 1/2 times as much as borax or uncatalyzed wood at both 550 and 650 C. The effect of biomass composition on gas production was determined by gasifying wood, bark, and

cellulose. In all cases bark samples produced more gas than their respective woods. The use of combined catalysis to optimize methane production was studied. Initial screening of catalysis was begun. The design, procurement, and installation of the process development unit is described.

78N28619# ISSUE 19 PAGE 2557 CATEGORY 44  
78/00/00 19 PAGES UNCLASSIFIED DOCUMENT

UTTL: Impact of novel energy sources: OTEC, wind, geothermal, biomass  
AUTH: A/ROBERTS, A. S., JR.  
CORP: Old Dominion Univ., Norfolk, Va. AVAIL.NTIS SAP: HC A07/MF A01  
In NASA, Langley Res. Center Emerging Energy Alternatives for Southeastern States p 39-57 (SEE N78-28615 19-44)  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY POLICY/\*GEOTHERMAL RESOURCES/\*OCEAN THERMAL ENERGY CONVERSION/\*WINDPOWER UTILIZATION  
MINS: / COMMERCIAL ENERGY/ DEVELOPMENT/ ENERGY CONVERSION EFFICIENCY  
ABA: Author

ABS: Alternate energy conversion methods such as ocean thermal energy conversion (OTEC), wind power, geothermal wells and biomass conversion are being explored, and re-examined in some cases, for commercial viability. At a time when United States fossil fuel and uranium resources are found to be insufficient to supply national needs into the twenty-first century, it is essential to broaden the base of feasible energy conversion technologies. The motivations for development of these four alternative energy forms are established. Primary technical aspects of OTEC, wind, geothermal and biomass energy conversion systems are described along with a discussion of relative advantages and disadvantages of the concepts. Finally, the sentiment is voiced that each of the four systems should be developed to the prototype stage and employed in the region of the country and in the sector of economy which is complimentary to the form of system output.

79N14946# ISSUE 5 PAGE 676 CATEGORY 65 RPT#:  
PB-285797/7 RMP-5495-1 EPA-600/7-78-086 CNT#:  
EPA-68-G2-2101 78/05/00 460 PAGES UNCLASSIFIED DOCUMENT

UTTL: Engineering and economic analysis of waste to energy systems TLSP: Final Report, Apr. 1975 - Jun. 1977  
AUTH: A/WILSON, E. M.; B/LEAVENS, J. M.; C/SNYDER, N. W.; D/BREHANY, J. J.; E/WHITMAN, R. F.  
CORP: Parsons (Ralph M.) Co., Pasadena, Calif. AVAIL.NTIS SAP: HC A20/MF A01  
ABA: GRA  
ABS: Waste quantities and characteristics in the U.S. are reviewed and waste-to-energy conversion technology evaluated. All waste materials, exclusive of those from mining operations, are considered. The technology is reviewed under the categories of mechanical processing, biological conversion systems, thermal/chemical systems, and combustion. Important features of many operating facilities are described and detailed engineering and economic analyses of seven specific systems are presented. An analysis is also made of the technology and costs for conversion of pyrolytic off-gas to methane, methanol, and ammonia. Environmental pollution data are presented where available and the current control technology briefly reviewed. Conclusions on the conversion technology are made and research needs considered in a series of recommendations.

79A40415# ISSUE 17 PAGE 3234 CATEGORY 44  
78/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Solid waste utilization in integrated community energy systems

AUTH: A/MARCINIAK, T. J.; B/HOLTZ, R. E. PAA: B/(Argonne National Laboratory, Argonne, Ill.)

In: Energy conservation through waste utilization; Proceedings of the Eighth Biennial National Waste Processing Conference, Chicago, Ill., May 7-10, 1978. (A79-40386 17-85) New York, American Society of Mechanical Engineers, 1978, p. 409-418.

ABA: C.K.D.

ABS: The application of two solid waste utilization technologies - incineration with heat recovery and pyrolysis - in Integrated Community Energy Systems (ICES) serving communities of 1000 to 100,000 inhabitants is considered. The suitability of two incinerator types (two-chamber incinerators and incinerators with waterwall design for heat recovery or heat exchangers in the fuel gas stream) and four pyrolysis systems (Occidental, Kurox, Landgard and RefuCycler) for use in ICES is examined. Design and cost parameters are presented for systems using solid waste to supply energy for a 115-acre shopping center and a 725-acre new community. Two designs are considered in detail: a system based on current technology in which a bank of diesel engines is used to meet the electricity requirements of the center while waste heat is used for space heating and cooling of the center and surrounding community; and a system based on advanced fuel technology. Results indicate that solid waste generated within a residential/commercial community can meet about 3 to 5% of the total fuel demand. Systems incorporating solid waste pyrolysis units appear to be economically viable if disposal costs exceed \$20/ton.

79A10036 ISSUE 1 PAGE 105 CATEGORY 44 78/00/00  
6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy from biomass through hydrolysis of wood

AUTH: A/GUHA, B.; B/TITCHENER, A. L. PAA: B/(Auckland, University, Auckland, New Zealand)

In: Intersociety Energy Conversion Engineering Conference, 13th, San Diego, Calif., August 20-25, 1978, Proceedings, Volume 1. (A79-10001 01-44) Warrendale, Pa., Society of Automotive Engineers, Inc., 1978, p. 233-238. Research supported by the New Zealand Energy Research and Development Committee.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*HYDROCARBON FUEL PRODUCTION/\*HYDROLYSIS/\*WOOD

MINS: / ENERGY TECHNOLOGY/ PILOT PLANTS/ SUGARS

ABA: (Author)

ABS: An effective method for converting biological material to liquid fuel is the production of ethanol by hydrolysis of cellulose and fermentation of the

resulting sugar. The conversion of wood cellulose to sugar is best achieved through dilute sulfuric acid hydrolysis process. The hydrolysis of wood is described by a two step consecutive reactions of saccharification and decomposition. The first order reaction kinetics of both of these reactions have been established. Experiments with wood chips show the presence of considerable resistance to diffusion of sugar and the nature of wood growth. An optimization analysis for maximum yield of sugar in a percolator reactor, used for hydrolysis reaction is presented. The analysis show possible improvements in performance of such reactors, with a proper choice of process parameters of temperature, liquid flow rate and total percolation time. A new plant design concept incorporating some new process innovations has been presented.

79A40386 ISSUE 17 PAGE 3326 CATEGORY 45  
78/00/00 578 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy conservation through waste utilization; Proceedings of the Eighth Biennial National Waste Processing Conference, Chicago, Ill., May 7-10, 1978  
SAP: \$45

Conference sponsored by the American Society of Mechanical Engineers, New York, American Society of Mechanical Engineers, 1978, 578 p (For individual items see A79-40387 to A79-40428)

MAJS: /\*CONFERENCES/\*INDUSTRIAL WASTES/\*SOLID WASTES/\*WASTE ENERGY UTILIZATION/\*WASTE UTILIZATION

MINS: / ENERGY CONSERVATION/ GARBAGE/ INCINERATORS/ MATERIALS RECOVERY/ POLLUTION CONTROL/ SEWAGE TREATMENT/ URBAN PLANNING/ WASTE DISPOSAL

TD  
785  
453  
1976

ABA: C.K.D.

ABS: A series of papers on the conservation of energy through utilization of industrial and municipal waste products is presented. General topics include recovery of energy from solid waste products, air pollution control measures implemented in conjunction with waste recovery systems, processing and material recovery

methods, legal and economic aspects of the development of waste utilization systems, the planning and operation of waste processing plants, liquid waste incineration, and research related to conservation of energy by waste utilization.

79A10131 ISSUE 1 PAGE 114 CATEGORY 44 78/00/00  
7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Utility fuel cells for biomass fuel

AUTH: A/LINDSTROM, O.; B/NILSSON, T.; C/BURSELL, M.;  
D/HORNELL, C.; E/KARLSSON, G.; F/SYLVAN, C.;  
G/AHGREN, B. PAA: G/(Kungl. Tekniska Hogskolan,  
Stockholm, Sweden)

In: Intersociety Energy Conversion Engineering  
Conference, 13th, San Diego, Calif., August 20-25,  
1978, Proceedings, Volume 2. (A79-10001 01-44)  
Warrendale, Pa., Society of Automotive Engineers,  
Inc., 1978, p. 1178-1184. Research supported by the  
National Swedish Board for Energy Source Development,  
Styrelsen for Teknisk Utveckling, and Tryggers  
Foundation for Scientific Research.

MAJS: /\*BIOCHEMICAL FUEL CELLS/\*BIOMASS ENERGY PRODUCTION/\*  
HYDROGEN FUELS/\*SYNTHETIC FUELS

MINS: / ANODES/ CATHODES/ ECONOMIC FACTORS/ ENERGY

TECHNOLOGY/ POWER PLANTS

ABA: (Author)

ABS: The fuel cell alternative is attractive because of the  
high reactivity of biomass in pyrolysis/gasification  
processes and the outstanding environmental qualities  
of the fuel cell. The system comprises a fuel  
processor for conversion of biomass and peat to  
hydrogen, and alkaline fuel cells. The fuel processor  
uses a modified steam iron process. A conceptual 100  
MW plant is using so-called FC-041 2.5 MW generator  
units. Fuel cell cathodes consist of nickel screens  
embedded in PTFE bonded silver catalysts and give 1  
kA/sq m in the range -0.11 to -0.21 V vs. Hg/HgO.  
Anodes with skeleton-nickel from AlNiTiMo alloys on  
nickel matrices operate at 1 kA/sq m at -0.87 V. The  
pseudoresistivity of the cathodes is inversely  
proportional to the 0.7th power of the oxygen partial  
pressure.

79N32373# ISSUE 23 PAGE 3062 CATEGORY 28 RPT#:  
SAND-78-0191 CONF-780737-1 CNT#: EY-76-C-04-0789  
78/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fuels from magma: A potential energy source ---  
producing hydrogen, carbon monoxide, and methane

AUTH: A/GERLACH, T. M.

CORP: Sandia Labs., Albuquerque, N. Mex. AVAIL NTIS  
SAP: HC A02/MF A01

Presented at the 20 Circum-Pacific Energy and Mineral  
Resources Conf., Honolulu, 30 Jul. 1978

MAJS: /\*CARBON MONOXIDE/\*ENERGY TECHNOLOGY/\*GEOTHERMAL  
RESOURCES/\*HYDROGEN PRODUCTION/\*MAGMA/\*METHANE

MINS: / BASALT/ BIOMASS ENERGY PRODUCTION/ IRON OXIDES/  
OXIDATION-REDUCTION REACTIONS/ WATER INJECTION

ABA: DOE

ABS: The chemical and thermodynamic basis, the confirmatory  
laboratory experiments, and the geological data that  
point to the potential of magma as a resource that  
could produce large amounts of hydrogen as well as  
carbon monoxide and methane are discussed. The method  
of fuel production proposed depends on the reducing  
action of basalt on injected water; this chemical  
interaction causes the oxidation of ferrous components  
in the basalt and the production of hydrogen. The  
amount of hydrogen produced by a given body of basalt  
can be enhanced by introducing natural organic matter  
(biomass) into the injected water. This also would  
permit the method to be used to produce appreciable  
quantities of carbon monoxide and methane, and allows  
the exploitation of less FeO-rich magmas and not  
rocks. Calculations show that the thermal energy of  
the magma may be used to gasify the biomass with  
resultant gas species resembling those from more  
conventional coal gasification processes.

79N13937# ISSUE 4 PAGE 536 CATEGORY 85 RPT#:  
NASA-TM-79966 HCP/M1011-02 CNT#: EX-76-A-31-1011  
78/06/00 37 PAGES UNCLASSIFIED DOCUMENT

UTTL: Utilization of waste heat in trucks for increased fuel  
economy TLSP: Final Report

AUTH: A/LEISING, C. J.; B/PURDHIT, G. P.; C/DEGREY, S. P.;  
D/FINEGOLD, J. G.

CORP: Jet Propulsion Lab., Calif. Inst. of Techn., Pasadena.

AVAIL NTIS SAP: HC A03/MF A01

ABA: DOE

ABS: The waste heat utilization concepts include  
preheating, regeneration, turbocharging,  
turbocompounding, and Rankine engine compounding.  
Predictions are based on fuel-air cycle analyses,  
computer simulation, and engine test data. All options  
are evaluated in terms of maximum theoretical  
improvements, but the Diesel and adiabatic Diesel are  
also compared on the basis of maximum expected  
improvement and expected improvement over a driving  
cycle. The study indicates that Diesels should be  
turbocharged and aftercooled to the maximum possible  
level. The results reveal that Diesel driving cycle  
performance can be increased by 20% through increased  
turbocharging, turbocompounding, and Rankine engine  
compounding. The Rankine engine compounding provides  
about three times as much improvement as  
turbocompounding but also costs about three times as  
much. Performance for either can be approximately  
doubled if applied to an adiabatic Diesel.

79A34097 ISSUE 13 PAGE 2422 CATEGORY 44 CNT#: E(49-18)-2253 EPA-R-804836-01 78/00/00 19 PAGES UNCLASSIFIED DOCUMENT

UTTL: A comparison of coal and biomass as feedstocks for synthetic fuel production

AUTH: A/ANTAL, M. J. PAA: A/(Princeton University, Princeton, N.J.)

In: Alternative energy sources: Proceedings of the Miami International Conference, Miami Beach, Fla., December 5-7, 1977. Volume 7. (A79-34065 13-44) Washington, D.C., Hemisphere Publishing Corp., 1978, p. 3203-3221. Research sponsored by the Council on Environmental Quality; U.S. Environmental Protection Agency

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*COAL UTILIZATION/\*GASEOUS FUELS/\*HYDROCARBON FUEL PRODUCTION/\*SYNTHETIC FUELS

MINS: / COAL GASIFICATION/ COAL LIQUEFACTION/ ENERGY TECHNOLOGY/ GASIFICATION/ PYROLYSIS/ REACTION KINETICS / THERMOCHEMISTRY

ABA: (Author)

ABS: The potential use of coal and biomass for the production of synthetic liquid and gaseous fuels has received widespread attention from differing groups during recent years. Conventional wisdom has maintained that the coal resource is much larger and more suitable for synfuel production than the biomass resource; however no comprehensive effort has been made to compare the strengths and weaknesses of the two fuels on a common basis. This paper constitutes a first step towards a sensible comparison of the two resources. Coal and biomass are first compared on the basis of their proximate and ultimate analysis. Following this, thermochemical calculations are used to predict the chemical products and gas calorific value of coal and biomass pyrolysis. Finally, studies of coal and biomass pyrolysis by thermogravimetry are used to compare the kinetic rates of gasification. These comparisons indicate biomass to be at least as well suited as coal for synthetic fuel production.

78N74919# CATEGORY 28 RPT#: C00-2991-14 REPT-1594 QPR-3 CNT#: EY-76-C-02-2991 77/03/15 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fuel gas production from animal waste, phase 1 TLSP: Quarterly Progress Report, 1 Dec. 1976 - 1 Mar. 1977

AUTH: A/ASHARE, E.; B/WENTWORTH, R. L.; C/WISE, D. L.; D/AUGENSTEIN, D. C.

CORP: Dynatech R/D Co., Cambridge, Mass. AVAILNTIS

MAJS: /\*ANAEROBES/\*BIOMASS ENERGY PRODUCTION/\*ENERGY POLICY /\*NATURAL GAS

MINS: / CARBON DIOXIDE/ ORGANIC WASTES (FUEL CONVERSION)/ WASTE UTILIZATION

78A28365 ISSUE 10 PAGE 1798 CATEGORY 44 77/00/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Using sugar crops to capture solar energy --- biomass conversion techniques

AUTH: A/LIPINSKY, E. S.; B/MCCLURE, T. A. PAA: B/(Battelle Columbus Laboratories, Columbus, Ohio) In: Biological solar energy conversion: Proceedings of the Conference, Miami, Fla., November 15-18, 1976. (A78-28351 10-44) New York, Academic Press, Inc., 1977, p. 397-410. ERDA-supported research.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*SOLAR ENERGY CONVERSION/\* SUGAR BEETS/\*SUGAR CANE

MINS: / ENERGY TECHNOLOGY/ FERMENTATION/ PHOTOSYNTHESIS

ABA: J.M.B.

ABS: The application of biomass conversion principles to sugarcane, a high-yield product requiring small amounts of arable land, is discussed. For purposes of bioconversion, sugar crops have an advantage over other plants in that they yield directly fermentable simple sugars. Sugarcane yield forecasts for high-quality and lower-quality land are presented; the importance of close-spacing during planting is also assessed. Areas suitable for growing sugarcane in Texas, Louisiana and Florida are estimated. Harvest

costs are also mentioned.

78A11149 ISSUE 1 PAGE 65 CATEGORY 44 77/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy from refuse - Theoretical and practical results

AUTH: A/NUEESCH, P. C.; B/WIRTH, M. PAA: B/(Von Roll, Ltd., Zurich, Switzerland)

In: Materials and energy from refuse: Proceedings of the First International Symposium, Antwerp, Belgium, October 21, 22, 1976. (A78-11140 01-44) Leiden, Spruyt, Van Mantgem en De Does, 1977, p. 71-78.

MAJS: /\*ELECTRIC POWER PLANTS/\*ENERGY CONVERSION/\*ENERGY REQUIREMENTS/\*SOLID WASTES/\*WASTE ENERGY UTILIZATION

MINS: / BOILERS/ COMBUSTION/ FURNACES

ABA: B.J.

ABS: A theoretical discussion is presented on energy production from refuse incineration, with emphasis on refuse composition and quality and techniques of using refuse as fuel. Operational experience at three refuse incineration and energy recovery plants (at Geneva, Zuerich and Lucerne) is reviewed. The relationships between the total energy consumption in the areas of the plants and the energy produced from refuse are summarized.

78A42137 ISSUE 18 PAGE 3295 CATEGORY 44  
77/00/00 3 PAGES UNCLASSIFIED DOCUMENT

UTTL: A study of biochemical fuel cells utilizing animal and kitchen waste as fuel

AUTH: A/SINGH, J.; B/DEV GUPTA, V. PAA: B/(Punjab Agricultural University, Ludhiana, India)  
In: National Solar Energy Convention, Calcutta, India, November 29-December 1, 1976, Proceedings, (A78-42101 18-44) Calcutta, Jadavpur University, 1977, p. 139-141.

MAJS: /\*BIOCHEMICAL FUEL CELLS/\*BIOMASS ENERGY PRODUCTION/\*ELECTROCHEMICAL OXIDATION/\*ORGANIC WASTES (FUEL CONVERSION)/\*WASTE UTILIZATION

MINS: / CHEMICAL REACTIONS/ DOMESTIC ENERGY/ ENERGY TECHNOLOGY/ STARCHES/ VOLT-AMPERE CHARACTERISTICS

ABA: (Author)

ABS: A preliminary study has been carried out on experimental biochemical fuel cells, fueled with gobar in one and kitchen waste including starch in the second. The yeast is employed as catalyst in the biochemical reaction. The V-I, Power-I, Voltage power and discharge characteristics have been studied for these cells. The peak power made available is 612 microw/sq cm with Cu-Zn electrodes and peak current drawn is 2.2 mA/sq cm. The open-circuit voltage available is 1 volt.

77A33280# ISSUE 14 PAGE 2370 CATEGORY 44  
77/03/25 3 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy from wastes

AUTH: A/MILLER, I. J. PAA: A/(Department of Scientific and Industrial Research, Chemistry Div., Petone, New Zealand)

New Zealand Energy Journal, vol. 50, Mar. 25, 1977, p. 31-33.

MAJS: /\*ENERGY CONSERVATION/\*MATERIALS RECOVERY/\*THERMAL ENERGY/\*WASTE UTILIZATION

MINS: / BIOMASS ENERGY PRODUCTION/ ENERGY POLICY/ ENERGY

TECHNOLOGY/ NEW ZEALAND/ ORGANIC WASTES (FUEL CONVERSION)/ RECYCLING

ABA: M. L.

ABS: The overall production of refuse in New Zealand is estimated to be about 3200 tons per day with a calorific value of approximately 11.5 GJ/t. Technical aspects of energy recovery and procedures for increasing the use of energy recovery systems are discussed. Consideration is given to the recycling of energy-intensive materials, the production of fuels, and the direct production of energy (usually in the form of heat).

78A20524 ISSUE 6 PAGE 1012 CATEGORY 44  
77/00/00 352 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fuels and energy from renewable resources; Proceedings of the Symposium, Chicago, Ill., August 29-September 2, 1977

AUTH: A/TILLMAN, D. A.; B/SARKANEN, K. V.; C/ANDERSON, L. L. PAA: A/(Materials Associates, Inc., Washington, D.C.); B/(Washington, University, Seattle, Wash.); C/(Utah, University, Salt Lake City, Utah) PAT: A/(ED.) SAP: \$17.50

Symposium sponsored by the American Chemical Society New York, Academic Press, Inc., 1977, 352 p

MAJS: /\*AIRCRAFT RELIABILITY/\*BIOMASS ENERGY PRODUCTION/\*CONFERENCES/\*ENERGY TECHNOLOGY/\*HYDROCARBON FUEL PRODUCTION/\*RESOURCES MANAGEMENT

MINS: / ENERGY REQUIREMENTS/ FOREST MANAGEMENT/ PYROLYSIS/ WASTE UTILIZATION/ WOOD

ABA: G. R.

ABS: Quantitative estimates of energy requirements for the longer term are considered, taking into account the rationale for estimating energy requirements, the approaches used for obtaining energy targets, and the relation of conservation to employment. Attention is given to the present contribution of renewable resources, the anticipated competition for available wood fuels in the U.S., a thermal analysis of forest fuels, the conversion of stagnated timber stands to productive sites and use of noncommercial material for fuel, industrial wood energy conversion, and the pyrolysis-gasification-combustion process. Prospects for cogeneration of steam and power in the forest products industry are discussed along with the feasibility of utilizing crop and forestry residues to produce energy, the use of wood oil from pyrolysis of pine bark-sawdust mixture, the logistics of energy resources and residues, bagasse as a renewable energy source, the use of ginning waste as an energy source, the design of a large-scale manure/methane facility, and energy recovery from municipal wastes.

79N79202# CATEGORY 26 RPT#: C00/2991-11

DYNATECH-1573 CNT#: EY-76-C-02-2991 77/02/01 50 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fuel gas production from animal waste. Report or quarterly review meeting

AUTH: A/ASHARE, E.; B/WENTWORTH, R. L.; C/WISE, D. L. CORP: Dynatech R/D Co., Cambridge, Mass. AVAIL:NTIS Meeting held in Palo Alto, Calif., 13-14 Dec. 1976

MAJS: /\*ANIMALS/\*METABOLIC WASTES/\*METHANE/\*WASTE ENERGY UTILIZATION

MINS: / BIODEGRADABILITY/ FERMENTATION/ FUELS/ HEAT TREATMENT

78A28362 ISSUE 10 PAGE 1798 CATEGORY 44  
77/00/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: Possibilities of biomass from the ocean - The Marine Farm Project  
AUTH: A/NORTH, W. J. PAA: A/(California Institute of Technology, Pasadena, Calif.)  
IN: Biological solar energy conversion: Proceedings of the Conference, Miami, Fla., November 15-18, 1976. (A78-28351 10-44) New York, Academic Press, Inc., 1977, p. 347-361. Research supported by the American Gas Association, ERDA, and NSF.  
MAJS: /\*AQUICULTURE/\*BIOMASS ENERGY PRODUCTION/\*HYDROCARBON FUEL PRODUCTION/\*METHANE/\*SEAWEEEDS  
MINS: / ENERGY TECHNOLOGY/ SOLAR ENERGY CONVERSION/ TRACE ELEMENTS  
ABA: J.M.B.  
ABS: Upwelling deep oceanic water provided by wave pumps was used in an attempt to fertilize Macrocystis (Giant Kelp) plantations; Macrocystis has been suggested as a raw material for methane production. However, the presence of one or more trace elements in the deep water apparently was responsible for inhibiting the kelp growth. It is suggested that EDTA might bind the inhibitory agent and increase production rates.

78A21700 ISSUE 7 PAGE 1207 CATEGORY 44  
77/00/00 72 PAGES UNCLASSIFIED DOCUMENT

UTTL: Bioconversion: Fuels from biomass --- Book  
AUTH: A/ROBERTSON, E. E. PAA: A/(Bion-Ess Energy Institute, Inc., Winnipeg, Canada) SAP: \$2.50  
Philadelphia, Pa., Franklin Institute Press, 1977. 72 p.  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY CONVERSION/\*FUELS /\*WASTE UTILIZATION  
MINS: / BIOCHEMISTRY/ BIOSPHERE/ CHEMICAL ENERGY/ ENERGY STORAGE/ HYDROCARBON FUELS/ PHOTOSYNTHESIS/ SOLAR ENERGY  
ABA: W.L.  
ABS: Topics related to the use of biomass for energy generation are surveyed. Urban and agricultural wastes as well as land and ocean farm products are common sources, while photosynthesis and anaerobic digestion are frequently used bioconversion processes. Subjects considered include the use of biomass to generate high temperatures, storing solar energy naturally, the biosphere's life support systems, the oxygen/carbon dioxide cycle, and self-reproducing machines and biomass.

77N78624\* CATEGORY 45 SPT#: NASA TM-X-74100 VOL-1  
77/05/00 3 VOLS 427 PAGES UNCLASSIFIED DOCUMENT

UTTL: Proceedings of the Conference on Waste Heat Management and Utilization, volume 1  
AUTH: A/LEE, S. S.; B/SENGUPTA, S. PAT: A/ed.; B/ed.  
CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL NTIS  
Conf. proc. held at Miami Beach, Fla., 9-11 May 1976; sponsored in part by EPA, the US Nuclear Regulatory Commission, Duke Power Co., Florida Power and Light Co., and Miami Univ.  
MAJS: /\*CONFERENCES/\*HEAT/\*WASTE ENERGY UTILIZATION  
MINS: / COOLING SYSTEMS/ ECOLOGY/ HEAT TRANSFER/ MATHEMATICAL MODELS/ REMOTE SENSORS

77A44396 ISSUE 21 PAGE 3610 CATEGORY 44  
77/08/19 2 PAGES UNCLASSIFIED DOCUMENT

UTTL: Photosynthetic solar energy - Rediscovering biomass fuels  
AUTH: A/HAMMOND, A. L. Science vol. 197, Aug. 19, 1977, p. 745, 746.  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ORGANIC WASTES (FUEL CONVERSION)/\*WASTE UTILIZATION  
MINS: / ECONOMIC ANALYSIS/ ETHYL ALCOHOL/ HYDROGEN PRODUCTION/ METHANE/ WOOD  
ABA: F.G.M.  
ABS: Possibilities for using biomass as an energy source are considered, noting that biomass is potentially a renewable source of a full range of liquid and gaseous fuels for which domestic sources of their fossil counterparts are increasingly in short supply. Biomass fuels discussed include wood products, gas derived from walnut shells, manure, crop residues, biomass ethanol, forest wastes, and aquatic plants. Some research projects are described which involve the development of biomass gasifiers, ethanol fermentation from sugarcane and sweet sorghum, cultivation of blue-green algae and kelp as methane sources, and a proposal for a biomass refinery in which hydrogen would be produced from organic wastes with steam generated by solar heat concentrated on a boiler. The extent of biomass resources in the United States and the economics of biomass energy systems are assessed.

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78A13625 ISSUE 3 PAGE 424 CATEGORY 44 77/11/00  
7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy - Fluid fuels from solids  
AUTH: A/OTHMER, D. F. PAA: A/(New York, Polytechnic  
Institute, Brooklyn, N.Y.)  
Mechanical Engineering, vol. 99, Nov. 1977, p. 29-35.  
MAJS: /\*BIOMASS ENERGY PRODUCTION/\*COAL GASIFICATION/\*

MINS: GASEOUS FUELS/\*HYDROCARBON FUEL PRODUCTION/\*SHALE OIL  
/ ENERGY TECHNOLOGY/ FUEL OILS/ LIQUEFACTION/ SOLIDS/  
TAR SANDS

ABA: M.L.  
ABS: A survey of processes that produce gas or liquid fuels  
from solid fuels is presented. Approaches considered  
include gasification of coal, liquid fuels from coal,  
and oil and gas from oil shales. Additional sources  
considered include tar sands and bio-solids or  
biomass. The costs of various processes are examined.  
Overall, it is thought that more than \$1 trillion will  
be required to build energy plants in the U.S. alone  
in the near future.

77A32592 ISSUE 14 PAGE 2369 CATEGORY 44  
77/04/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy from bio-conversion for developing countries  
AUTH: A/PARIKH, J. K. PAA: A/(International Institute for  
Applied Systems Analysis, Laxenburg, Austria)  
Revue de l'Energie, vol. 28, Apr. 1977, p. 239-251,  
in English and French.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*DEVELOPING NATIONS/\*  
ENERGY CONVERSION EFFICIENCY/\*ENERGY TECHNOLOGY/\*  
ORGANIC WASTES (FUEL CONVERSION)

MINS: / ANAEROBES/ ENERGY CONSUMPTION/ ENERGY REQUIREMENTS/  
FERMENTATION/ METHANE/ NITROGEN COMPOUNDS

ABA: M.L.  
ABS: Large- and small-scale organic waste anaerobic  
fermentation systems used in developing countries are  
described. These systems generate a gas which is 60%  
methane. The leftover sludge, which retains nitrogen  
compounds, is used as fertilizer. A bio-gas plant used  
in India has two main parts, a digester and a gas  
holder. Data concerning the amount of dung consumed  
and the amount and the quality of gas produced are  
provided. Characteristics of Indian communities are  
described and the economic impact of single-family  
bio-gas plants is analyzed.

77A48713 ISSUE 23 PAGE 3980 CATEGORY 44  
77/00/00 6 PAGES UNCLASSIFIED DOCUMENT

UTTL: The prospects for fuels from biomass  
AUTH: A/LIPINSKY, E. S. PAA: A/(Battelle Columbus  
Laboratories, Columbus, Ohio)  
In: Intersociety Energy Conversion Engineering  
Conference, 12th, Washington, D.C., August  
28-September 2, 1977, Proceedings, Volume 1,  
(A77-48701 23-44) La Grange Park, Ill., American  
Nuclear Society, Inc., 1977, p. 94-99. ERDA-supported  
research.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY TECHNOLOGY/\*  
FEASIBILITY ANALYSIS/\*SYNTHETIC FUELS

MINS: / AUTOMOBILE FUELS/ COST ANALYSIS/ ENERGY CONVERSION/  
ETHYL ALCOHOL/ SUGAR CANE

ABA: P.T.H.  
ABS: The prospects for making fuels from biomass are  
investigated by considering the process of converting  
sugarcane to ethanol and studying the economics of  
ethanol as a motor fuel. A cost analysis is made for a  
large ethanol distilling plant, and it is found that  
the cost of anhydrous ethanol would be about \$0.31 per  
liter. Adding anhydrous ethanol in a suitable gasoline  
blend would increase the selling price of gasoline  
\$0.015 to \$0.021 per liter.

77A24569 ISSUE 9 PAGE 1445 CATEGORY 44  
77/00/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fuels via bioconversion  
AUTH: A/KEENAN, J. D. PAA: A/(Pennsylvania, University,  
Philadelphia, Pa.)  
Energy Conversion, vol. 16, no. 3, 1977, p. 95-103.

MAJS: /\*BIOCHEMICAL FUEL CELLS/\*BIOMASS ENERGY PRODUCTION/\*  
CHEMICAL FUELS/\*ENERGY CONVERSION EFFICIENCY/\*  
PHOTOSYNTHESIS

MINS: / ENERGY SOURCES/ HEAT OF COMBUSTION/ HYDROGEN/ METHYL  
ALCOHOLS/ NATURAL GAS/ ORGANIC MATERIALS/ SOLAR ENERGY  
CONVERSION/ SYNTHETIC FUELS

ABA: (Author)  
ABS: The potential mechanisms for fuels production by  
biochemical means are reviewed within the context of  
the principal metabolic pathways. Engineering options  
for bioconversion of fuels include the direct use of  
photosynthetic materials, the photosynthetic  
production of hydrogen and the fermentation of organic  
matter. It is concluded that, although biological  
processing is a feasible renewable energy source,  
process economics prevent the present-day use of such  
systems. This problem will be overcome by improving  
conversion efficiencies and by reducing the cost of  
harvesting. The application of biochemical engineering  
techniques to these problems is discussed.

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OF POOR QUALITY

79N10562# ISSUE 1 PAGE 75 CATEGORY 44 RPT#:  
PB-281649/4 77/00/00 54 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Solid waste and biomass. Their potential as energy sources in Illinois, 1977

AUTH: A/KOENIG, H. L.

CORP: Illinois Energy Resources Commission, Springfield.  
AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /\*BIOMASS/MANAGEMENT PLANNING/\*RECLAMATION/\*SYNTHETIC FUELS/\*WASTE DISPOSAL

MINS: / ECONOMIC ANALYSIS/ ENERGY POLICY/ ILLINOIS/ RECOMMENDATIONS/ SOLID WASTES/ WASTE ENERGY UTILIZATION

ABA: GRA

ABS: The Solid Waste and Biomass Study Panel was established in April, 1976, to prepare a comprehensive report describing current programs, problems, and recent technical developments pertaining to the conversion to fuel of solid waste and biomass. The panel was also directed to recommend legislative action, as well as educational and research programs, that could be undertaken by the state to encourage the development of solid waste and biomass as sources of energy for the state. The panel's recommendations are described in this report.

78A28366 ISSUE 10 PAGE 1798 CATEGORY 44  
77/00/00 16 PAGES UNCLASSIFIED DOCUMENT

JTTL: Fuel gas production from selected biomass via anaerobic fermentation

AUTH: A/WISE, D. L.; B/WENTWORTH, R. L.; C/KISPERT, R. G.  
PAA: C/IDynatech R/D Co., Cambridge, Mass.)  
In: Biological solar energy conversion; Proceedings of the Conference, Miami, Fla., November 15-18, 1976. (A78-28351 10-44) New York, Academic Press, Inc., 1977, p. 411-426.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*COAL GASIFICATION/\* FERMENTATION/\*HYDROCARBON FUEL PRODUCTION/\*WASTE UTILIZATION

MINS: / CARBON DIOXIDE/ CARBON MONOXIDE/ ENERGY TECHNOLOGY/ HYDROGEN/ METHANE/ SEAWEEDES/ SEWAGE/ SOLID WASTES

ABA: J.M.B.

ABS: Fuel gas production through anaerobic fermentation of municipal solid wastes, animal wastes and seaweed is discussed; the manufacture of methane from coal is also described. Anaerobic digestion is held to be a more desirable alternative for treating solid wastes than conventional sewage sludge digestion. Anaerobic processing of animal waste appears to have the greatest potential for providing a source of fuel gas in the U.S. In addition, bioconversion concepts may be profitably applied to coal gasification; carbon monoxide, carbon dioxide and hydrogen are treated through anaerobic fermentation to yield methane.

78N28263# ISSUE 19 PAGE 2510 CATEGORY 28 RPT#:  
TID-28024 ET-78-D-01-4126 77/11/14 194 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Research and development for fuels from woody biomass  
ILSP: Program Research and Development Announcement

CORP: Department of Energy, Washington, D. C. (SS: (Div. of Solar Energy.) AVAIL.NTIS SAP: HC A09/MF A01

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY CONVERSION/\*ENERGY POLICY/\*ORGANIC MATERIALS/\*RESEARCH AND DEVELOPMENT

MINS: / ANIMALS/ ENERGY CONSUMPTION/ FOSSIL FUELS/ TREES (PLANTS)/ WASTE UTILIZATION

ABA: Author (ERA)

ABS: A program is summarized which develops biomass resources to produce clean fuels, petrochemical substitutes, and other energy incentive products. These products will supplement similar products made from conventional fossil fuels. All forms of plant materials, those grown on land and in water were considered. Forest and crop residues, crops grown for their energy content, and animal manures were also considered. Research and development in the following areas were conducted: (1) growing biomass; (2) harvesting, collection, transporting, and storing biomass; and (3) converting biomass.

79N10241# ISSUE 1 PAGE 33 CATEGORY 28 RPT#:  
PB-282531/3 77/11/00 331 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Biomass utilization in Minnesota ILSP: Research Report, Mar. 1975 - Sep. 1977

AUTH: A/BLACKSHEAR, P. L., JR.; B/AIKEN, R.; C/PETERSON, R. A.

CORP: Minnesota Univ., Minneapolis. CSS: (Center for Study of the Physical Environment.) AVAIL.NTIS SAP: HC A15/MF A01  
Sponsored by Minnesota Pollution Control Agency

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY CONVERSION/\*ENERGY POLICY/\*MINNESOTA/\*ORGANIC WASTES (FUEL CONVERSION)/\* PLANTS (BOTANY)

MINS: / ANAEROBES/ COST ANALYSIS/ ENERGY TECHNOLOGY/ PYROLYSIS/ VAPORIZING/ WOOD

ABA: GRA

ABS: Contents: pyrolysis; crop residues as energy sources-assessing the cost and energy feasibility of direct firing; cost and energy assessment of alternate uses of crop and timber residues in Minnesota; anaerobic digestion of crop residues for methane generation as an adjunct to farming; energy recovery on the farm by anaerobic digestion of animal manures; ammonia volatilization from animal manures; effect upon soil properties of utilization of plant residues for fuel energy; and waste cellulose conversion to sugars by cellulose enzymes.

77A38673 ISSUE 17 PAGE 2910 CATEGORY 44  
77/09/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fuels from biomass - Energy outlay versus energy returns: A critical appraisal

AUTH: A/LEWIS, C. W. PAA: A/(Strathclyde, University, Glasgow, Scotland)

Energy (UK), vol. 2, Sept. 1977, p. 241-248.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY TECHNOLOGY/\*FUELS  
/\*PHOTOSYNTHESIS/\*VEGETATION GROWTH

MINS: / ALCOHOLS/ ENERGY SOURCES/ ENERGY STORAGE/  
FERMENTATION/ METHANE/ PRODUCTION ENGINEERING

ABA: (Author)

ABS: The concept of fuel production by the microbial conversion of biomass is discussed with particular emphasis upon the energy implications involved. Both the energy requirements and energy returns for a number of selected systems are assessed in the light of current technology, while areas for future improvements are also mentioned. The general trend of such biological energy systems is that energy gains made via plant photosynthesis using intensive systems are subsequently more than lost in the conversion of biomass energy content into storable, high-energy fuels such as ethanol and methane. Of the operations under investigation, the growth of sugarcane and its fermentation to ethanol is considered to be the most favorable as a marginal net energy production process.

78N26613# ISSUE 17 PAGE 2283 CATEGORY 44 RPT#:  
ORNL/TM-5841 CNT#: W 7405-ENG-26 77/12/00 51  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Power plant reject heat utilization: An assessment of the potential for wide-scale implementation

AUTH: A/OLSZEWSKI, M.

CORP: Oak Ridge National Lab., Tenn. AVAIL.NTIS SAP: HC  
A04/MF A01

ABA: ERA

ABS: Economic and heat utilization merits of plant reject heat utilization systems were assessed in an effort to indicate those technologies that show the greatest potential for wide-scale implementation in the power generating industry. It was assumed that these systems replaced the cooling tower as the primary condenser cooling water heat dissipation system. Implementation potential and user incentive considerations were used in assessing the technologies. Assessment of the implementation potential included economic, marketing, and power plant performance criteria. The user incentive assessment essentially viewed the use of reject heat from the user's perspective. The overall

assessment indicated that extensive pond aquaculture offered the greatest potential for wide-scale implementation.

78A11127 ISSUE 1 PAGE 63 CATEGORY 44 77/00/00  
15 PAGES UNCLASSIFIED DOCUMENT

UTTL: Trees as a renewable energy resource

AUTH: A/JAMISON, R. L. PAA: A/(Weyerhaeuser Co., Tacoma, Wash.)

In: Clean fuels from biomass and wastes; Proceedings of the Second Symposium, Orlando, Fla., January 25-28, 1977. (A78-11120 01-44) Chicago, Ill., Institute of Gas Technology, 1977, p. 169-183.

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ORGANIC WASTES (FUEL  
CONVERSION)/\*TREES/\*WASTE UTILIZATION

MINS: / COST ANALYSIS/ ECONOMIC FACTORS/ ENERGY TECHNOLOGY/  
LAND USE/ PAPER (MATERIAL)/ WOOD

ABA: J.M.B.

ABS: Sources of forest biomass for energy conversion, including manufacturing wastes, post-consumer paper and wood wastes, forest residuals and energy plantations, are discussed. At present, wood products industries obtain about 45% of their energy from manufacturing wastes; technical and economic barriers may limit the amount by which this percentage can be increased. In the area of post-consumer waste processing, the choice between recycling or burning paper and wood products is considered. The use of forest residuals for energy is shown to be economic under certain circumstances. Forest energy plantations, however, are not presently economic and may become even less so due to rising demand for wood products and shortages of timber.

79N70345# CATEGORY 28 RPT#: CONF-770235 CNT#:  
EY-76-S-04-3779 77/02/23 167 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Fuels from Biomass Program: Thermochemical  
Coordination Meeting

CORP: Energy Research and Development Administration,  
Washington, D. C. CSS: (Div of Solar Energy.)  
AVAIL.NTIS

Meeting held at Lubbock, Tex., 23 Feb. 1977

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*CONFERENCES/\*  
THERMOCHEMISTRY

MINS: / CLEAN ENERGY/ ENERGY TECHNOLOGY/ WASTE ENERGY  
UTILIZATION

TP369  
F83

78A27801 ISSUE 10 PAGE 1791 CATEGORY 44  
77/00/00 242 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fuels from waste --- Book  
AUTH: A/ANDERSON, L. L.; B/TILLMAN, D. A. PAA: A/(Utah, University, Salt Lake City, Utah); B/(Materials Associates, Inc., Washington, D.C.) PAT: A/(ED.)  
SAP: \$26.50  
New York, Academic Press, Inc., 1977. 242 p (For individual items see A78-27802 to A78-27813)  
MAJS: /\*ENERGY SOURCES/\*INDUSTRIAL WASTES/\*ORGANIC WASTES (FUEL CONVERSION)/\*SOLID WASTES/\*SYNTHETIC FUELS/\* WASTE UTILIZATION  
MINS: / BIOMASS ENERGY PRODUCTION/ COST EFFECTIVENESS/ ENERGY TECHNOLOGY/ FLUIDIZED BED PROCESSORS/ GASIFICATION/ METHANE/ PILOT PLANTS/ PYROLYSIS/ WASTE DISPOSAL/ WASTE ENERGY UTILIZATION/ WOOD  
ABA: J.M.B.  
ABS: Transformation of manure, agricultural crop wastes, urban refuse, sewage solids, industrial process wastes and logging and wood manufacturing residues to fuels is discussed; technologies considered include pyrolysis systems, fluidized-bed combustion, landfill gas extraction, anaerobic digestion and wood-waste liquefaction. Among the subjects of the papers are: a molten salt gasifier for production of low-Btu gas; hydrogasification of solid wastes, a mobile anaerobic digestion plant for methane production from feedlot residues; biomass conversion of aquatic and terrestrial plants; pyrolytic gasification of black liquors from the Kraft process; and fluidized-bed combustion of petrochemical wastes.

77A49083 ISSUE 23 PAGE 4014 CATEGORY 44  
76/00/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Agricultural and forestry wastes as an energy resource  
AUTH: A/ALICH, J. A., JR.; B/WITWER, J. G. PAA: B/(Stanford Research Institute, Menlo Park, Calif.)  
In: Sharing the sun: Solar technology in the seventies; Proceedings of the Joint Conference, Winnipeg, Canada, August 15-20, 1976. Volume 7. (A77-48910 23-44) Cape Canaveral, Fla., International Solar Energy Society, 1976. p. 146-156.  
MAJS: /\*AGRICULTURE/\*BIOMASS ENERGY PRODUCTION/\*ENERGY SOURCES/\*FORESTS/\*WASTE UTILIZATION  
MINS: / CLEAN ENERGY/ CROP INVENTORIES/ ECONOMIC FACTORS/ FARM CROPS/ FEASIBILITY ANALYSIS/ METABOLIC WASTES  
ABA: (Author)  
ABS: The feasibility of converting agricultural and forestry residues to energy is evaluated based on a county-by-county inventory for the conterminous United States. The impact of this energy resource on the U.S. energy system is forecast using the SRI energy model.

78A11146 ISSUE 1 PAGE 65 CATEGORY 44 77/00/00  
14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy recovery from municipal and industrial waste  
AUTH: A/KREITER, B. G. PAA: A/(Stichting Verwijdering Afvalstoffen, Amersfoort, Netherlands)  
In: Materials and energy from refuse: Proceedings of the First International Symposium, Antwerp, Belgium, October 21, 22, 1976. (A78-11140 01-44) Leiden, Spruyt, Van Mantgen en De Does, 1977. p. 43-56.  
MAJS: /\*GARBAGE/\*GASIFICATION/\*INCINERATORS/\*INDUSTRIAL WASTES/\*PYROLYSIS/\*WASTE ENERGY UTILIZATION  
MINS: / ENERGY CONVERSION/ EXHAUST GASES  
ABA: B.J.  
ABS: The use of thermal conversion processes - pyrolysis and gasification, and incineration - for energy recovery from municipal and industrial wastes is reviewed, along with the use of incineration for supplying urban heat and producing electricity is discussed. Different thermal waste treatment processes are compared in terms of environmental hygiene (emissions and reliability), suitability for different types of wastes, net energy production, net operational costs, volume reduction, and recycling of materials from waste or treatment residues.

78A11126 ISSUE 1 PAGE 63 CATEGORY 44 77/00/00  
16 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy and materials from the forest biomass  
AUTH: A/SAEMAN, J. F. PAA: A/(U.S. Forest Service, Forest Products Laboratory, Madison, Wis.)  
In: Clean fuels from biomass and wastes: Proceedings of the Second Symposium, Orlando, Fla., January 25-29, 1977. (A78-11120 01-44) Chicago, Ill., Institute of Gas Technology, 1977. p. 153-168.  
ABA: J.M.B.  
ABS: The contribution of forests to reducing U.S. dependency on foreign energy sources is discussed, with mention made of the direct application of wood residues as fuel and the conversion of forest products to ethanol, furfural, methanol, formaldehyde and phenol, as well as to indirect savings resulting from the use of conventional forest products instead of more energy-intensive alternatives. It is suggested that energy available from unused but accessible manufacturing and logging wastes could produce two times ten to the 15th power Btus per year, amounting to a 3% contribution to the national energy budget. Environmental problems associated with the handling and burning of wood residues are held to be minimal. However, the chemical or biochemical conversion of forest biomass appears at present to involve high capital costs and low profits.

78N11506# ISSUE 2 PAGE 213 CATEGORY 44 RPT#:  
ERDA-77-47/7 77/03/00 144 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Solar program assessment: Environmental factors.  
Fuel from biomass --- environmental impact  
CORP: Energy Research and Development Administration,  
Washington, D. C. (55: (Div. of Solar Energy.)  
AVAIL.NTIS SAP: HC A07/MF A01  
WAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY POLICY/\*SOLAR  
ENERGY/\*TECHNOLOGY ASSESSMENT  
MINS: / ENERGY TECHNOLOGY/ ENVIRONMENTAL MONITORING/  
RESEARCH AND DEVELOPMENT  
ABA: ERA  
ABS: The major environmental issues associated with the  
further development of biomass production and biomass  
conversion systems are presented and evaluated with  
respect to priority. The basic concepts of the  
technology are reviewed, as are resource requirements.  
The potential effects of this technology on the full  
range of environmental concerns (i.e., air and water  
quality, biosystems, safety, social/institutional  
structures, etc.) are then discussed in terms of both  
their relative significance and possible solutions.  
Only those impacts unique to the solar portion of the  
technology are discussed in depth. An environmental  
work plan is presented, listing research and  
development proposals and a NEPA work plan, which  
might help clarify and/or alleviate specific  
environmental problems.

77N19279# ISSUE 10 PAGE 1296 CATEGORY 28 RPT#:  
PB-258499/3 EPA-600/2-76-148 CNT#: EPA-68-03-0295  
76/03/00 78 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fuel and energy production by bioconversion of waste  
materials: State-of-the-art  
AUTH: A/WARE, S. A.  
CORP: Municipal Environmental Research Lab., Cincinnati,  
Ohio. AVAIL.NTIS SAP: HC A05/MF A01  
WAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY POLICY/\*TECHNOLOGY  
ASSESSMENT/\*WASTE DISPOSAL  
MINS: / BIOLOGICAL EFFECTS/ ENERGY SOURCES/ HYDROLYSIS/  
MATERIALS RECOVERY  
ABA: GRA  
ABS: A state of the art summary of biological processes for  
converting waste cellulosic materials (agricultural,  
municipal and lumbering wastes) to fuels is presented.  
It indicates the locations and quantities of suitable  
wastes and discusses the status of the current  
processing schemes. The processes discussed are: Acid  
hydrolysis followed by fermentation; enzyme hydrolysis  
followed by fermentation; anaerobic digestion of  
manure and municipal solid waste; and, biophotolysis.

78A12222 ISSUE 2 PAGE 251 CATEGORY 44 77/11/00  
5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Biomass and waste production as energy resources -  
Update  
AUTH: A/KLASS, D. L. PAA: A/(Institute of Gas Technology,  
Chicago, Ill.)  
Energy, vol. 2, Fall 1977, p. 23-27.  
WAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY CONVERSION  
EFFICIENCY/\*SYNTHETIC FUELS/\*WASTE UTILIZATION  
MINS: / ANAEROBES/ CLEAN ENERGY/ ENERGY TECHNOLOGY/  
PYROLYSIS/ RESEARCH AND DEVELOPMENT/ SOLID WASTES/  
WOOD  
ABA: S.R.  
ABS: Various arguments which have been made against biomass  
energy applications are considered. It is found that  
there exist factors which negate these arguments. In  
particular, it is felt that difficulties can be  
overcome with the aid of suitable research and  
development projects. Attention is given to the use of  
water conservation techniques, the recycling of  
nutrients, the selection of genetically-engineered  
biomass species for conversion to synfuels, the  
optimization of conversion processes, the solution of  
pollution problems, the determination of conversion  
efficiencies, the utilization of wood as biomass raw  
material, new research developments, solid waste  
conversion, and anaerobic digestion systems.

78A11120 ISSUE 1 PAGE 62 CATEGORY 44 77/00/00  
528 PAGES UNCLASSIFIED DOCUMENT

UTTL: Clean fuels from biomass and wastes: Proceedings of  
the Second Symposium, Orlando, Fla., January 25-28,  
1977 SAP: \$40  
Symposium sponsored by the Institute of Gas  
Technology, Chicago, Ill., Institute of Gas  
Technology, 1977. 528 p (For individual items see  
A78-11121 to A78-11139)  
ABA: J.M.B.  
ABS: The use of biomass and wastes as a source of fuel is  
studied, with attention given to land requirements of  
biomass plantations, the application of forest biomass  
to energy production, hydrogen production through  
photolysis ethanol-gasoline automotive fuels, the  
conversion of solid-waste cellulose to glucose,  
genetic engineering to improve plant photosynthesis  
rates, and the operation of a 100,000-gallon anaerobic  
digester to treat municipal solid wastes. Other topics  
discussed include the design of a compact reactor to  
produce methane from solid wastes, the efficiency of  
several pyrolytic processes, the gasification of  
biomass and wastes with a rotary kiln, the production  
of methane through fermentation of microalgae in waste  
water treatment ponds, and the culture and processing  
of waterhyacinths.

78A11122 ISSUE 1 PAGE 62 CATEGORY 44 77/00/00  
20 PAGES UNCLASSIFIED DOCUMENT

UTTL: Biomass as a long range source of hydrocarbons  
AUTH: A/WATERMAN, W. W.; B/KLASS, D. L. PAA: E/(Institute  
of Gas Technology, Chicago, Ill.)  
In: Clean fuels from biomass and wastes: Proceedings  
of the Second Symposium, Orlando, Fla., January 25-28,  
1977. (A78-11120 01-44) Chicago, Ill., Institute of  
Gas Technology, 1977, p. 29-48.

ABA: J.M.B.  
ABS: Coal and petroleum resources of the U.S. are examined,  
and possible future sources of hydrocarbons, including  
biomass, wastes and carbon dioxide extraction from  
stack gases, are considered as replacements for  
domestic fossil fuel reserves, which may be exhausted  
within a century. The amount of land needed to produce  
biomass fuels is estimated, to obtain 4223 trillion  
Btu equivalents, it is suggested that 56,000 square  
miles of land may be required for biomass plantations.  
Processes for the conversion of biomass to fuels and  
energy, including combustion, pyrolysis, partial  
oxidation, and catalytic gasification are reviewed.  
Problems associated with the large-scale use of  
biomass, such as selection of plant types and  
development of efficient harvesting methods and  
conversion processes, are also mentioned.

78A11116 ISSUE 1 PAGE 62 CATEGORY 44 77/00/00  
9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Biomass as an energy mechanism  
AUTH: A/CLAUSEN, E. C.; B/SITTON, O. C.; C/PARK, E. L.;  
D/GADDY, J. L. PAA: D/(Missouri-Rolla, University,  
Rolla, Mo.)  
In: Energy Crisis: An evaluation of our resource  
potential: Proceedings of the Third Annual UMR-MEC  
Conference on Energy, Rolla, Mo., October 12-14, 1976.  
(A78-11089 01-44) North Hollywood, Calif., Western  
Periodicals Co., 1977, p. 670-678.

ABA: (Author)  
ABS: Laboratory studies at the University of Missouri-Rolla  
have demonstrated the feasibility of producing methane  
by anaerobic digestion of various crop materials, such  
as grasses and corn stalks. These studies indicate  
that about 6.0 scf of methane are produced per pound  
of crop material destroyed. Preliminary design and  
economic studies of a large methane plant show that  
the reactors represent the largest cost item and that  
efforts should be concentrated on defining reaction  
kinetics and reactor design. This paper discusses  
various approaches to reactor design. A process to  
produce 50 MSCFD of methane is described, and the  
design and economics are analyzed.

78A28351 ISSUE 10 PAGE 1796 CATEGORY 44  
77/00/00 465 PAGES UNCLASSIFIED DOCUMENT

UTTL: Biological solar energy conversion: Proceedings of the  
Conference, University of Miami, Miami, Fla., November  
15-18, 1976

AUTH: A/MITSUI, A.; B/MIYACHI, S.; C/SAN PIETRO, A.;  
D/TAMURA, S. PAA: A/(Miami, University, Miami, Fla.)  
; B/(Tokyo, University, Tokyo, Japan); C/(Indiana  
University, Bloomington, Ind.); D/(Tokyo, University,  
Tokyo, Japan) PAI: A/(ED.) SAP: \$18.50  
Conference sponsored by the United States-Japan  
Cooperative Science Program, NSF, Japan Society for  
the Promotion of Science, and ERDA New York, Academic  
Press, Inc., 1977, 465 p (For individual items see  
A78-28352 to A78-28368)

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*CONFERENCES/\*SOLAR ENERGY  
CONVERSION  
MINS: / ALFALFA/ ALGAE/ CARBON DIOXIDE/ CELLS (BIOLOGY)/  
ENERGY TECHNOLOGY/ ORGANIC COMPOUNDS/ PHOTOSYNTHESIS/  
SEAWEEEDS

ABA: J.M.B.  
ABS: Hydrogen photoevolution in algae, kelp colonies for  
biomass conversion, and anaerobic fermentation of  
biomass are discussed. Topics of the papers include  
the anaerobic metabolism of green algae containing  
hydrogenase, methane production from sewage and algae,  
the catalytic activity of hydrogenase in  
biophotolysis, cell-free hydrogen photoevolution  
systems, development of mutant *Chlamydomonas reinhardtii*  
cells possessing oxygen-resistant hydrogenase, the  
technique of single-turnover flashes for assessing  
photosynthetic oxygen evolution in algae, an alfalfa  
biomass conversion system, kelp plantations fertilized by  
deep-ocean water, the design and maintenance of  
seaweed colonies for biomass conversion, and the  
application of bioconversion principles to U.S.  
sugarcane production.

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**Robertson, E. E.**  
**Bioconversion : fuels from biomass /**  
**E. E. Robertson. Philadelphia :**  
**Franklin Institute Press, c1977 .**  
**72 p. : ill. ; 23 cm. (Solar**  
**energy series) \$6.50**  
**1. Biomass energy. I. Title. II.**  
**Series.**  
**662.6 77-84975 0-891680-03-8 77V36765**

77A46250 ISSUE 22 PAGE 3811 CATEGORY 44  
77/00/00 789 PAGES UNCLASSIFIED DOCUMENT

UTTL: Biomass energy for Hawaii. Volume 1 - Summary and background. Volume 2 - Sugar operations. Volume 3 - Mixed municipal refuse. Volume 4 - Terrestrial and marine plantations --- Book

AUTH: A/GILL, A.; B/BECK, C.; C/SALVESEN, K.; D/CHUN, L.; E/YANG, C.; F/MURATA, D.; G/KELLER, M. PAT: A/(ED.) SAP: PRICE OF FOUR VOLUMES, \$20  
Stanford, Calif., Stanford University, 1977. Vol. 1, 175 p.; vol. 2, 159 p.; vol. 3, 212 p.; vol. 4, 243 p.

ABA: J.M.B.

ABS: The conversion of biomass resources into energy, fuels and by-products is discussed, with attention given to programs in Hawaii involving terrestrial and marine biomass plantations, energy recovery from municipal refuse treatment plants and uses for sugar cane harvesting wastes. Biomass conversion processes to increase the available energy supply in Hawaii, such as direct combustion, pyrolysis anaerobic digestion or fermentation, are described. In particular, the generation of electrical power from bagasse (sugar cane waste) and the production of ethanol fuel as a by-product of sugar refining are considered. Schemes for exploiting municipal refuse resources, including use of pyrolytic gases in power plants, are also treated. The reports emphasize an interdisciplinary approach to the energy problem, relying on legal and economic analyses as well as technical studies.

77N78699\* CATEGORY 45 77/05/00 12 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Waste heat utilization in aquaculture: Some futuristic and plausible schemes

AUTH: A/WILCOX, J. R.

CORP: Florida Power and Light Co. AVAIL.NTIS  
In NASA, Washington Proc. of Conf. on Waste Heat Management and Util., Vol. 3 12 p (SEE N77-78681 13-45)

MAJS: /\*HEAT/\*LAKES/\*MARINE BIOLOGY/\*WASTE ENERGY UTILIZATION

MINS: / COOLING SYSTEMS/ ENERGY SOURCES/ ENVIRONMENT PROTECTION/ FISHES/ MAMMALS/ THERMAL POLLUTION/ WATER POLLUTION

78A11121 ISSUE 1 PAGE 62 CATEGORY 44 77/00/00  
28 PAGES UNCLASSIFIED DOCUMENT

UTTL: Biomass and wastes as energy resources - Update

AUTH: A/KLASS, D. L. PAA: A/(Institute of Gas Technology, Chicago, Ill.)  
In: Clean fuels from biomass and wastes: Proceedings of the Second Symposium, Orlando, Fla., January 25-28, 1977. (A78-11120 01-44) Chicago, Ill.: Institute of Gas Technology, 1977. p. 1-28.

ABA: J.M.B.

ABS: Technological developments facilitating the conversion of biomass to fuels and chemicals in desirable forms are reviewed. Topics considered include the design of an ideal synthetic fuel plantation, methods for calculating the net energy production of hypothetical biomass plantations, the economics of substitute natural gas, and the competition between agriculture and biomass plantations for available land. Various conversion processes, such as incineration, pyrolysis, hydrogenation, chemical and enzyme hydrolysis and fermentation, are mentioned. Comparisons are made between the heating values of biomass, wastes and coal, and the conversion efficiencies of several types of municipal refuse-to-steam systems are considered. The use of wood as fuel for electric power generation and for the production of ethanol, furfural and phenol is also discussed.

77N78681\* CATEGORY 45 RPT#: NASA-TM-X-74100-VOL-3  
76/05/00 620 PAGES UNCLASSIFIED DOCUMENT

UTTL: Proceedings of the Conference on Waste Heat Management and Utilization, volume 3

AUTH: A/LEE, S. S.; B/SENGUPTA, S. PAT: A/ed.; B/ed.  
CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS

Sponsored in part by Nucl. Regulatory Comm. and EPA

MAJS: /\*CONFERENCE/\*HEAT/\*RESOURCES MANAGEMENT/\*WASTE ENERGY UTILIZATION  
MINS: / COOLING SYSTEMS/ ECOLOGY/ ENVIRONMENT PROTECTION/ WATER QUALITY

77NB1953# CATEGORY 44 RPT#: ERDA-76-137 76/11/00  
47 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fuels from Biomass program: Program and project status

CORP: Energy Research and Development Administration, Washington, D. C. CSS: (Div. of Solar Energy.) AVAIL.NTIS

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*COST ESTIMATES/\*ENERGY CONVERSION

MINS: / EARTH RESOURCES/ FOOD

77A36346 ISSUE 16 PAGE 2729 CATEGORY 44  
77/00/00 17 PAGES UNCLASSIFIED DOCUMENT

UTTL: Economic feasibility of the conversion of organic waste to fuel oil and pipeline gas

AUTH: A/DEL BEL, E.; B/FRIDMAN, S.; C/YAVORSKY, P. M.  
PAA: C/ERDA, Pittsburgh Energy Research Center,  
Pittsburgh, Pa.)

In: Synthetic fuels processing: Comparative economics: Proceedings of the Symposium, New York, N.Y., April 4-9, 1976. (A77-36326 16-44) New York, Marcel Dekker, Inc., 1977, p. 443-459.

MAJS: /\*FEASIBILITY ANALYSIS/\*FUEL OILS/\*ORGANIC WASTES  
(FUEL CONVERSION)/\*SOLID WASTES/\*SYNTHANE/\*WASTE  
UTILIZATION

MINS: / BIOMASS ENERGY PRODUCTION/ COST ANALYSIS/ COST  
ESTIMATES/ ENERGY TECHNOLOGY/ FERMENTATION

ABA: (Author)

ABS: Current estimates indicate that approximately 130 million tons of municipal solid waste are generated in the United States each year. Combustion, pyrolysis, fermentation, gasification, and liquefaction have been proposed as practicable methods for the utilization of this material which has an energy equivalent of 150 million barrels of oil and contains about 20 million tons of metals and glass. The Pittsburgh Energy Research Center (ERDA) has been involved in the development of processes for the conversion of organic wastes to fuel oil, and pipeline gas. In the liquefaction process, the refuse is converted to fuel oil by reaction with carbon monoxide, or synthesis gas, and steam at 3,000 psi and 350-400 C. Pipeline quality gas is made from organic waste by hydrogasification at 1,000 psi and 650-800 C. The economic feasibility of these two processes as applied to municipal solid waste (MSW) and cattle manure is discussed.

78N75036 CATEGORY 44 76/00/00 63 PAGES  
UNCLASSIFIED DOCUMENT DCAF F010266

UTTL: The utilization of forest biomass and forest industry wastes for the production and conservation of energy

CORP: Canadian Forestry Service, Ottawa (Ontario), CSS: (Dept. of the Environment.) AVAIL NTIS

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*ENERGY CONSERVATION/\*  
ENERGY POLICY/\*FORESTS/\*INDUSTRIAL WASTES

MINS: / EARTH RESOURCES/ FOSSIL FUELS/ HEAT PUMPS/ SOLAR  
ENERGY/ WASTE UTILIZATION

79N10237# ISSUE 1 PAGE 32 CATEGORY 28 RPT#  
SAN-1241-77-1 CNT#: E(04-31-1241 77/10/00 143  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Conversion of biomass materials into gaseous products,  
phase 1 TLSP: Final Technical Report, 25 May 1976 -  
24 Jun. 1977

AUTH: A/GARRETT, D. E.

CORP: Garrett Energy Research and Engineering, Inc.,  
Claremont, Calif. AVAIL NTIS SAP: HC 207/WF 201

MAJS: /\*BIOMASS ENERGY PRODUCTION/\*COMBUSTION PRODUCTS/\*  
GASES/\*ORGANIC WASTES (FUEL CONVERSION)/\*WASTE  
UTILIZATION

MINS: / CHEMICAL REACTORS/ DRYING/ ECONOMIC ANALYSIS/ HEAT  
TRANSFER COEFFICIENTS, PILOT PLANTS/ PYROLYSIS

ABA: DOE

ABS: A one year exploratory bench scale pilot plant and laboratory study was completed on proprietary double effect dryer-multiple hearth biomass pyrolysis process. The results indicate that an initial vacuum drying stage is quite feasible, and that an effective overall heat transfer coefficient of 4.5 Btu/hr x sq. ft. x F can be obtained for the flue gas-vacuum dryer. Direct contact drying was also efficiently conducted in the hearths, with an effective overall drying rate

for manure of about 5 lbs water/hr x cu. ft. of hearth space. Acceptably low solids entrainment and lack of hearth plugging occurred at a flue gas velocity of 0.1 ft/sec, and 60 ft/sec through the base plate holes. The 450 Btu/cu ft (dry, carbon dioxide-free) product gas was obtained in about a 74% yield, was low in carbon monoxide, and should be blendable into natural gas pipelines. Costs are estimated for constructing a 100 t/d manure processing plant producing a medium Btu gas for \$2.84/MMBtu, if manure is free, with a 10% return on investment.

77N23012\* ISSUE 13 PAGE 1796 CATEGORY B5 RPTA:  
BNL-50559 TID-4500 CNT# : E(30-1)-16 76/06/00 191  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Solid waste as an energy source for the northeast  
AUTH: A/MEIER, P. M.; B/MCCOY, T. H.  
CORP: Brookhaven National Lab., Upton, N. Y. AVAIL NTIS  
SAP: HC AG9/MF A01

ABA: ERA

ABS: The potential contribution of energy recovery from municipal refuse to energy supply is assessed. A brief review of the present and likely future quantity and composition of municipal refuse and the technologies available for energy recovery is followed by a comparison of the potential contributions to energy supply of the various recovery options including direct firing in utility boilers, pyrolysis to oil or gas, and steam generation for industrial process heat or district space heating. The relationship of refuse energy recovery to market conditions for alternative energy sources is considered, which also includes an analysis of the impact of haul costs, interest rates, and delivered prices of the major fuels.

77A37670 ISSUE 17 PAGE 2907 CATEGORY 44  
76/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Federal Fuels from Biomass Energy Program  
AUTH: A/WARD, R. F. PAA: A/ERDA, Washington, D.C.)  
In: Clean fuels from biomass, sewage, urban refuse, agricultural wastes; Proceedings of the Symposium, Orlando, Fla., January 27-30, 1976. (A77-37652 17-44)  
Chicago, Institute of Gas Technology, 1976, p. 427-436.

ABA: M.L.

ABS: The paper surveys federal research concerned with developing fuels from biomass. Biomass production studies deal with the growing, harvesting, and collection of agricultural, feedlot, and forestry residues. Biomass conversion procedures involve biological techniques (aerobic digestion, acid hydrolysis, enzyme hydrolysis, biophysics) and thermochemical techniques (pyrolysis and hydrogasification) as well as direct combustion. Field crops and tree crops considered potential feedstocks for conversion to fuels are listed. The use of kelp is examined. Waste utilization, which could involve manure, agricultural crop and food wastes, logging and wood manufacturing residues, or urban solid wastes, is discussed. The research and development implementation strategy is described with attention to research categorization and the scheduling of research projects.

77A12673\* ISSUE 2 PAGE 232 CATEGORY 44  
76/00/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: A preliminary assessment of the feasibility of deriving liquid and gaseous fuels from grown and waste organics  
AUTH: A/GRAHAM, R. W.; E/REYNOLDS, T. W.; C/NSU, Y.-Y.  
PAA: C/(NASA, Lewis Research Center, Hampton, Va.)  
In: Intersociety Energy Conversion Engineering Conference, 11th, State Line, Nev., September 12-17, 1976. Proceedings, Volume 1. (A77-12662 02-44) New York, American Institute of Chemical Engineers, 1976, p. 98-104.

ABA: G.R.

ABS: An estimate is obtained of the yearly supply of organic material for conversion to fuels, the energy potential is evaluated, and the fermentation and pyrolysis conversion processes are discussed. An investigation is conducted of the estimated cost of fuel from organics and the conclusions of an overall evaluation are presented. It is found that climate, land availability and economics of agricultural production and marketing, food demand, fertilizer shortage, and water availability combine to cast doubts on the feasibility of producing grown organic matter for fuel, in competition with food, feed, or fiber. Less controversial is the utilization of agricultural, industrial, and domestic waste as a conversion feedstock. The evaluation of a demonstration size system is recommended.

77A23990\*# ISSUE 9 PAGE 1437 CATEGORY 44  
76/01/01 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Clean fuels from biomass  
AUTH: A/HSU, Y.-Y. PAA: A/(NASA, Lewis Research Center, Cleveland, Ohio)  
CORP: National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.  
Energy Quarterly, vol. 6, Jan. 1, 1976, p. 6-19.  
MAJ: /\*BIOMASS ENERGY PRODUCTION/\*CLEAN ENERGY/\*DOMESTIC ENERGY/\*ENERGY SOURCES/\*FERMENTATION/\*PYROLYSIS  
MINS: / ANAEROBES/ BACTERIA/ COST EFFECTIVENESS/ ENERGY TECHNOLOGY/ METHANE/ OPTIMIZATION/ SYSTEMS ENGINEERING  
ABA: S.D.  
ABS: The paper discusses the U.S. resources to provide fuels from agricultural products, the present status of conversion technology of clean fuels from biomass, and a system study directed to determine the energy budget, and environmental and socioeconomic impacts. Conversion processes are discussed relative to pyrolysis and anaerobic fermentation. Pyrolysis breaks the cellulose molecules to smaller molecules under high temperature in the absence of oxygen, whereas anaerobic fermentation is used to convert biomass to methane by means of bacteria. Cost optimization and energy utilization are also discussed.

77A18743 ISSUE 6 PAGE 864 CATEGORY 44 76/12/00  
6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fuel gas production by anaerobic digestion of kelp  
AUTH: A/TROIANO, R. A.; B/WISE, D. L.; C/AUGENSTEIN, D. C.  
; D/KISPERT, R. G.; E/COONEY, C. L. PAA:  
D/(Dynatech R/D Co., Cambridge, Mass.); E/(MIT,  
Cambridge, Mass.)  
Resource Recovery and Conservation, vol. 2, Dec. 1976,  
p. 171-176.  
MAJS: / \*ANAEROBES/ \*BIOMASS ENERGY PRODUCTION/ \*GASEOUS FUELS  
/ \*SEAWEEDES  
MINS: / DIGESTING/ METHANE/ SOLID WASTES  
ABA: S.D.

ABS: Results are presented for an experimental study  
designed to assess the feasibility of anaerobic  
digestion of freshly harvested U.S. East Coast kelp  
(Laminaria saccharina) to produce methane. The

discussion covers details of digester operation,  
digester start-up and steady-state operation, alkali  
pretreatment of kelp, and comparison of kelp digestion  
with other substrates. For the prescribed feed levels  
used in the digester, the conversions were 131.5 ml  
CH<sub>4</sub> at STP per gram of dry kelp feed for a 9.3 g per  
day feed and a 25 day retention time, and 121 ml CH<sub>4</sub>  
at STP per gram of kelp feed for a 137 g per day feed  
and a 25 day retention time. It is shown that  
mariculture systems can achieve gas production rates  
similar to those obtained to date with municipal solid  
waste. Further work is required to determine peak  
conversion rates.

77A11038 ISSUE 1 PAGE 73 CATEGORY 44 76/00/00  
10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy from wastes  
AUTH: A/SABEL, W. PAA: A/(Oxford Polytechnic, Oxford,  
England)  
In: Aspects of energy conversion; Proceedings of the  
Summer School, Oxford, England, July 14-25, 1975.  
(A77-11026 01-44) Oxford, Pergamon Press, 1976, p.  
449-457; Discussion, p. 458.

ABA: G.R.

ABS: Suitable approaches of dealing with disposal problems  
are considered, taking into account domestic and  
industrial sources of waste. It is found that  
questions concerning the use of processes which make  
it possible to obtain energy from wastes depend not  
only on technology and financial cost factors, but  
also on a consideration of social costs and benefits.  
Attention is given to the need for the proper use of  
food, the economic employment of wastes from animal  
rearing, and the utilization of fermentation  
processes.

77N10656# ISSUE 1 PAGE 92 CATEGORY 44 RPT#:  
DRNL-TM-5069 CNTR: W-7405-ENG-26 76/03/00 39  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Waste heat vs conventional systems for greenhouse  
environmental control: An economic assessment  
AUTH: A/OLSZEWSKI, M.; B/HILENBRAND, S. J.; C/REED, S. A.  
CORP: Oak Ridge National Lab., Tenn. AVAIL NTIS SAP: HC  
403/MF A01  
MAJS: / \*BUILDINGS/ \*ECONOMIC ANALYSIS/ \*ENERGY POLICY/ \*  
ENVIRONMENTAL ENGINEERING/ \*VEGETATION/ \*WASTE ENERGY  
UTILIZATION  
MINS: / COOLING SYSTEMS/ COSTS/ ELECTRIC POWER PLANTS/  
ENERGY TECHNOLOGY/ FOSSIL FUELS/ HEAT TRANSFER/  
HEATING EQUIPMENT  
ABA: Author (ERA)

ABS: Because of rising fuel costs greenhouse operators are  
seeking alternate methods and fuels to heat their  
greenhouses. A hypothetical greenhouse operation using  
power plant reject heat for winter heating was  
investigated on a cost basis. The greenhouse  
temperature control system, which is used for both  
heating and cooling, operates by flowing water down an  
evaporative pad while air is drawn across the pad.  
This direct contact energy exchange provided cooling  
in the summer, by water evaporation, while heating in  
the winter is provided by sensible heat transfer. The  
warm water for winter heating is supplied by the  
reject heat from a power plant. A comparison of the  
total cost for the bimodal system and a traditional  
greenhouse system indicates that the bimodal system is  
economically competitive if the pad water inlet  
temperature is maintained above 80 F. An analysis of  
typical greenhouse fixed and operating costs and  
revenue shows that the use of fossil fuels (coal or  
natural gas) results in an operating loss for all but  
mild climates.

77A36605 ISSUE 16 PAGE 2781 CATEGORY 85  
76/00/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy recovery from municipal and industrial waste  
AUTH: A/KREITER, B. G. PAA: A/(Stichting Verwijdering  
Afvalstoffen, Amerfoort, Netherlands)  
Conservation and Recycling, vol. 1, no. 1, 1976, p.  
71-81.

MAJS: /\*INDUSTRIAL WASTES/\* SOLID WASTES/\* WASTE ENERGY  
UTILIZATION/\* WASTE UTILIZATION

MINS: / COST ANALYSIS/ ECONOMIC FACTORS/ ELECTRIC POWER  
PLANTS/ INCINERATORS/ PYROLYSIS

ABA: (Author)

ABS: A detailed analysis is given of the economics of heat  
recovery and utilization in the incineration of waste  
materials. Energy may be recovered as heat with or  
without electricity generation but, since electricity  
may be generated at little marginal cost, only the  
alternatives involving its production are considered.  
Detailed calculations are made for the economic  
implications of treating 140,000 tons of waste  
annually, and a net saving of 23 million cu m of  
natural gas is indicated. It is not yet possible to  
compare incineration with pyrolysis since much  
information regarding the latter is still unavailable,  
but published figures indicate that an energy saving  
of 430 kWh per ton of waste is attainable by  
combustion of fuels produced by pyrolysis in a utility  
power station. Incineration for steam production,  
followed by electricity generation, can save about 730  
kWh per ton of waste.

77A19123 ISSUE 6 PAGE 872 CATEGORY 44 76/00/00  
7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Improved use of energy --- through waste and solar  
energy utilization

AUTH: A/HATAMI, R. PAA: A/(Arya Mehr University of  
Technology, Teheran, Iran)  
In: Heliotechnique and development; Proceedings of the  
International Conference, Dhanan, Saudi Arabia,  
November 2-6, 1975, Volume 2. (A77-19043 06-44)  
Cambridge, Mass., Development Analysis Associates,  
Inc., 1976, p. 536-602.

ABA: V.P.

ABS: The sudden sharp increase in the price of fossil fuels  
has destabilized the world's energy economy. This  
otherwise unfortunate event has had the beneficial

effect of revising the methods of energy consumption  
and initiating a search for new energy sources. The  
various possibilities of energy conservation in  
buildings and recovery of waste from nuclear plants  
are briefly reviewed.

77A37667 ISSUE 17 PAGE 2907 CATEGORY 44 CNT#:  
DACA23-74-C-00C9 76/00/00 25 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Design, operation and economics of the energy  
plantation

AUTH: A/FRASER, M. D.; B/HENRY, J.-F.; C/VAIL, C. W.  
PAA: C/(InterTechnology Corp., Warrington, Va.)  
In: Clean fuels from biomass, sewage, urban refuse,  
agricultural wastes; Proceedings of the Symposium,  
Orlando, Fla., January 27-30, 1976. (A77-27652 17-44)  
Chicago, Institute of Gas Technology, 1976, p.  
371-375.

ABA: G.R.

ABS: The energy plantation concept considered represents an  
innovative, systematic approach for producing a  
practical and economic fuel from plant matter on a  
large scale. Ultimately, the fuel derives from solar  
energy, which is collected and stored in plants grown  
for their fuel value. The advantages of energy  
plantations are examined and questions regarding the  
plant resources are investigated. Attention is given  
to natural stands versus managed plantings, annual  
plants versus perennials, deciduous plants versus  
conifers, preferred deciduous species, and preferred  
perennial grasses. Suitable land resources are  
considered along with plant-matter production rates,  
plantation design and operation, and the economics of  
the energy plantation.

77A37652 ISSUE 17 PAGE 2905 CATEGORY 44  
76/00/00 465 PAGES UNCLASSIFIED DOCUMENT

UTTL: Clean fuels from biomass, sewage, urban refuse,  
agricultural wastes; Proceedings of the Symposium,  
Orlando, Fla., January 27-30, 1976 SAP: \$40  
Symposium sponsored by the Institute of Gas  
Technology, Chicago, Institute of Gas Technology,  
1976, 465 p (For individual items see A77-37653 to  
A77-37671)

ABA: R.D.V.

ABS: Papers dealing with production of biomass for  
conversion to synthetic fuels with concomitant savings  
in materials and energy are presented. Major topics  
covered include: fundamentals of photosynthesis,  
scaled-up production of biomass, biomass-to-fuels  
conversion processes, characteristics and compositions  
of municipal and agricultural wastes, separation  
techniques, microbiological and anaerobic processes  
for production of gas from sewage effluents and other  
wastes, and economics of energy and materials recovery  
processes. Recovery of methane from landfill wastes,  
gas production from ocean kelp, microalgae, and water  
hyacinths, and reprocessing of cellulose to produce  
sugars and eventually alcohols are discussed.

77A10698 ISSUE 1 PAGE 72 CATEGORY 44 76/00/00  
513 PAGES UNCLASSIFIED DOCUMENT

UTTL: Energy from solid wastes --- Book

AUTH: A/CHEREMISINOFF, P. N.; B/MORRESI, A. C. PAA:  
A/(New Jersey Institute of Technology, Newark, N.J.);  
B/(Exxon Research and Engineering Co., Linden, N.J.)

SAP: \$35

New York, Marcel Dekker, Inc. (Pollution Engineering  
and Technology, Volume 1), 1976, 513 p.

MAJS: /ENERGY SOURCES/ PYROLYSIS/ RECYCLING/ RESEARCH  
PROJECTS/ SOLID WASTES/ WASTE ENERGY UTILIZATION

MINS: / ECONOMIC ANALYSIS/ ENERGY TECHNOLOGY/ INCINERATORS/  
MATERIALS RECOVERY/ METHANE/ SANITATION/ SEWAGE/  
SLUDGE/ WASTE DISPOSAL/ WOOD

ABA: P. T. H.

ABS: The book examines a number of ways in which various  
types of solid waste can be used for extracting  
energy. Projects currently in operation or under study  
are described. These include the St. Louis solid waste  
demonstration project, the East Bridgewater Eco-Fuel  
II resource recovery plant, the Baltimore pyrolysis  
resource recovery system, a 1200 ton-per-day solid  
waste burning steam-generating plant, European steam  
producing incinerators, and Japanese and Canadian  
projects. The basic principles of a number of  
processes are studied, including the extraction of  
clean liquid and gaseous fuels from organic wastes,  
plastics recycling, waste oil treatment, pyrolysis for  
energy recovery, generation of methane in sanitary  
landfills, and solid waste separation methods.

J

V. WASTE HEAT UTILIZATION . . . . .	518
A. General . . . . .	519
B. District Heating & Total Energy . . . . .	532
C. Modular Integrated Utility Systems . . . . .	537

WASTE HEAT UTILIZATION - GENERAL

79A51969 ISSUE 23 PAGE 4384 CATEGORY 44  
79/00/00 4 PAGES UNCLASSIFIED DOCUMENT

UTTL: The energy reformation --- waste energy utilization  
for heating and electricity

AUTH: A/CIRRITO, A. J. PAA: A/(Lowell, University, Lowell,  
Mass.)

In: Intersociety Energy Conversion Engineering  
Conference, 14th, Boston, Mass., August 5-10, 1979.  
Proceedings, Volume 2. (A79-51726 23-44) Washington,  
D.C., American Chemical Society, 1979, p. 1758-1761.

VAJS: /\*ELECTRIC POWER/\*ENERGY POLICY/\*SPACE HEATING  
(BUILDINGS)/\*WASTE ENERGY UTILIZATION

WINS: / DOMESTIC ENERGY/ ENERGY TECHNOLOGY/ GAS TURBINE  
ENGINES/ INDUSTRIAL ENERGY

ABA: A. L. W.

ABS: Future strategies for producing and distributing  
domestic and industrial heat and electricity are  
proposed, emphasizing the necessity of conserving all  
available and heat energy. Smaller, well dispersed  
power plants incorporating advanced technology and  
combined with sewage disposal facilities are discussed  
as means for controlling pollution and utilizing all  
available energy and heat generated by fuel  
combustion. It is suggested that the gain in available  
energy achieved by combined cycle power plants be used  
for the transfer of generated heat to fluids involved  
in domestic and process heating, and a gas turbine  
heating unit is also proposed as a source of  
high-pressure gases for heat transfer and utilization.  
In addition, the necessity of federal support to  
overcome the short-term economic losses involved in  
the development and implementation of  
energy-conserving technology is stressed.

**INDUSTRIAL COGENERATION: PROBLEMS AND PROMISE.**  
L. Icerman and D. M. Staples.  
Energy, vol 4, no 1, February 1979, p. 101-116.

**Abstract**—Considerable potential for industrial cogeneration of electricity and process heat is currently available in the U.S. A number of prime mover technologies suitable for application in cogeneration facilities are already technically proven in other conventional systems. Industries with particularly attractive opportunities include paper and pulp, chemical, petroleum refining, iron and steel, and cement manufacturers. The apparent technical potential is limited significantly by economic, environmental, and regulatory factors, as well as by the need for new dimensions in industry and utility cooperation. Although substantial societal benefits in the form of energy conservation are available from a strong commitment to industrial cogeneration systems, many obstacles to systems deployment remain, which will not be readily overcome without the adoption of policy incentives.

**EFFECTS OF STEAM INJECTION ON THE PERFORMANCE OF  
GAS TURBINE POWER CYCLES.**

Transactions of the ASME, vol 101, no 2, April 1979,  
p. 217-227.

*The effect of injecting steam generated by exhaust gas waste heat into a gas turbine with 3060°R turbine inlet temperature has been analyzed. Two alternate steam injection cycles are compared with a combined cycle using a conventional steam bottoming cycle. A range of compression ratios (8, 12, 16, and 20) and water mass injection ratios (0 to 0.4) were analyzed to determine effect on net turbine power output per pound of air and cycle thermodynamic efficiency. A water/fuel cost tradeoff analysis is also provided. The results indicate promising performance and economic advantages of steam injected cycles relative to more conventional utility power cycles. Application to coal-fired configuration is briefly discussed.*

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OF POOR QUALITY

79A24047 ISSUE 8 PAGE 1435 CATEGORY 44  
79/02/00 17 PAGES UNCLASSIFIED DOCUMENT

UTTL: Industrial cogeneration - Problems and promise ---  
waste heat utilization from electricity production  
AUTH: A/ICERMAN, L.; B/STAPLES, D. M. PAA: B/(Washington  
University, St. Louis, Mo.)  
Energy (UK), vol. 4, Feb. 1979, p. 101-117. Research  
sponsored by the Missouri Department of Natural  
Resources.  
MAJS: /\*ELECTRIC POWER PLANTS/\*ENERGY TECHNOLOGY/\*HEAT  
SOURCES/\*INDUSTRIAL ENERGY/\*WASTE ENERGY UTILIZATION  
MINS: / DOMESTIC ENERGY/ ECONOMIC FACTORS/ ENERGY  
CONSERVATION/ ENERGY POLICY/ ENVIRONMENT EFFECTS/  
FINANCE/ INDUSTRIAL WASTES/ MODULAR INTEGRATED UTILITY  
SYSTEM

ABA: (Author)

ABS: Considerable potential for industrial cogeneration of  
electricity and process heat is currently available in  
the U.S. A number of prime mover technologies suitable  
for application in cogeneration facilities are already  
technically proven in other conventional systems.  
Industries with particularly attractive opportunities  
include paper and pulp, chemical, petroleum refining,  
iron and steel, and cement manufacturers. The apparent  
technical potential is limited significantly by  
economic, environmental, and regulatory factors, as  
well as by the need for new dimensions in industry and  
utility cooperation. Although substantial societal  
benefits in the form of energy conservation are  
available from a strong commitment to industrial  
cogeneration systems, many obstacles to systems  
deployment remain, which will not be readily overcome  
without the adoption of policy incentives.

A79-32476 # Major considerations in the design and engineering of cogeneration facilities. R. E. Kropp, E. J. Hansen (Dravo Cogeneration Co., Pittsburgh, Pa.), and R. Destefanis (Gibbs and Hill, Inc., New York, N.Y.). *American Society of Mechanical Engineers, Gas Turbine Conference and Exhibit and Solar Energy Conference, San Diego, Calif., Mar. 12-15, 1979, Paper 79-GT-151*. 5 p. Members, \$1.50; nonmembers, \$3.00.

Since the 1973 oil embargo, cogeneration has received renewed attention, particularly from industry and government. The paper summarizes the various options, aspects, and considerations which may be considered in the study, design and engineering of industrial cogeneration facilities. Emphasis is placed on large grass roots fossil fired facilities. However, these facilities probably will not be the short term solutions to the U.S. energy dilemma. One of the prime short term solutions appears to be waste stream utilization with gas turbines. S.D.

79N32726# ISSUE 23 PAGE 3114 CATEGORY 44 RPT#:  
CONF-790443-2 CNT#: W-7405-ENG-26 79/04/00 18  
PAGES UNCLASSIFIED DOCUMENT

UTTL: Overview of waste heat utilization techniques ---  
spray irrigation, soil heating, aquaculture and  
biomass production  
AUTH: A/OLSZEWSKI, M.  
CORP: Oak Ridge National Lab., Tenn. AVAIL:NTIS SAP: HC  
A02/WF A01  
Presented at Am. Power Conf., Chicago, 23 Apr. 1979  
MAJS: /\*AQUICULTURE/\*BIOMASS/\*IRRIGATION/\*SOILS/\*VEGETATION  
GROWTH/\*WASTE ENERGY UTILIZATION  
MINS: / COOLING SYSTEMS/ MARINE BIOLOGY/ ORGANIC WASTES  
(FUEL CONVERSION)/ SPRAYING/ WASTE TREATMENT

ABA: DOE

ABS: Cooling water from power plants is generally  
discharged in the range of 15 to 43 C (60 to 110 F)  
depending on the temperature of the available inlet  
water, quantity circulated, plant load, and  
heat-rejection system used. Possible uses for this  
low-grade heat include greenhouse horticulture; soil  
heating (both open field and in greenhouses); spray  
irrigation for frost protection; organic waste  
treatment (particularly for algae or biomass  
production); and aquaculture/mariculture. To date  
greenhouse and aquaculture/mariculture systems have  
received the most attention and have, therefore,  
progressed farthest. Several innovative techniques  
that utilize powerplant reject heat for these  
applications are described for the U.S., Canada,  
France, West Germany, and the USSR.

CONSERVING ENERGY VIA COGENERATION. W. B. Wilson.

Mechanical Engineering, vol 101, no 8, August 1979,  
p. 20-27.

For decades, industry has generated much of its  
power with cogeneration systems that used roughly  
half the power required for systems generating and  
transmitting electric power only. Even so, many in-  
dustrial plants are not sure that the increment of  
investment for a cogeneration system versus a system  
with process boilers and purchased electric power can  
meet their criteria for return on investment (ROI)  
to reduce operating costs. To lay such doubts to rest,  
examples are presented that indicate the energy-

conserving potential of different cogeneration systems.

## COGENERATION-AN ENERGY ALTERNATIVE FOR THE U. S.?

Gary S. Was and Michael W. Golay

Energy, vol. 4, no. 6, Dec. 1979, pp. 1023-1031.

**Abstract**—A Total Energy System (TES) is proposed to supply the Massachusetts Institute of Technology (MIT) with its total electrical and steam energy needs at a cost below that of the present system of a steam production facility and purchased electricity. Diesel-engine, steam-turbine, and gas-turbine plants, with supplementary or auxiliary fired boilers, are the design alternatives to the current boiler plant. Each system design is evaluated for economic potential using the net present value method of analysis. Results show that only the diesel engine may be competitive with the current cost of producing steam and purchasing electricity. Preliminary analysis indicates that the annual savings of this plant may be as high as \$959,000. However, a more realistic figure of \$278,000 results after considering the costs of back-up service, the use of higher priced fuel, and the savings due to peak-pricing plans. This figure is exclusive of the difficult-to-quantify variables such as the cost of emission controls and the future price of oil. The cost of fuel for each TES option accounts for over 81% of the annual cost (capital charge + fuel + operation and maintenance) indicating a higher degree of sensitivity to oil prices than for a utility. Because of the many uncertainties and the dependence on oil, such a system is not economically attractive for MIT.

Our results are of general interest since many applications for which total energy systems and cogeneration have been suggested are less attractive, in terms of energy-demand schedules and initially-installed equipment, than MIT. This work suggests that total energy and cogeneration proposals involving low demand-density and low capacity factors should be viewed with suspicion.

**A79-44225 \* #** Energy and cost savings results for advanced technology systems from the Cogeneration Technology Alternatives Study (CTAS). G. D. Sagerman, G. J. Barne, and R. K. Burns (NASA, Lewis Research Center, Cleveland, Ohio). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, Orlando, Fla., June 4-6, 1979, Paper 79-1000*. 20 p. Contract No. EC-77-A-31-1062.

The Cogeneration Technology Alternatives Study (CTAS), a program undertaken to identify the most attractive advanced energy conversion systems for industrial cogeneration applications in the 1985-2000 time period, is described, and preliminary results are presented. Two cogeneration options are included in the analysis: a topping application, in which fuel is input to the energy conversion system which generates electricity and waste heat from the conversion system is used to provide heat to the process, and a bottoming application, in which fuel is burned to provide high temperature process heat and waste heat from the process is used as thermal input to the energy conversion system which generates energy. Steam turbines, open and closed cycle gas turbines, combined cycles, diesel engines, Stirling engines, phosphoric acid and molten carbonate fuel cells and thermionics are examined. Expected plant level energy savings, annual energy cost savings, and other results of the economic analysis are given, and the sensitivity of these results to the assumptions concerning fuel prices, price of purchased electricity and the potential effects of regional energy use characteristics is discussed. C.K.D.

## Cogeneration - A Viable Alternative by R.A. Edelman & S. Bongiorno

Public Utilities Fortnightly, Vol. 10h, No. 12,  
6 December 1979, p. 36-43

*The development of cogeneration plants, which simultaneously produce electric power and other useful forms of thermal energy, has been receiving increasing attention by industry as a means of energy conservation. The rising cost of natural gas, oil, and coal makes it more important than ever that both utilities and industry thoroughly evaluate the economics of cogeneration for the production of electrical power and process steam. This article discusses the major considerations in such an evaluation.*

## Energy Conservation Through Industrial Cogeneration. Final Report by J. Joyce

Dept. of Energy Document COO-2893-7, August 1978  
Contract no. EY-76-S-02-2893

## INDUSTRIAL COGENERATION: PROBLEMS AND PROMISE, by L. Icerman and D. M. Staples. Energy, vol. 4, no. 1, Feb. 1979, p. 101-119.

**Abstract**—Considerable potential for industrial cogeneration of electricity and process heat is currently available in the U.S. A number of prime mover technologies suitable for application in cogeneration facilities are already technically proven in other conventional systems. Industries with particularly attractive opportunities include paper and pulp, chemical, petroleum refining, iron and steel, and cement manufacturers. The apparent technical potential is limited significantly by economic, environmental, and regulatory factors, as well as by the need for new dimensions in industry and utility cooperation. Although substantial societal benefits in the form of energy conservation are available from a strong commitment to industrial cogeneration systems, many obstacles to systems deployment remain, which will not be readily overcome without the adoption of policy incentives.

CO-GENERATION OF HEAT AND ELECTRICITY AS AN ALTERNATIVE METHOD OF HEATING, by H.U. Frutschi, Zurich, Brown Boveri Review, vol. 65, no. 11, Nov. 1978, p.700-707.

*Because of the seasonal variations of demand for electricity and for heat for space heating, it is clear that electrical resistance heating must be limited to the utilization of genuine daily surpluses of output. Alternative heating methods are therefore considered, in a thermodynamic assessment, and the great advantages of co-generation of heat and power are elucidated with the aid of heat balances. Co-generation permits not only a better overall utilization of the energy contained in the fuel, but also a substantial improvement in the efficiency of thermal power generation. The combined use of nuclear power stations, fossil-fuelled heat-and-power stations and heat pumps is illustrated and discussed with reference to an assumed model of a regional energy supply system.*

Cogeneration

1979

Energy and Cost Savings Results for Advanced Technology Systems From the Cogeneration Technology Alternatives Study (CTAS) by G.D. Sagerman, G.J. Barna & R.K. Burns

DOE/NASA/1062-79/2 and NASA TM-79213,

**N80 10665#** Department of Energy, Washington, D. C. Office of Conservation and Solar Applications  
**WASTE HEAT UTILIZATION: PROCEEDINGS OF 1978 ENGINEERING FOUNDATION CONFERENCE**  
Apr 1979 327 p refs Conf. held at Henniker, N. H. 13-18 Aug 1978  
(CONF-7808102) Avail. NTIS HC A15/MF A01  
Fifteen papers are presented containing engineering concepts, improved methods, and/or equipment descriptions pertaining to waste heat utilization. RES

**A80-11957** Techniques for evaluation of advanced cogeneration technologies. O. H. Brown (General Electric Co., Schenectady, N.Y.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. (A80-11953 02-44) Washington, D.C., Government Institutes, Inc., 1979, p. 354-360.

A methodology is presented that characterizes the performance parameters of advanced energy conversion systems for cogeneration. Process temperature is directly coupled to the characteristic of the energy conversion system in a manner that is straightforward, simple, easy-to-check, and requires a minimum of computation. Parameters are expressed as ratios to the cogeneration fuel energy; the more familiar expression of fuel charged to power is shown to be a derivative of these expressions. B.J.

**A79-46660 #** Conserving energy via cogeneration. W. B. Wilson (General Electric Co., Schenectady, N.Y.). *Mechanical Engineering*, vol. 101, Aug. 1979, p. 20-27.

Consideration is given to the problem of whether industrial plants can realize a return on investment (ROI) with the installation of a cogeneration system, as opposed to a system with process boilers and purchased electric power. Topics covered include low-level heat recovery, waste gas-flow requirements for steam generation and inlet steam pressure effects. Data are also given showing capital requirements and annual operating costs of process boilers versus steam turbine cogeneration, along with the effect of investment tax credit and depreciation allowances on discounted rate of return. It is concluded that for cogeneration projects with a typical 4 or 5 yr gross payout period, such tax incentives should significantly increase the number that will be implemented. M.E.P.

TK  
1005  
.C63

Cogeneration of steam and electric power / edited by Robert Noyes. — Park Ridge, N.J. : Noyes Data Corp., 1978.

ix, 259 p. — (Energy technology review ; no. 29)

Bibliography: p. 258-259.

1. Hydrothermal electric power systems.
2. Energy conservation. I. Noyes, Robert. II. Series.

79A45201# ISSUE 19 PAGE 3624 CATEGORY 44  
78/00/00 504 PAGES UNCLASSIFIED DOCUMENT

UTTL: Application of solar energy: Proceedings of the Third  
Southeastern Conference, Huntsville, Ala., April  
17-19, 1978

AUTH: A/WU, S. T.; B/CHRISTENSEN, D. L.; C/HEAD, R. R.  
PAA: C/(Alabama, University, Huntsville, Ala.) PAT:  
A/(ED.) SAP: \$25

Conference sponsored by the University of Alabama,  
NASA, Alabama Solar Energy Association, et al  
Huntsville, Ala., UAH Press, 1978, 504 p (For  
individual items see A79-45202 to A79-45231)

MAJS: /\*CONFERENCES/\*ENERGY CONVERSION EFFICIENCY/\*SOLAR  
COLLECTORS/\*SOLAR COOLING/\*SOLAR ENERGY CONVERSION/\*  
SOLAR HEATING

WINS: / BIOMASS ENERGY PRODUCTION/ COMPUTERIZED SIMULATION/  
ENERGY SOURCES/ HEAT PUMPS/ INDUSTRIAL ENERGY/  
METEOROLOGICAL PARAMETERS/ OCEAN THERMAL ENERGY  
CONVERSION/ SYSTEM EFFECTIVENESS/ WATER HEATING/  
WINDPOWER UTILIZATION

ABA: V. T.

ABS: Demonstration projects, systems-subsystems simulation  
programs, applications (heating, cooling,  
agricultural, industrial), and climatic data testing  
(standards, economics, institutional) are the topics  
of the book. Economics of preheating water for  
commercial use and collecting, processing, and  
dissemination of data for the national demonstration  
program are discussed. Computer simulation of a solar  
energy system and graphical representation of solar  
collector performance are considered. Attention is  
given to solar driven heat pumps, solar cooling  
equipment, hybrid passive/active solar systems, and  
solar farm buildings. Evaluation of a thermographic  
scanning device for solar energy and conservation  
applications, use of meteorological data in system  
evaluation, and biomass conversion potential are  
presented.

78N25663# ISSUE 16 PAGE 2151 CATEGORY 44 RPT#:  
NTIS/PS-78/0295 78/03/00 187 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Waste heat utilization, volume 2. Citations from the  
engineering index data base TLSP: Progress Report,  
1975-1976

AUTH: A/HUNDEMANN, A. S.

CORP: National Technical Information Service, Springfield,  
Va. AVAIL: NTIS SAP: HC \$28.00/MF \$28.00

MAJS: /\*BIBLIOGRAPHIES/\*ENERGY POLICY/\*HEAT GENERATION/\*  
WASTE ENERGY UTILIZATION

WINS: / BOILERS/ BUILDINGS/ ELECTRIC POWER PLANTS/ ENERGY  
CONSERVATION/ INCINERATORS/ INDUSTRIAL PLANTS

ABS: For abstract, see .

79A40393# ISSUE 17 PAGE 3327 CATEGORY 85  
78/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Practice of heat utilization from refuse

AUTH: A/MARTIN, W. J.; B/WEIAND, H. PAA: B/(Josef Martin  
Co., Munich, West Germany)

In: Energy conservation through waste utilization;  
Proceedings of the Eighth Biennial National Waste  
Processing Conference, Chicago, Ill., May 7-10, 1978.  
(A79-40386 17-85) New York, American Society of  
Mechanical Engineers, 1978, p. 83-88; Discussion, p.  
89; Authors' Reply, p. 89, 90.

MAJS: /\*ENERGY CONSERVATION/\*INCINERATORS/\*PILOT PLANTS/\*  
THERMAL ENERGY/\*WASTE ENERGY UTILIZATION

WINS: / ELECTRIC POWER PLANTS/ ENERGY TECHNOLOGY/ FUEL  
CONSUMPTION/ HEATING EQUIPMENT/ SOLID WASTES/ WASTE  
DISPOSAL

ABA: C.K.D.

ABS: The characteristics of five European incinerator  
plants for recovery of heat from municipal refuse are  
presented, and operational experience for the past  
three years is summarized. The quantity of light fuel  
oil saved by each plant is reported. The plants  
considered include: an incinerator with hot water  
production for district heating in Rennes (France); a  
heat and power station in Vienna-Spittelau (Austria)  
which produces hot water for district heating and  
electricity for in-plant requirements; the KEZO  
incinerator at Hinwil (Switzerland), associated with a  
power plant with condensing turbo-alternators; a heat  
and power station at Paris/Issy-les-Moulineaux  
(France) with back-pressure, condensing turbines, and  
steam export for district heating; and a plant in  
Munich-North II (Germany) in which refuse and  
pulverized coal are used to produce electricity and  
hot water for district heating.

## ECONOMIC ASPECTS OF THE COMBINED GENERATION OF HEAT AND ELECTRICITY

G. Oplatka

Brown Boveri Review, vol. 65, 1978, p.48-54

*The combined generation of heat and electricity effectively  
satisfies the desire for rational use of primary energy. This  
article deals quantitatively with the saving of primary  
energy in the form of fuel which can be effected by com-  
bining the generation of heat and electricity, as against  
their separate generation. Observing a criterion of eco-  
nomy, the study determines the most favourable design  
stipulations for a supply system comprising a combined  
heating and power station, a pure electric power station  
and a pure heating station.*

79A50884 ISSUE 22 PAGE 418B CATEGORY 44  
78/00/00 19 PAGES UNCLASSIFIED DOCUMENT

UTTL: Environmental aspects of wood fuel  
AUTH: A/GARABEDIAN, H. T.; B/SANBORN, C. R. PAA:  
B/(Vermont Agency of Environmental Conservation,  
Montpelier, Vt.)  
In: Conference on Environmental Aspects of  
Non-Conventional Energy Resources - II, Denver, Colo.,  
September 26-29, 1978, Proceedings. (A79-50876 22-45)  
La Grange Park, Ill., American Nuclear Society, 1978,  
p. 19-3 to 19-21.  
WAJS: /\*ELECTRIC POWER PLANTS/\*ENERGY SOURCES/\*ENVIRONMENT  
EFFECTS/\*WOOD  
WINS: / BIOMASS ENERGY PRODUCTION/ ENERGY TECHNOLOGY/ FUEL  
COMBUSTION/ LAND MANAGEMENT/ UTILITIES/ VERMONT  
ADA: V.T.  
ABS: An analysis of whole tree harvesting for wood fuel and  
the conversion of existing electric generating  
stations to consume wood fuel is presented.  
Consideration is given to planning an experimental  
harvest, preharvesting inventory, wood operation,  
environmental impacts of the harvesting operation, and  
the economics of wood fuel. It is noted that whole  
tree removal resulted in 3 - 4.5 times the yield  
expected by traditional inventory methods. Wood fuel  
is low in heating value, high in moisture, and has  
undesirable handling characteristics; however, the  
contents of sulfur and nitrogen are low. Emission  
testing has determined that the particulate emission  
rate from a mix of 45% oil/55% coal increased  
threefold as compared with 80% wood/20% oil.

78N25662# ISSUE 16 PAGE 2151 CATEGORY 44 RPT#:  
NTIS/PS-78/0296 NTIS/PS-77/0284 NTIS/PS-76/0278  
78/03/00 160 PAGES UNCLASSIFIED DOCUMENT  
Supersedes NTIS/PS-77/0284; NTIS/PS-76/0278

UTTL: Waste heat utilization, volume 3. Citations from the  
engineering index data base TLSP: Progress Report,  
1977 - Mar. 1978  
AUTH: A/HUNDEMANN, A. S.  
CORP: National Technical Information Service, Springfield,  
Va. AVAIL.NTIS SAP: HC \$28.00/MF \$28.00  
ABA: GRA  
ABS: Worldwide research of waste heat from industrial  
process plants, electric power plants, buildings, and  
incineration of wastes is covered. Emphasis is on  
energy conservation in industrial plants. Studies of  
waste heat boilers and the use of waste heat for  
irrigation, sewage treatment, odor control,  
desalination, and heating are included.

78N29576# ISSUE 20 PAGE 2688 CATEGORY 44  
RPT#: NASA-IM-78953 DOE/NASA/1034-78/2 E-9702 CNT#:  
EC-77-A-31-103 W-7405-ENG-26 78/08/00 10 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Thermal energy storage for industrial waste heat  
recovery  
AUTH: A/HOFFMAN, H. W.; B/KEDL, R. J.; C/DUSCHA, R. A.  
PAA: A/(ORNL); B/(ORNL)  
CORP: National Aeronautics and Space Administration, Lewis  
Research Center, Cleveland, Ohio. AVAIL.NTIS SAP:  
HC A02/MF A01  
Presented at 13th Intersociety Energy Conversion  
Engineering Conf., San Diego, Calif., 20-25 Aug. 1978  
WAJS: /\*ENERGY POLICY/\*HEAT STORAGE/\*INDUSTRIAL WASTES/\*  
WASTE ENERGY UTILIZATION  
WINS: / ALUMINUM/ BOARDS (PAPER)/ CEMENTS/ ENERGY TECHNOLOGY  
/ FOOD/ IRON/ STEELS  
ABA: U.S.  
ABS: The potential is examined for waste heat recovery and  
reuse through thermal energy storage in five specific  
industrial categories: (1) primary aluminum, (2)  
cement, (3) food processing, (4) paper and pulp, and  
(5) iron and steel. Preliminary results from Phase 1  
feasibility studies suggest energy savings through  
fossil fuel displacement approaching 0.1 quad/yr in  
the 1985 period. Early implementation of recovery  
technologies with minimal development appears likely  
in the food processing and paper and pulp industries;  
development of the other three categories, though  
equally desirable, will probably require a greater  
investment in time and dollars.

79A20448 ISSUE 6 PAGE 1010 CATEGORY 37  
78/12/00 8 PAGES In GERMAN UNCLASSIFIED DOCUMENT

UTTL: Gas turbine with waste heat utilization - low  
investment costs and high fuel use efficiency  
AUTH: A/GARD, M.; B/SARONEN, J.  
Energiewirtschaftliche Tagesfragen, vol. 28, Dec.  
1978, p. 751-758. In German.  
ABA: G.R.  
ABS: Investments related to power generation for industrial  
projects require careful investigations to assure  
economical operation. In the case of a firm in  
Finland, electrical power and steam was needed in  
connection with the production of paper. It was found  
in a study of various possibilities for obtaining the  
required energy that a solution based on the use of a  
gas turbine and a waste-heat boiler with a  
supplementary heating system would provide an approach  
involving the lowest investment costs and an optimal  
fuel utilization. The new gas turbine-generator system  
is used in parallel operation with existing  
back-pressure steam-turbosets. Attention is given to  
electric power and steam requirements, details of  
installation design, the employment of air-filter  
systems, the anti-icing system, and operational  
details.

79N22638# ISSUE 13 PAGE 1741 CATEGORY 44 RPT#:  
AD-A064108 AD-E400264 ARLCD-CR-78029 CNT#:  
DAAA21-77-C-0021 78/12/00 104 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Recovery of waste heat from propellant forced-air dry house TLSP: Final Report, Nov 1976 - Apr. 1978  
AUTH: A/ALARIO, J.; B/BLAZA, E. F.; C/MULLANEY, P.  
CORP: Grumman Aerospace Corp., Bethpage, N.Y. AVAIL.NTIS  
SAP: HC A06/MF A01  
MAJS: /\*DRYING APPARATUS/\*ENERGY CONSERVATION/\*HEAT PIPES/\*  
HEAT TRANSFER/\*PROPELLANTS/\*WASTE ENERGY UTILIZATION  
MINS: / COST EFFECTIVENESS/ EXHAUST GASES/ INDUSTRIAL PLANTS  
/ WEAPONS INDUSTRY  
ABA: Author (GRA)  
ABS: This report describes the design, installation, and test evaluation of a heat pipe heat exchanger for a multi-base propellant forced-air dry house for the purpose of recovering heat from the hot air exhausted to the atmosphere during a typical drying operation. Detailed descriptions of the special safety and operating features of the recovery unit are also presented. Evaluation of the unit showed that approximately 62% of the energy used to dry multi-base propellants can be saved by the heat recovery technique employed. Energy/cost saving projections are based upon the installation of similar recovery units at a major Army propellant manufacturing facility such as Radford Army Ammunition Plant.

78N25661# ISSUE 16 PAGE 2151 CATEGORY 44 RPT#:  
NTIS/PS-78/0294 NTIS/PS-77/0283 NTIS/PS-76/0276  
NTIS/PS-75/215 COM-74-11138 COM-73-11582 78/03/00  
258 PAGES UNCLASSIFIED DOCUMENT  
Supersedes NTIS/PS-77/0283; NTIS/PS-76/0276;  
NTIS/PS-75/215; COM-74-11138; COM-73-11582

UTTL: Waste heat utilization. Citations from the NTIS data base TLSP: Progress Report, 1964 - Mar. 1978  
AUTH: A/HUNDEMANN, A. S.  
CORP: National Technical Information Service, Springfield, Va. AVAIL.NTIS SAP: HC \$28.00/MF \$28.00  
MAJS: /\*BIBLIOGRAPHIES/\*ENERGY POLICY/\*HEAT GENERATION/\*  
WASTE ENERGY UTILIZATION  
MINS: / ABSTRACTS/ BOILERS/ BUILDINGS/ IRRIGATION/ POWER  
PLANTS/ RESEARCH AND DEVELOPMENT/ SEWAGE TREATMENT/  
WASTE DISPOSAL  
ABA: GRA  
ABS: Federally-funded research on techniques of recovering waste heat from power plants, buildings, industrial processes, and waste disposal is covered. Studies of waste heat boilers and the use of waste heat for irrigation, sewage treatment, odor control, desalination, heating, and aquaculture are included.

79N30770# ISSUE 21 PAGE 2845 CATEGORY 44 RPT#:  
AD-A069650 USAFESA-TSD-2057 CNT#:  
78/08/00 43 PAGES UNCLASSIFIED DOCUMENT

UTTL: Performance and evaluation of concepts and devices for heat reclamation from air conditioners, heat pumps, and refrigeration equipment TLSP: Final Report  
AUTH: A/MOHAMMADI, S. S.; B/SLOAN, E. D. PAA: A/(Colorado School of Mines); B/(Colorado School of Mines)  
CORP: Johns-Manville Sales Corp., Denver, Colo. CSS: (Research and Development Center.) AVAIL.NTIS SAP:  
HC A02/MF A01  
MAJS: /\*AIR CONDITIONING/\*SYSTEMS ANALYSIS/\*WASTE ENERGY UTILIZATION  
MINS: / COST EFFECTIVENESS/ ENERGY CONSERVATION/ HEAT EXCHANGERS/ HEAT PUMPS  
ABA: GRA  
ABS: A heat recovery system is described which uses air conditioner or heat pump waste heat for domestic water heating. Current commercial units and field test data are detailed with economic guidelines to aid in choice of a unit. This report enables the reader to determine the cost effectiveness of having such a unit installed. Safety, product warranty, and city and state coding restrictions are discussed. The current and future testing and demonstration plans are cited for the unit.

**COGENERATION: A SYSTEMATIC ANALYSIS OF  
COMBINED STEAM AND POWER GENERATION**  
Herbert Fox, Rifat Tabi, Edward Nelson and  
Joseph E. Robbins  
J. of Energy  
vol. 2 no. 1 January-February 1978  
p. 24 -

**CAPTURING ENERGY FROM INDUSTRIAL WASTE HEAT.**  
Beno Sternlicht.  
Mech. Engineering, v.100, no.8, Aug.1978, p.30-41.

With the current emphasis on energy conservation, the spotlight focuses on the largest energy consumer—the industrial sector—and the possibilities for recovering all the available energy from industrial waste heat.

TT 163.2  
.A6  
v.3 Annual review of energy, v. 3 / Jack M. Hollander, editor ; Melvin K. Simmons, David O. Wood, associate editors. — Palo Alto, Calif. : Annual Reviews, 1979. 544 p.

Includes bibliographical references and index.

ISEN 0-P2A3-2303-3

1. Power resources—Addresses, essays, lectures. 2. Energy conservation—Addresses, essays, lectures. I. Hollander. Jack M. Simmons

INDUSTRIAL COGENERATION, Robert H. Williams

313

COMBINED GAS/STEAM TURBINE POWER PLANTS FOR THE COGENERATION OF HEAT AND ELECTRICITY, by R. Kehlhofer. Brown Boveri Review, vol. 65, October 1978, p.680-686.

*The high thermal efficiencies achieved in combined gas/steam turbine power stations are also advantageous for plants which supply not only electricity, but heat as well, in the form of steam or hot water. Owing to the special control requirements, special plant layouts are required, which differ those of ordinary combined-cycle plants. This article deals with a number of applications in industrial plants, sea-water desalination and district heating plants, the fuel burnt in which is mostly or entirely utilized for the gas turbine.*

Proceedings of 1978 Engineering Foundation Conference on Waste Heat Utilization  
Held August 13-18, 1978 New England College, Henniker, New Hampshire

U.S. Department of Energy report CONF-7808102, April 1979  
Sponsored by: The Engineering Foundation of the United Engineering Center

Available from NTIS

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1979

Greater Los Angeles Area Energy Symposium, Los Angeles, 1979.

Greater Los Angeles Area Energy Symposium : Tuesday, May 23, 1979 ... Los Angeles, California / sponsored by the Los Angeles Council of Engineers and Scientists under the auspices of the Los Angeles Section of the American Nuclear Society ... [et al.].

• Analysis of the Institutional Constraints for Implementing Cogeneration in Southern California — Ed Edelson, Jet Propulsion Laboratory

• Industrial Cogeneration in Southern California: A Survey of the Industry Perspective — M. L. Slonksi, H. S. Davis, V. C. Moretti, Jet Propulsion Laboratory

Western

(Los Angeles Scientists

continued on card 2)

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Institute of Electrical and Electronics Engineers, Region 5.

Energy '79...c1979.

(Card-2)

Cogeneration Pricing Issues

W. H. Comtois, Westinghouse Electric Corporation

Cogeneration can be an effective means of conserving energy. Through multiple uses of source heat to produce process steam and electric power, the amount of energy which these processes would otherwise reject to the environment is greatly reduced. Several means of combining the separate production functions are described as well as some of the operational problems which result from tying them together in one facility. Solutions to these problems are suggested which also indicate increases in cost to provide them.

Issues surrounding the pricing, actual cost allocation, of the cogeneration plant's products are discussed. Several methods are described for allocation of costs with a particular one chosen for detailed discussion. The necessity for simple, easy application and audit, as well as a fair and reasonable result, guided the selection. Some interesting aspects of cogeneration plant economics are then discussed. It is assumed throughout the paper that the utilization facilities are in reasonable proximity, for otherwise the cogeneration plant would have to be burdened with extra costs for product transportation. That cogeneration plants are in limited use today may reflect the fact that not all the assumptions made in the paper for equitable distribution of costs actually exist in practice, or that the savings from combined operation do not balance the costs of providing them.

ORIGINAL PAGE IS  
OF POOR QUALITY

TJ Energy Technology Conference, 5th, Washington,  
153 D.C., 1978.

.E4787 Energy technology V : challenges to  
1978 technology : proceedings of the fifth  
Energy Technology Conference, February 27-  
March 1, 1978, Washington, D.C. / edited by  
Richard F. Hill. -- Washington : Government

COGENERATION PRACTICES IN EUROPE p.919  
Heinz A. Gorges, Vineta, Inc.

THE KEY TO COGENERATION DEVELOPMENT: A COOPERATIVE  
INDUSTRY-GOVERNMENT EFFORT p.933  
Peter G. Bos, Resource Planning Associates, Inc.

RC-699 ONE UTILITY'S EXPERIENCE WITH CO-GENERATION p.945  
C. F. Mlinar, Vice President, Marketing, Southwestern Public Service Co.

USE OF CONVENTIONAL TECHNOLOGY AND POTENTIAL FOR EMERGING  
TECHNOLOGIES IN COGENERATION p.948  
John W. Neal, Acting Assistant Director, Heat Engines & Heat Recovery, Division of  
Power Systems, Department of Energy

COGENERATION: IS IT DUE FOR A REVIVAL?

Vincent Cavaseno

Chemical Engineering, Vol. 85, No. 17, July  
31, 1978, p. 44 & 46.

**Production of steam and electricity from the same facility  
had been losing favor in the U.S. But now it is seen  
as a road to saving energy.**

HEAT RECOVERY FROM LOW PRESSURE STEAM BOILER FLUE  
GASES.

H. Kunstadt.

Building Systems Design, v.75, no.8, Dec.77/Jan.78,  
p.49-58.

**The heat in the boiler flue gases in an apartment house  
complex is available for preheating feedwater, combustion air,  
heavy fueloil and domestic hot water, providing substantial  
savings for the owner.**

A79-40406 # The economics of energy recovery from in-  
dustrial waste incineration. W. K. Lombard (Trecan, Ltd., Missis-  
sauga, Ontario, Canada). In: Energy conservation through waste  
utilization; Proceedings of the Eighth Biennial National Waste  
Processing Conference, Chicago, Ill., May 7-10, 1978. (A79-  
40386 17-85) New York, American Society of Mechanical Engineers,  
1978, p. 263-274; Discussion, p. 275, 276; Author's Reply, p. 276.

The types of solid, liquid and gaseous wastes typical of  
industrial plants are discussed, and the incineration and heat recovery  
systems appropriate to their processing are described. An approach  
to evaluation of the economic feasibility of installing an energy  
recovery system utilizing given quantities and types of industrial  
waste is presented. The proposed approach is based on a "justification  
factor", defined as the cost of equipment and installation divided by  
the difference between savings factors (cost of equivalent purchased  
fuel and waste removal costs) and cost factors (incinerator fuel,  
maintenance labor and ash removal costs for solid wastes). Projected  
1980 justification factors and 1977 justification factors for several  
different combinations of hours of use and tons per day of solid or  
liquid waste are presented.

C.K.D.

77N78707\* CATEGORY 45 77/05/00 18 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Integrated steam systems for electric power generation  
from waste heat

AUTH: A/DAVIS, J. P.; B/DUNILAY, J. B.

CORP: Thermo Electron Corp., Waltham, Mass. AVAIL NTIS  
In NASA, Washington Proc. of Conf. on Waste Heat  
Management and Util., Vol. 3 15 p (SEE N77-78611  
13-45)

MAJS: /\*ELECTRIC POWER PLANTS/\*HEAT/\*WASTE ENERGY  
UTILIZATION

MINS: / BOILERS/ INCINERATORS/ INDUSTRIAL WASTES

78N79674 CATEGORY 44 RPT#: ERDA-TR-167 IR-2  
77/01/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Basic study on the possibility of waste heat utilization in the home TLSP: Interim Report, 1 Jul. - 31 Dec. 1975

CORP: Energy Research and Development Administration, Oak Ridge, Tenn. AVAIL.NTIS

Transl. into ENGLISH of "Grundsatzliche untersuchung ueber die Moeglichkeiten der abwaermenutzung im haushalt" Munich, 18 Mar. 1976

MAJS: /\*ENERGY CONSUMPTION/\*RESIDENTIAL AREAS/\*WASTE ENERGY UTILIZATION

MINS: / ENERGY CONSERVATION, GRAPHS (CHARTS)/ WASHERS (CLEANERS)

77A48829 ISSUE 23 PAGE 3989 CATEGORY 44  
77/00/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: 600 kW Organic Rankine Cycle Waste Heat Power Conversion System

AUTH: A/CHEFK, R. M.; B/LACEY, P. D. PAA: B/(Sundstrand Corp., Rockford, Ill.)

In: Intersociety Energy Conversion Engineering Conference, 12th, Washington, D.C., August 28-September 2, 1977, Proceedings, Volume 2, (A77-48701 23-44) La Grange Park, Ill., American

Nuclear Society, Inc., 1977, p. 1095-1099.

MAJS: /\*HEAT SOURCES/\*INDUSTRIAL WASTES/\*RANKINE CYCLE/\*WASTE ENERGY UTILIZATION/\*WORKING FLUIDS

MINS: / CONDENSERS (LIQUIFIERS)/ DIESEL ENGINES/ ENERGY TECHNOLOGY/ GAS TURBINE ENGINES/ ORGANIC MATERIALS/ SYSTEMS ENGINEERING/ TOLUENE/ VAPORIZERS

ABA: J.M.B.

ABS: The 600 kW Organic Rankine Cycle Waste Heat Power Conversion System, which can be adapted to heat sources such as diesel engine exhaust, gas turbine exhaust, or industrial process waste heat streams, is described. Design criteria for the waste heat recovery system, including selection of power rating, waste heat temperature range and working fluid, are reviewed; development programs involving 425 or 315 C source temperatures and toluene as the working fluid are discussed. Components of the system, such as the boost pump, feed pump, regenerator, vaporizer, turbine and condenser are also considered. The prototype system developed has the advantages of being adaptable to use with a large reciprocating engine as the heat source, and of accommodating several inches of pressure drop without upsetting the operation of the heat source.

78N27554# ISSUE 18 PAGE 2412 CATEGORY 44 RPT#: DRD-5003-1 CNT#: EY-76-S-05-5003 77/06/00 67 PAGES UNCLASSIFIED DOCUMENT

UTTL: Subsurface waste-heat storage: Experimental study TLSP: Final Report, 15 Nov. 1975 - 30 Jun. 1977

AUTH: A/WARMAN, J. C.; B/MOLZ, F. J.; C/JONES, T. E.

CORP: Auburn Univ., Ala. CSS: (Inst. of Water Resources Research.) AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /\*ELECTRIC POWER PLANTS/\*HEAT STORAGE/\*SOLAR HEATING/\*WASTE ENERGY UTILIZATION

MINS: / AQUIFERS/ ENERGY STORAGE/ SYSTEMS ANALYSIS/ SYSTEMS ENGINEERING

ABA: ERA

ABS: Electrical power plant and solar heating systems were proposed wherein confined aquifers are used as storage reservoirs for moderate to high temperature water. The Water Resources Research Institute of Auburn University performed an aquifer storage experiment involving warm water (94 F; 36 C). Phase I consisted of the drilling of an exploratory well at the field site near Mobile, Alabama. Phase II involved construction of the central injection well, three observation wells, and performance of preliminary pumping tests. Phase III was devoted to construction of the remainder of the observation well field, performance of final pumping tests, and measurement of aquifer thermal properties; while Phase IV was devoted to a cycle of warm water injection, storage, and recovery. It was concluded that heat storage aquifers must have low natural pore velocities, and much care must be taken not to clog the injection well with solids.

78N14651# ISSUE 5 PAGE 648 CATEGORY 44 RPT#: BNL-22559 CONF-770516-2 77/00/00 27 PAGES UNCLASSIFIED DOCUMENT

UTTL: Prospects for the utilization of waste heat in large scale district heating systems

AUTH: A/KARKHECK, J.; B/POWELL, J.

CORP: Brookhaven National Lab., Upton, N. Y. CSS: (Dept. of Applied Science.) AVAIL.NTIS SAP: HC A03/MF A01

Presented at Conf. on Waste Heat Management and Util., Miami Beach, Fla., 9 May 1977

ABA: ERA

ABS: Analyses of model district heating systems for nine U.S. urban areas, including projected heat costs, are presented. In addition, projections of nationwide levels if implementation of district heating systems are discussed. Results show that about half of the current population could be served through district heating at heat cost levels equal to the effective heat cost of imported oil.

77A48B2B ISSUE 23 PAGE 3989 CATEGORY 44  
77/00/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Development status - Binary Rankine cycle waste heat recovery system  
AUTH: A/RHINEHART, H. L.; B/KETLER, C. P.; C/ROSE, R. K.  
PAA: A/(ERDA, Div. of Conservation, Washington, D.C.);  
B/(Department of Public Utilities and Public Works,  
Rockville Centre, N.Y.); C/(Mechanical Technology,  
Inc., Latham, N.Y.)  
In: Intersociety Energy Conversion Engineering  
Conference, 12th, Washington, D.C., August  
28-September 2, 1977, Proceedings, Volume 2  
(A77-48701 23-44) La Grange Park, Ill., American  
Nuclear Society, Inc., 1977, p. 1099-1094.  
MAJS: /DIESEL ENGINES/ELECTRIC POWER PLANTS/RANKINE CYCLE  
/THERMODYNAMIC EFFICIENCY/WASTE ENERGY UTILIZATION  
MINS: / ENERGY TECHNOLOGY/ FREON/ PRESSURE EFFECTS/ STEAM/  
SYSTEMS ENGINEERING/ WORKING FLUIDS  
ABA: (Author)  
ABS: This paper presents the status of a program under  
development by MTL for USERDA and concerns development  
and demonstration of a binary-Rankine cycle waste-heat  
recovery system for a Diesel generating set. The  
demonstration site is located at an existing municipal  
power plant in the Village of Rockville Centre, New  
York. The system employs two safe and well accepted  
power fluids, steam and Freon, and recovers 500 kw  
from the exhaust of a turbocharged Diesel engine. The

78A32116 ISSUE 12 PAGE 2197 CATEGORY 44  
77/00/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Technologies for the utilization of waste energy  
AUTH: A/KIANG, Y.-H. PAA: A/(Trane Thermal Co.,  
Conshohocken, Pa.)  
In: Environmental technology '77: Proceedings of the  
Twenty-third Annual Technical Meeting, Los Angeles,  
Calif., April 25-27, 1977. (A78-32101 12-31) Mount  
Prospect, Ill., Institute of Environmental Sciences,  
1977, p. 161-167.  
MAJS: /ENERGY CONSERVATION/ INDUSTRIAL ENERGY/ TECHNOLOGY  
ASSESSMENT/ WASTE ENERGY UTILIZATION  
MINS: / CRYOGENIC EQUIPMENT/ ENERGY TECHNOLOGY/ HEAT  
EXCHANGERS/ STEAM  
ABA: M.L.  
ABS: Available and proven technologies for the utilization  
of waste energy are reviewed with attention to the use  
of waste energy for reducing waste disposal expenses  
and for generating heat for process plant purposes.  
Four systems are discussed: gas to gas heat exchanger,  
steam generation, condensing type heat exchanger, and  
cryogenic heat transfer equipment. The equipment can  
also be used to recover heat from flue gases. The  
problem of timing, that is, of having waste heat  
available when it is required, is considered.

78A11095 ISSUE 1 PAGE 60 CATEGORY 44 77/00/00  
8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Utilization of waste heat from electric power  
generation  
AUTH: A/BARCLAY, D. A.; B/GADDY, J. L. PAA:  
B/(Missouri-Rolla, University, Rolla, Mo.)  
In: Energy crisis: An evaluation of our resource  
potential: Proceedings of the Third Annual UMR-MEC  
Conference on Energy, Rolla, Mo., October 12-14, 1976.  
(A78-11089 01-44) North Hollywood, Calif., Western  
Periodicals Co., 1977, p. 104-111.  
MAJS: /ELECTRIC POWER PLANTS/HEATING EQUIPMENT/WASTE  
ENERGY UTILIZATION  
MINS: / AIR CONDITIONING/ BUILDINGS/ ECONOMIC ANALYSIS/  
ENERGY TECHNOLOGY  
ABA: M.L.  
ABS: It is suggested that waste heat from the generation of  
electricity could supply all of the U.S. space heating  
needs so that the U.S. would become energy  
independent. Energy rejected in cooling water in 1975  
is estimated to represent 13% of the total U.S. energy  
consumption, while total conversion losses amounted to  
20%. Various uses of low level heat and of high level  
heat are considered. Necessary conditions for a  
practical waste heat system are stated, and an  
economic analysis is presented which suggests that  
district heating could be economical at present energy  
prices. The system considered would complement a 1000  
MW fossil-fueled generating system.

TA Institute of Environmental Sciences,  
1 Environmental technology '77: proceedings,  
.I39913 — Mt. Prospect, Ill. : The Institute, c1977.  
1977 xviii, 437 p.  
23rd annual technical meeting held in Los  
Angeles, Calif. April 25-27, 1977.  
ISBN 0-915414-17-1  
1. Environmental testing. 2.  
Environmental engineering--Societies, etc.  
I Title.

TECHNOLOGIES FOR THE UTILIZATION OF WASTE ENERGY  
By Yen-Hsiung Kiang . . . . .

R0168

TA Institute of Environmental Sciences.  
1 Environmental technology '77: proceedings.  
.I39913 -- Mt. Prospect, Ill. : The Institute, c1977.  
1977 xviii, 437 p.  
23rd annual technical meeting held in Los  
Angeles, Calif. April 25-27, 1977.  
ISBN 0-015414-17-1  
1. Environmental testing. 2.  
Environmental engineering--Societies, etc.  
T 74+1a

LOW GRADE HEAT UTILIZATION BY AN ORGANIC BOTTOMING CYCLE  
By Nyle F. Parchim and Dr. K. C. Tsao . . . . .

Ag 168

TA Canadian Congress of Applied Mechanics,  
350 6th, University of British Columbia, 1977.  
.C3 CNACAM 77 ; proceedings = Comptes rendus  
1977 / V. J. Modi, editor. -- [s.l. : s.n.,  
Vol. 2 1977?]  
2 v. (xli, 1051 p.) : ill. ; 28 cm.  
Held May 30 to June 3, 1977.  
Includes bibliographical references.  
1. Mechanics, Applied--Congresses. I.  
Modi, V. J. II. Title.

Heating and CO2 Enrichment of Greenhouses with Exhaust Gases  
G. Green, M. Haukness, E. Maginnes, E. Brooks . . . 839

NUCLEAR WASTE DISPOSAL: POLITICS CLOUD PROSPECTS.  
Peter R. Savage.

Chemical Engineering, Vol. 84, No. 13, June 20, 1977  
p. 72-76

ORIGINAL PAGE IS  
OF POOR QUALITY

N78-25661# National Technical Information Service, Springfield,  
Va.

WASTE HEAT UTILIZATION. CITATIONS FROM THE NTIS  
DATA BASE Progress Report, 1964 - Mar. 1978

Audrey S. Hundemann Mar. 1978 258 p Supersedes  
NTIS/PS-77/0283; NTIS/PS-76/0276; NTIS/PS-75/215;  
COM-74-11138; COM-73-11582  
(NTIS/PS-78/0294; NTIS/PS-77/0283; NTIS/PS-76/0276;  
NTIS/PS-75/215. COM-74-11138. COM-73-11582)  
Copyright Avail: NTIS HC \$28.00/MF \$28.00 CSCL 10A

Federally-funded research on techniques of recovering waste  
heat from power plants, buildings, industrial processes, and waste  
disposal is covered. Studies of waste heat boilers and the use  
of waste heat for irrigation, sewage treatment, odor control,  
desalination, heating, and aquaculture are included. GRA

N78-25662# National Technical Information Service, Springfield,  
Va.

WASTE HEAT UTILIZATION, VOLUME 3. CITATIONS FROM  
THE ENGINEERING INDEX DATA BASE Progress Report,  
1977 - Mar. 1978

Audrey S. Hundemann Mar. 1978 160 p Supersedes  
NTIS/PS-77/0284; NTIS/PS-76/0278  
(NTIS/PS-78/0296; NTIS/PS-77/0284; NTIS/PS-76-0278)  
Copyright Avail: NTIS HC \$28.00/MF \$28.00 CSCL 10A

Worldwide research of waste heat from industrial process  
plants, electric power plants, buildings, and incineration of wastes  
is covered. Emphasis is on energy conservation in industrial plants.  
Studies of waste heat boilers and the use of waste heat for  
irrigation, sewage treatment, odor control, desalination, and  
heating are included. GRA

N78-25663# National Technical Information Service, Springfield,  
Va.

WASTE HEAT UTILIZATION, VOLUME 2. CITATIONS FROM  
THE ENGINEERING INDEX DATA BASE Progress Report,  
1975-1976

Audrey S. Hundemann Mar. 1978 187 p  
(NTIS/PS-78/0295) Copyright Avail: NTIS  
HC \$28.00/MF \$28.00 CSCL 10A

HEAT RECOVERY FROM WASTEWATERS FOR HOUSEHOLD SPACE HEATING

Eric V. Pemberton, Ph.D., Wilfrid Laurier University,  
Journal of Environmental Science and Health  
Vol. A12, no. 8, 1977,  
p. 389-392.

This article considers the heat energy lost from the average household which is carried into the sewers by the wastewater. A survey of average daily household water use is presented, with average daily hot water consumption, and the likely heat energy recoverable is then considered. A brief summary of relevant measurements made in my own home is given, and the paper concludes with a summary of the feasibility and means of recovering heat from this source for residential space heating.

British engineering units are employed throughout, and source material has not been referenced as the concept is at the preliminary stage only, and detailed references do not seem necessary.

ENERGY CONSERVATION THROUGH HEAT RECOVERY WATER HEATING

R.S. Mason, Jr. and H.S. Bierenbaum  
ASHRAE Journal  
Vol. 19, no. 8, August 1977,  
p. 36-40

*Heat recovered from air conditioning and heat pumps used for water heating is analyzed as an energy conservation action. Economics appear favorable and, if widespread use of this technique were adopted in southern states, primary and secondary annual energy sales could be reduced by  $235 \times 10^6$ . Capital requirements for such a savings would be about  $680 \times 10^6$  and produce paybacks of two to six years.*

77N78644\* CATEGORY 45 RPI#: NASA-TM-X-74100-VOL-2  
76/05/00 861 PAGES UNCLASSIFIED DOCUMENT

UTTL: Proceedings of the Conference on Waste Heat Management and Utilization, volume 2

AUTH: A/LEF, S. S.

CORP: National Aeronautics and Space Administration,  
Washington, D. C. AVAIL NTIS  
Conf. held at Miami Beach Fla., 9-11 May 1976

MAJS: / \*CONFERENCES/ \*RESOURCES MANAGEMENT/ \*WASTE ENERGY UTILIZATION

MINS: / AGRICULTURE/ COOLING SYSTEMS/ ELECTRIC POWER PLANTS/ FISHERIES/ THERMAL POLLUTION/ WASTE DISPOSAL/ WATER QUALITY

77N12568# ISSUE 3 PAGE 360 CATEGORY 45 RPT#:  
PB-254401/3 EPRI-FP-165 76/06/00 56 PAGES  
UNCLASSIFIED DOCUMENT

UTTL: Selected aspects of waste heat management

AUTH: A/SEPPER, A.

CORP: Equitable Environmental Health, Inc., Woodbury, N. Y.  
AVAIL NTIS SAP: HC 204/MF A01  
Sponsored by Electric Power Research Inst.

MAJS: / \*HEAT TRANSFER/ \*INDUSTRIAL WASTES/ \*WASTE ENERGY UTILIZATION/ \*WATER TREATMENT

MINS: / COOLING/ ELECTRIC POWER PLANTS/ ION EXCHANGING/ MATHEMATICAL MODELS/ MONITORS/ RESEARCH AND DEVELOPMENT/ TEMPERATURE CONTROL/ THERMAL POLLUTION

ABA: GFA

ABS: The study reviews the state-of-the-art in: (1) treatment of evaporative cooling systems and offstream cooling system effluents; (2) additional treatment required to utilize wastewater from sewage treatment plants as makeup for cooling systems and boilers; (3) mathematical modeling for power plants cooling systems and discharges; (4) current and recent field monitoring programs; (5) present research to reduce the capital cost and penalties associated with dry

cooling towers; and (6) areas where future research is needed.

TJ

266

.C64

RR-FM

The Cost of inefficiency in fluid machinery : (papers and discussions of a symposium) presented at the Winter Annual Meeting of the American Society of Mechanical Engineers, New York, New York, November 17-21, 1974 / sponsored by the Fluid Machinery Committee of the Fluids Engineering Division, ASME ; edited by David Japikse. — New York : ASME, c1975.

vii, 74 p. : ill. ; 26 cm.

Includes bibliographical references.

DISTRICT HEATING AND TOTAL ENERGY

District Heating/Cogeneration Application Studies for the Minneapolis-St. Paul Area. by J.C. Yeoman

Oak Ridge National Laboratory Report ORNL/TM-6830/P6, October 1979

A Net Energy Analysis of a Cogeneration-District Heating System and Two Conventional Alternatives

NEW TYPES OF HOT WATER DISTRIBUTION SYSTEMS FOR LOW-DENSITY HEAT AREAS, by Peter Margen.  
Energy Engineering, vol. 76, no. 1, Dec. 1978/Jan. 1979  
p 23

This paper starts by outlining the evolution of district heating systems in Sweden, examining the economic background and describing technology currently in use, particularly for the smaller pipe distribution networks. It then proceeds to outline new technology and the experimental or demonstration work to back it up. To complete the picture of district heating development issues, a brief account is given of development in progress on larger pipes, such as those required for bulk heat transport from future nuclear heat-electric stations to cities which can utilize such large heat quantities.

District Heating and Cooling Systems for Communities Through Power Plant Retrofit and Distribution  
Final Report

by J.R. Watt & G.A. Sommerfield  
Dept. of Energy Report COO-4979-1

Volume 1: Executive Summary

Volume 2: Tasks 1-3

Toledo Edison Company, Toledo, Ohio

August 1979

Volume 3: Tasks 4-6

Volume 4: Tasks 7-9

COMBINED GAS/STEAM TURBINE POWER STATION FOR DISTRICT HEATING IN UTRECHT, by H.R. Gubser.  
Brown Boveri Review, vol. 65, October 1978, p. 687-690.

*At the beginning of 1977 Brown Boveri received an order for the construction in Utrecht (Netherlands) of a combined gas/steam turbine district heating power station with a total heating capacity of 111 500 kW.*

*This article explains the constraints and technical data which governed the design and describes the solution chosen.*

District heating/Cogeneration Application Studies for the Minneapolis-St. Paul Area. by P. Margen, L.-A. Cronholm, K. Larsson, J.-E. Marklund

Oak Ridge National Laboratory Report ORNL/TM-6830/P3  
October 1979

A study was undertaken to determine the feasibility of introducing a large-scale, hot water, district heating system for the Minneapolis-St. Paul area. The analysis was based on modern European hot water district heating concepts in which cogeneration power plants supply the base-load thermal energy. Heat would be supplied from converted turbines of existing coal-fired power plants in Minneapolis and St. Paul. Toward the end of the 20-year development period, one or two new cogeneration units would be required. Thus, the district heating system could use low-grade heat from either coal-fired or nuclear cogeneration power stations to replace the space heating fuels currently used - natural gas and distillate oil.

The following conclusions can be drawn: the concept is technically feasible, it has great value for fuel conservation, and with appropriate financing the system is economically viable.

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1979

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Southeastern Region 3 Conference, Atlanta, Ga., 1979.

A creative exchange of ideas: proceedings of Southeastern '78 Region 3 Conference, Atlanta, Ga., April 10, 11, 12, 1979, Sheraton - Atlanta. - New York: Institute of Electrical and Electronics Engineers, 1979.

4. Cogenerating District Heating Systems

534

J. S. Tiller  
Engineering Experiment Station,  
Georgia Institute of Technology  
Atlanta, GA

A79-16465 # Prospects for ambient energy and cogeneration utilization in urban and regional planning. A. Bowen (Miami University, Coral Gables, Fla.). In: International Symposium Workshop on Solar Energy, Cairo, Egypt, June 16-22, 1978, Symposium Lectures. (A79-16451 04-44) Coral Gables, Fla., University of Miami, 1978, p. 305-350. 71 refs.

The paper develops strategies and a methodology for the utilization of available fossil and non-fossil energy sources in relation to urban and regional planning needs. Consideration is given to such factors as bioclimatic comfort, urban modification of regional climate, energy responsive shelter and settlement, regional implications of ambient energy utilization, access to ambient energies, and ambient energy utilization techniques for buildings and sites. Regional energy utilization patterns are reviewed and attention is given to the projected utilization of responsive energy hybrid systems. Many illustrative figures are included. R.J.

N79-31829# Argonne National Lab., Ill  
FEASIBILITY OF DISTRICT HEATING OF NORTHERN US CITIES BY COGENERATION

D. J. Santini, A. A. Davis, and S. M. Marder 1978 19 p refs  
Presented at 1st Conf. on Energy and Community Development, Athens, Greece, 10 Jul 1978  
(ANL/EES-CP-18; Conf 780744-1) Avail NTIS  
HC A02/MF A01

A study is summarized that examines the engineering and economic feasibility of providing district heating to six major northern U.S. central cities by utilizing cogenerated electrical and thermal energy from retrofit of existing power plants. The four major components of the analysis are discussed, namely: (1) demand estimation, (2) supply analysis, (3) transmission/distribution design, and (4) approximation of operations. A cost comparison to three coal-based heating alternatives is made. In addition to costs, energy savings are illustrated for the district-heating technology. Results indicate that cogeneration-based district heating is a technology worthy of continued evaluating by the U.S. DOE

COGENERATION POWER PLANTS SERVE DISTRICT HEATING SYSTEMS.

I. Olikar  
Mechanical Engineering, Vol. 100, No. 7,  
July 1978, p. 24-29.

Cogeneration plants providing economical power and district heating are already popular in Europe. Now they are arousing high interest in the U.S. Here's a look at typical systems and how their operational problems are being overcome.

ENERGY CASCADING IN LARGE DISTRICT HEATING SYSTEMS,  
by Franz Wolfgang Mayer

Nuclear Technology, vol. 40, no. 3, October 1978,  
p. 234-239

**N79 3735#** Stadtwerke Saarbruecken (West Germany).  
**OPERATION OF A COMBINED DISTRICT HEATING AND  
POWER PRODUCTION SCHEME WITH A COMBINED  
CYCLE GAS TURBINE**  
Johannes Flad. In: Von Karman Inst for Fluid Dyn. Combined  
Cycles for Power Generation, Vol. 1 1978 41 p (For primary  
document see N79 28732 19 44)  
Avail. NTIS HC A14/MF A01

Steam and gas combined cycles used for district heating in  
the city of Saarbruecken is described. Performance data with project  
and operation particulars are discussed. The total efficiency is  
dependent on the operating mode, being 44 percent in the zero  
extraction unfired mode, 80.4 percent with 46 t/hr district  
heating extraction for a total steam production of 47 t/hr with  
no gas. With a steam production of 85 t/hr with firing, the efficiency  
is 54.3 percent with 25 t/hr extraction and 73.9 percent with  
60 t/hr extraction. Author (ESA)

TJ Energy Technology Conference, 5th, Washington,  
153 D.C., 1978.  
.E4787 Energy technology V : challenges to  
1978 technology : proceedings of the fifth  
Energy Technology Conference, February 27-  
March 1, 1978, Washington, D.C. / edited by  
Richard F. Hill. -- Washington : Government  
Institutes, 1978.  
xiii, 1063 p. : ill.

**DUAL ENERGY FOR COMBINED POWER AND DISTRICT HEATING** p. 854  
Lars Elmenius, Johan Kull, Industrial Turbines Projects Department, STALSAVAL



STEAM TURBINES FOR DISTRICT HEATING IN NUCLEAR  
POWER PLANTS<sup>1</sup>.

H. Muhlhauser, Baden  
Brown Boveri Review 3, Vol. 65, March 1978,  
p. 193-202.

*The increased emphasis attached to the economic utilization  
of energy is now a worldwide topic. By incorporating  
various types of power plant in district heating schemes  
a major contribution can be made to the efficient utilization  
of energy.*

*This article discusses several possible ways of extracting  
heat from nuclear power plant cycles for use in district  
heating schemes. Various methods of incorporating heating  
turbines in saturated steam cycles are outlined. On the basis  
of a plant with an electrical output of 1000 MW, possible  
turbines for different heat extraction rates are shown.  
The article concludes with a brief discussion on district  
heating turbines for use in conjunction with high-temper-  
ature reactor plants.*

THE USE OF NUCLEAR ENERGY FOR DISTRICT HEAT-  
ING

Peter Margen  
Progress in Nuclear Energy  
Vol. 2 no. 1 1978  
p. 1-28

Abstract—So far only one reactor—the Ågesta reactor, south of Stockholm has been used to supply a  
district heating scheme. For 10 years this pilot scheme delivered 10 MW of electricity to the grid and  
50 later 70 MW of heat to the suburb 'Farsta' of Stockholm, with a very good reliability record. As y  
had no successors anywhere in the world. Ågesta was of course too small to give good economics, bu  
valuable experience. As the citizens of Farsta had become accustomed to the smokeless nuclear he:  
were many protests from the public when Ågesta was shut down to allow the nuclear effort in Swed  
concentrated on bigger units.

Since the oil crisis, nuclear district heating schemes have, however, been studied with increasing of  
number of countries as one of the possible ways of achieving lower heat costs, conserving the limited  
natural gas resources, and reducing air pollution. In this article the author describes the basis for asses  
performance and economics of such schemes. To do this it has been necessary to treat not merely the  
plants but also the entire system of transport distribution and storage of heat. Many of the numerical e  
in this area have been taken from the Swedish scene with which the author is best acquainted but ab  
comments on conditions in other countries are included.

Also the institutional obstacles which often stand in the way of a wider use—and the manner in wh  
are starting to be tackled by several countries—are discussed. The subject is treated in a manner wh  
hoped will be useful also to those without previous experience of district heating.

Brown Boveri Review, v.64, Sept.1977.

- A. Schwarzenbach:*  
Economical Design of District-Heating  
Power Plants 546
- H. Mühlhäuser:*  
Steam Turbines in Conventional Combined  
District Heating and Power Stations 552
- U. Bopp:*  
Turbotrol® 4—An Electronic Turbine Controller  
for Steam Turbines in District Heating Plants 566
- A. Schwarzenbach and H.-U. Fruttschi:*  
Gas Turbines for District Heating Power Plants 572
- N. Gassner:*  
The Electrical Equipment  
of the Basle District Heating Power Station 578

**A79-34142** An evaluation of the potential for district heating in the United States. C. L. McDonald (Battelle Pacific Northwest Laboratories, Richland, Wash.). In: Alternative energy sources; Proceedings of the Miami International Conference, Miami Beach, Fla., December 5-7, 1977. Volume 9. (A79 34131 13-44) Washington, D.C., Hemisphere Publishing Corp., 1978, p. 4107-4130. 15 refs.

Results from recent studies evaluating costs of district heating from geothermal resources and power plant waste heat are compared with results from other feasibility studies. Estimates of costs from these studies are comparable and indicate that district heating is competitive with other forms of heating. International experience in district heating is briefly surveyed, illustrating the variety of systems in use and proving the technical feasibility of district heating with hot water. The sensitivity of costs to major design parameters is examined to show the effects of possible improved system design and technical changes on reducing costs. Institutional barriers, which seem to be the major obstacles to building district heating systems, are discussed. Some special commitment to district heating is required to overcome the institutional barriers which are preventing the realization of the energy savings possible with district heating.

(Author)

Physics in Technology, v.8, no.4, July 1977.

### 163 Combining district heating and power generation G HAMMOND

Significant savings in fuel could be made if electrical power plants were used to supply heat direct to our homes, but the capital expenditure would be high. Here we look at some of the physical factors that determine the economics of combining heating and electricity generation

**N77-19664j** Massachusetts Inst. of Tech., Cambridge Dept. of Nuclear Engineering

#### **ECONOMIC AND TECHNICAL ASPECTS OF GAS TURBINE POWER STATIONS IN TOTAL ENERGY APPLICATIONS** Final Report

Joseph Kelley and M. W. Golay 30 Jan. 1976 124 p refs (Contract DAAK02-74-C-0308; DA Proj 4A7-62719-AT-41) (AD-A031236; USAFESA-RT-2013) Avail: NTIS HC A06/MF A01 CSCL 10/2

This report summarizes a study of gas turbine power plant options which will be available in 1985 for use in total energy system applications. The gas turbines examined are of the aircraft derivative and industrial types. If coal were used as the fuel combustion chamber modification for use of low-BTU gasified coal in the power plant would be required. Such power plants could be controlled by means of the standard fuel control method, although turbine bypass control would also be possible. For total energy applications it would be necessary to replace the steam boiler of the steam bottoming cycle which is currently used in such applications with a high temperature water heat exchanger; however, such a design change would not be difficult to implement. Aircraft derivative turbines are more expensive but easier to maintain, transport, and repair, and are amenable to design of a more reliable power station than industrial turbines. On that basis, the former turbine type is judged to be preferable for military installation total energy applications. Author (GRA)

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Agriculture, biomass, wind, new developments  
: joint conference, American Section,  
International Solar Energy Society and  
Solar Energy Society of Canada, inc.,  
August 15-20, 1976, Winnipeg / editor, K.  
W. Boer. — Cape Canaveral, Fla. : American  
Section of the International Solar Energy  
Society, c1976.

x, 391 p. : ill. ; 28 cm. -- (Sharing  
the sun ; v. 7)

"Contains sections 8.1, 8.2, 9.11."

NITINOL ENGINE DEVELOPMENT

360

MODULAR INTEGRATED UTILITY SYSTEMS

Georgetown University Generic Integrated Community Energy System GU-ICES Demonstration Project. Modified Work Management Plan. Final Report.

Dept. of Energy Report COO-hh88-2, April 1979  
Contract no. EC-77-C-02-hh88

Phase I. Integrated Community Energy Plan for Riverside, California. Volume 2. Final Report.

Dept. of Energy Report DOE/TIC-10117(Vol. 2)  
January 1979

This document defines the effort performed in replanning the Work Management Plan for the Georgetown University ICES Program in general and in Phase III Stage I Feasibility Analysis Study in substantial detail.

Integrated Community Energy Systems Engineering Analysis and Design Bibliography. by J.M. Calm & G.R. Sapienza

Dept. of Energy Document ANL/CNSV-2, May 1979

This bibliography cites 368 documents which may be helpful in the planning, analysis, and design of Integrated Community Energy Systems (ICES). It has been prepared for use primarily by engineers and others involved in the development and implementation of ICES concepts. These documents include products of a number of Government research, development, demonstration, and commercialization programs; selected studies and references from the literature of various technical societies and institutions; and other selected material.

**N79 26777#** Argonne National Lab. III. Energy and Environmental Systems Div

**COST STUDY APPLICATION OF THE GUIDEBOOK ON INTEGRATED COMMUNITY ENERGY SYSTEMS: INDIRECT ECONOMIC AND ENERGY IMPACTS**

Nov 1978 31 p

(Contract W 31-109 eng 38)

(ANL/ICES TM-17) Avail NTIS HC A03/MF A01

An integrated community energy system (ICES) was considered for a community located in a small New England city. The ICES involves substitution of energy forms as well as modification of fuel requirements. Examination of the integrated system, in comparison with existing energy systems, includes both indirect economic impacts (employment and fiscal effects on the city) and indirect energy impacts. The indirect economic analysis proceeds from an initial description of conditions that determine employment and fiscal results through specific estimates of employment and then revenues and costs to municipal government and finally to an evaluation of ICES's worth to the city. The indirect energy analysis compares energy resource requirements of the ICES with those for gas, oil, and electric systems now serving the community. DOE

**N79-30813#** Department of Energy, Washington, D. C. Office of Conservation and Solar Applications

**COMMUNITY SYSTEMS PROGRAM**

Feb. 1979 55 p refs

(DOE/CS-0072) Avail: NTIS HC A04/MF A01

The Community Systems program of DOE through research, development, and demonstration will help communities develop and put into practice effective energy conservation programs. To do this, the program develops and demonstrates approaches to community energy conservation that: combine use of the energy resources available within a community, reducing reliance on external and scarce fuels; increase the use of fuel-efficient energy systems in supplying utility services; substitute energy systems that use nonscarce fuels for those that consume oil and natural gas; and reduce the end-use demand for energy through planning and development practices. A community is described here as any complex of buildings and open spaces used by large numbers of people and connected by networks for moving the people as well as messages, goods, and services. Before energy conservation in communities can have a national impact, comprehensive energy management must become an integral part of community processes. The Community Systems program is organized into three components--systems engineering products, planning and development products, and implementing mechanisms products. The activities within each program element are presented followed by a discussion of current site-specific prototype application projects (grid-connected systems, coal-using systems, district heating and cooling, heat pump systems, power plant retrofit, site design applications, subsystems development case studies, general development planning applications, and comprehensive community energy management pilot projects). Program management, organizational responsibilities, and budget are summarized. The current program activities and significant milestones are described. A list of publications resulting from Community Systems programs efforts is presented. DOE

**N79-28778#** Development Sciences, Inc. East Sandwich, Mass.  
**GUIDEBOOK ON INTEGRATED COMMUNITY ENERGY SYSTEMS: INDIRECT ECONOMIC AND ENERGY IM-  
PACTS**

Nov. 1978 79 p refs

(Contract W-31-109-eng-38)

(ANL/ICES TM-16) Avail: NTIS HC A05/MF A01

Descriptions of how indirect impacts of energy systems can be estimated are presented so that various members of the community can understand them and participate in the energy-related decisions. DOE

**N79-24520#** Geiringer (Paul L.) and Associates, Roslyn, N. Y.  
**COMMUNITY APPLICATION OF INTEGRATED ENERGY/  
UTILITY SYSTEMS**

Oct. 1978 34 p refs. Sponsored in part by NBS and DOE  
(Contract DHEW-100-77-0014)

(PB-290675/8) Avail: NTIS HC A03/MF A01 CSCL 13A

Sufficient information is provided for prospective Integrated Energy Utility System (IEUS) participants to determine the feasibility of an IEUS project that would fit their specific needs. Past studies made at the University of Florida and Central Michigan are summarized and the Burlington, Vermont study is examined in detail for lessons learned and recommendations on how to design and implement a successful IEUS project. GRA

## Integrated Community Energy System

### ON THE GRID CONNECTION OF AN INTEGRATED COMMUNITY ENERGY SYSTEM

Robert E. Holtz  
Energy Conversion

Vol. 17 no. 1

1977

p. 41-44

**N78-21644#** National Consumer Research Inst., Washington, D. C.

**PROCEEDINGS OF THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION CONFERENCE ON COGENERATION AND INTEGRATED ENERGY/UTILITY SYSTEMS**

1977 209 p refs. Proc. held at Washington, D. C., 3 Jun.

1977 Prepared for Argonne National Lab.

(Contracts W-31-109-eng-38)

(CONF-770632) Avail: NTIS HC A10/MF A01

Cogeneration or integrated energy/utility systems have established their place in contributing energy supply in major cities throughout the United States. Cogeneration has been primarily associated with industrial processes, while integrated energy systems have been primarily associated with residential and commercial applications or with district heating of large metropolitan areas. The conference was conceived to bring the two ideas together as much as technically and economically possible. An attempt was made to broaden the scope and integrate the two concepts establishing a very workable basis for the utilization of both in the performance of providing utility services to industrial applications and population centers. The resurgence of cogeneration evolves through the efforts to maximize the use of resources in the United States today. This forum, brought together some of the most prominent individuals associated with the concepts of cogeneration, community energy systems, and integrated utility systems. Author (ERA)

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**Intersociety Energy Conversion Engineering  
Conference, 12th, Washington, 1977.**

Proceedings of the 12th Intersociety  
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Sc W. Kirmse, *University of Florida*, Gainesville,  
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Manyimo, *Reynolds, Smith & Hills*, Jacksonville,  
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NUCLEAR - GENERAL AND FISSION (NONBREEDER)

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"Prepared under the direction of the  
American Nuclear Society for the Division  
of Technical Information, United  
States Atomic Energy Commission."  
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2 v. in various pagings : ill. ; 28 cm.  
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1. Atomic power-plants--Design and  
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Pedersen, Erik Storm.  
Nuclear power, v.1 : nuclear power plant  
design / Erik S. Pedersen. -- Ann Arbor,  
Mich. : Ann Arbor Science Publishers,  
c1978.  
xv, 558 p. : ill.  
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ISBN 0-250-40230-0  
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2. Nuclear engineering--Collected works.  
I. Title: Nuclear power plant  
design.

IEEE Transactions on Nuclear Science,  
v.NS-27, no.1

Feb.  
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NUCLEAR SCIENCE SYMPOSIUM - 1979. SYMPOSIUM ON  
NUCLEAR POWER SYSTEMS - 1979. (Held in San  
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IEEE, DOE, and NASA).

N80-13630# Argonne National Lab. III  
WORLD ENERGY DATA SYSTEM (WENDS). VOLUME 8:  
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Jun. 1979 234 p refs  
(Contract W-31-109-eng-38)  
(ANL-PMS-79-2-Vol-8) Avail NTIS HC A11/MF A01  
Pertinent facts regarding nuclear facilities are summarized.  
The entire fuel cycle from resource recovery through waste  
management is covered. The profiles are ordered by country  
name and then by facility code  
DOE

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N80-13629# Argonne National Lab. III  
WORLD ENERGY DATA SYSTEM (WENDS). VOLUME 7:  
NUCLEAR FACILITY PROFILES. AG-CH  
Jun. 1979 254 p  
(Contract W-31-109-eng-38)  
(ANL-PMS-79-2-Vol-7) Avail NTIS HC A12/MF A01  
Capsule summaries of pertinent facts regarding nuclear  
facilities are presented. The facilities described include the entire  
fuel cycle from resource recovery to waste management. Power  
plants and all U.S. facilities are excluded.  
DOE

TK Pedersen, Erik Storm.  
1078 Nuclear power, v.2 : nuclear power project management / Erik S. Pedersen. --  
.P377 Ann Arbor, Mich. : Ann Arbor Science Publishers, c1978.  
v.2 xii, 397 p. : ill.  
Includes bibliographical references and index.  
ISBN 0-250-40231-9  
1. Atomic power-plants--Collected works.  
2. Nuclear engineering--Collected works. I. Title: Nuclear power project management.

Inservice inspection of light water moderated reactor systems. C.E. Lautzenheiser.

Atomic Energy Review. v. 16, no. 3, September 1978, p. 355-425.

ABSTRACT. The principal reason for inservice inspection of nuclear power stations is to increase the reliability and safety of the nuclear system. Over the past 20 years inspection methods and code and standard requirements have become increasingly formal, extensive and sophisticated. The review discusses the history and philosophy of inservice inspection; inspection equipment, requirements and techniques; and defect analysis. Associated factors such as radiation, personnel and costs are covered, together with the present state-of-the-art of mechanized equipment, inservice inspection of pressurized and boiling water systems, and research in progress on new techniques. A resume of international inservice inspection requirements is provided.

N80 15564# California Univ. Livermore Lawrence Livermore Lab

**NOVEL SCHEME FOR MAKING CHEAP ELECTRICITY WITH NUCLEAR ENERGY**

J A Pettibone 24 Aug 1979 23 p refs  
(Contract W-7405 eng 48)

(UCID 18153-Rev 1) Avail NTIS HC A02/MF A01

Nuclear fuels should produce cheaper electricity than coal, considering their high specific energy and low cost. To exploit these properties, the scheme proposed here replaces the expensive reactor/steam turbine system with an engine in which the expansion of a gas heated by a nuclear explosion raises a mass of liquid, thereby producing stored hydraulic energy. This energy could be converted to electricity by hydroelectric generation with water as the working fluid or by magnetohydrodynamic (MHD) generation with molten metal. A rough cost analysis suggests the hydroelectric system could reduce the present cost of electricity by two thirds, and the MHD system by even more. Such cheap power would make feasible large scale electrolysis to produce hydrogen and other fuels and chemical raw materials. DOE

**NUCLEAR POWER**

Harry J. Otway, Dagmar Maurer and Kerry Thomas  
Futures, v.10, no.2, April 1978, p. 109-118

Here the authors describe an attitude model, and present the results of its application to the question of public attitudes to nuclear power—including the discovery of the relatively minor role that technical and environmental questions play in determining those attitudes.

Public Utilities Fortnightly, v.101, no.3, Feb.2,1978,

**Nuclear Power's Effects on**

**Electric Rate Making** .....Don S. Smith and

A. Angela Lancaster 16

Addresses cost and rate-making questions which arise or gain increased importance with the use by electric utilities of nuclear reactors as a source of power generation.

TJ 5 .A55 1978	American Power Conference, 40th, Illinois Institute of Technology, 1978. Proceedings of the American Power Conference, volume 40 : papers and addresses presented at the 40th Anniversary Meeting of the American Power Conference held in Chicago on April 24-26, 1978; / [sponsored by] Illinois Institute of Technology. -- Chicago : Illinois Institute of Technology, c1978.	
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EPRI Journal, v. 3, no. 6,  
p. 7-15.

July/Aug  
1978

THE BIRTH & EARLY HISTORY OF NUCLEAR POWER.  
John E. Kerton.

NUCLEAR POWER. John E. Kerton.

A decade of work on nonmilitary uses preceded the first token generation of electricity by a reactor in the Idaho desert in 1951. The technology has since come a long way.

HD  
9698  
.U52  
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1979

Economic and environmental  
impacts of a U. S. nuclear  
moratorium, 1985-2010  
Oak Ridge Associated Universities.  
Institute for Energy Analysis.  
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moratorium, 1985-2010 / authors,  
Charles E. Whittle ... [et al.],  
[members of the] Institute for  
Energy Analysis, Oak Ridge  
Associated Universities. -  
Cambridge, MA : MIT Press, 1979.

Major stakes hang on how the issue of nuclear energy is ultimately resolved. As this study points out, "the outcome is consequential in terms of this generation, but also will affect the lives and life styles of generations to come. The wrong decisions could be costly and difficult to reverse. Clearly, Americans are now facing one of the most profound choices in their history."

Specialists in energy analysis, policy-makers, and readers who are seriously involved in the nuclear energy debate will find this book provides an objective and analytical discussion of an emotionally charged subject. It focuses on the question, "What would happen to the economy and environment of the United States if there was a moratorium on construction of new nuclear plants beginning in 1985?"

Based on a projection of economic growth and energy production during the next thirty years, the book examines five possible economic implications of a nuclear moratorium—future costs of electricity, regional dislocations, impact on the nuclear industry, effect on the coal industry, and impact abroad. It also discusses four levels of environmental tradeoffs as a result of shifting the additional fuel requirements from nuclear to coal after 1985—proliferation of nuclear weapons and greatly increased carbon dioxide (CO<sub>2</sub>) from fossil fuel on a global scale, probability of reactor and coal-mining accidents, impact on public health of reactor radiation emissions and coal-fired emissions, and the impact of uranium and coal mining on land use.

An entire section of the book speculates on the distant nonfossil future when nuclear or solar energy may be the only major long-term energy options. One of the book's major findings is that the rate of growth in energy demand is likely to be significantly lower than the projected estimates in most published studies.

BT  
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1979

Greater Los Angeles Area Energy Symposium, Los Angeles, 1979.

Greater Los Angeles Area Energy Symposium : Tuesday, May 23, 1979 ... Los Angeles, California / sponsored by the Los Angeles Council of Engineers and Scientists under the auspices of the Los Angeles Section of the American Nuclear Society ... [et al.]. — North Hollywood, Calif. : Western Periodicals Co., c1979.

- Comparison of Nuclear and Coal Power Plant Capacity Factors — Dr. Peter Gottlieb, Dames & Moore P116
- Standardization of Nuclear Power Plants — T. C. Gillett, C.F. Braun & Co. P126

#### 14219 NUCLEAR PLANT CONSTRUCTION — OVERVIEW

9761

KEY WORDS: Construction; Control; Costs; Nuclear power plants; Planning; Regulation; Standardization; Time

ABSTRACT: The paper provides a general overview of the nuclear power plant construction process with literature references to a more detailed treatment. The paper deals specifically with: (1)The planning process; (2)regulation and licensing (3)design and standardization; (4)project control; (5)organizational alternatives; and (6)time and costs for construction.

REFERENCE: "Nuclear Power Plant Construction — Overview," *Journal of the Construction Division*, ASCE, Vol. 104, No. CO4, Proc. Paper 14219, December, 1978, pp. 463-478

NUCLEAR POWER: A BALANCED APPROACH, by Corwin L. Rickard and Richard C. Dahlberg  
*Science*, vol. 202, no. 4368, November 1978, p. 581-584

Summary. A proposed technological approach to meeting recognized nuclear power needs is a symbiotic combination of breeders and advanced converter reactors. Breeders, situated in secured areas, would be fueled with and self-sufficient in plutonium. The excess fuel produced in the breeder would be uranium-233, sufficient in quantity to supply several advanced converters located near load centers. This approach is suggested as a balanced way to meet important criteria applicable to the continued development of nuclear power.

THE NUCLEAR QUESTION: TWO ANSWERS, by Sarah Miller. Chemtech, vol. 8, no. 12, December 1978, p.740-742.

Europe and the U.S. view energy from differing resource bases. Miller shows how this difference generates divergent responses.

NUCLEAR DILEMMA, THE ATOM'S FIZZLE IN AN ENERGY-SHORT WORLD.

Business Week, no. 2566, December 25, 1978, p.54-60.

One by one, the lights are going out for the U.S. nuclear power industry. Reactor orders have plummeted from a high of 41 in 1973 to zero this year. Nuclear power stations are taking longer to build, and the delays are tacking hundreds of millions of dollars onto their costs. Waste disposal, which was supposed to be solved by now, is not. The export market is already glutted and shrinking fast. And the cumulative effect of these and other troubles has been a severe erosion of both public and political support for nuclear power.

ENERGY TRADEOFFS BETWEEN NORTHEAST FISHERY PRODUCTION AND COASTAL POWER REACTORS,

by Stephen Rochereau and David Pimentel

Energy, vol. 3, no. 5, October 1978, p. 575-589

Abstract—An investigation of the energy trade-offs between Northeast fishery production and coastal power reactors included an analysis of the fishery as an energy producer and the potential impact of once through cooling nuclear power plants on fishery energy output. The Northeast fishery system is highly efficient in food protein production (an input of 4 kcal per kcal of fish protein produced). For every ton of fish protein lost, an added  $1.4 \times 10^4$  ton oil equivalent per year would be required to replace the fish protein with livestock protein. Assuming perfect substitutability between forms of energy, the impact of a river/salt water sited reactor represents 2% of its annual energy output (measured by fish yield loss and "excess energy investment" loss in equipment). Employing sound environmental and energy conservation management in both fishery activities and nuclear power plant siting, combined with judicious water cooling technology, it would appear that the fishery and power reactors can be relatively compatible.

OUTLINE FOR AN ACCEPTABLE NUCLEAR FUTURE, by Alvin M. Weinberg

Energy, vol. 3, no. 5, October 1978, p. 599-606

Abstract—Nuclear energy is likely to develop in two phases. Phase I, based on burner reactors, is self-limiting because the reserve of uranium is limited. Phase II, based on breeders, might last for an extremely long time. It is suggested that opposition to Phase I of nuclear energy might be reduced if an acceptable Phase II can be constructed. Elements of an acceptable Phase II might include isolated and collocated energy centers with resident IAEA inspectors; heavier security; professionalization of the nuclear cadre; immortality of the operating entities; and separation of generation and distribution. Though these measures are aimed primarily at increasing the safety and reliability of the nuclear system, it is suggested that the proposed siting plan with IAEA resident inspection, might be more proliferation-resistant than is the current dispersed system.

FORUM: THE NUCLEAR POWER PROGRAM - A BRITISH VIEWPOINT.

S. E. Hunt

Environmental Management, Vol. 2, No. 3, May 1978, p. 195 - 203

There is, of course, no unanimous British viewpoint regarding future nuclear power policy on the development of the fast breeder reactor. Many see President Carter's condemnation of the latter as a genuine and welcome initiative to minimize the possibility of a future nuclear war. Indeed, this cautious approach to the plutonium economy obtained advanced support in the findings of our own "Flowers Report" in 1976 (Royal Commission on Environmental Pollution).

Others see the non-breeder philosophy as yet another instance of the U.S.A.'s profligate waste of natural resources or as an attempt to obtain at least partial control of the energy supplies of other countries. This, coupled with a global shortage of energy, could increase rather than diminish the threat of nuclear war.

N80-14509# Oak Ridge National Lab., Tenn.

OUTLOOK FOR NUCLEAR FISSION ENERGY

T. D. Anderson 1978 14 p refs Presented at 2d Ann Intern. Conf. on Energy, Washington, D.C.

(Contract W-7405-eng-26)

(CONF-7811126-1) Avail: NTIS HC A02/MF A01

The status of nuclear power as an energy source is discussed. The development of light water breeder reactors for electric power generation is examined. Present nuclear energy research and development are reported. The electric utility industry's commitment to nuclear power and the effects of the energy crisis on the nuclear power industry are examined.

A.W.H.

KEY WORDS: Construction; Construction management; Costs; Evaluation; Management; Nuclear electric power generation; Performance; Planning; Powerplants; Scheduling

ABSTRACT: Because of the current importance of adequate energy supply to the United States economy, the construction of nuclear generating stations is of high national priority. Historical performance on Nuclear projects indicates a trend toward both longer construction schedules and increased capital costs. The challenge to more effectively manage nuclear construction is therefore emphasized. During early 1976, the writer conducted a survey to identify the critical tasks necessary for managing nuclear projects, to define the current practices utilized, and to suggest improved techniques. The research used a three-category management model: planning; direction of operations; and review and evaluation. Findings and conclusions in each of these categories are examined. Recommendations and practical applications for both individual nuclear projects and the industry segment devoted to this activity are also presented.

REFERENCE: "Managing Nuclear Construction-An Experience Survey." *Journal of the Construction Division, ASCE*, Vol. 104, No. CO4, Proc. Paper 14233, December, 1978, pp. 487-501

THE IMPACT OF THE PRESIDENCY ON TECHNOLOGY:  
THE CASE OF NUCLEAR ENERGY.

W. Henry Lambright

Mechanical Engineering, Vol. 100, No. 6,  
June 1979, p. 20-25.

*The changing priorities and attitudes of the Presidents—from Franklin D. Roosevelt to Jimmy Carter—have profoundly influenced the development of the atom, both in the military sector and in industrial applications. In this article—based on the 1977 Roy V. Wright Lecture—the crucial decisions of the recent past are analyzed and interpreted with an eye for what lies ahead.*

NUCLEAR POWER PLANT QUALITY ASSURANCE -  
PALLIATIVE OR PANACEA?

W. D. Poling

Mechanical Engineering, Vol. 100, No. 7,  
July 1979, p. 30-37.

Nuclear plants should be flawless in design, construction, and performance. QA systems help achieve this. Sometimes, though, they are blamed for skyrocketing costs and construction delays.

*of the Atomic Scientists*  
The Bulletin, vol. 34, no. 3, March 1978, p.21-26 and  
54-57

**Nuclear Power: A Perspective of the Risks,  
Benefits and Options**

Brian Flowers

A pioneer in the British nuclear industry presents his view  
of the nuclear debate

WHERE DOES THE PRESIDENT STANDS ON NUCLEAR  
ENERGY

Juan Cameron

Fortune

Vol. 97 no. 6

p. 99-106

March 27, 1978,

Sometimes it seems that President Carter himself understands the need to push the nuclear option. But often it seems that he doesn't. At any rate, he has failed to develop a consistent policy for fostering the growth of nuclear energy. In the absence of such a policy, guerrilla warfare goes on in his Administration between friends and foes of nuclear energy—and the outlook for a large increase in the use of nuclear power in the U.S. keeps getting bleaker.

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Nuclear power / James J. Duderstadt.  
New York : M. Dekker, 1979.  
ix, 388 p. : ill. ; 24 cm. (Energy,  
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Includes index. Bibliography: p.  
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33268 Guidebook to nuclear reactors. Nero, A.V. Jr. Berkeley, CA; University of California Press (1979) 302p. The Publisher, 2223 Fulton Street, Berkeley, CA 94720 \$9.95

The volume presents a description of the important reactor types and fuel cycles and explains how the choice of nuclear systems relates to the broader contemporary issues, such as safety, pollution, resources, and proliferation. The book provides a general introduction to power reactions, identifying basic design features, characterizing the various fuel cycles, describing power plant emissions, and discussing accident potential. The book includes an analysis of four commercial or near-commercial reactor types: PWR, BWR, PHWR, and HTGR type reactors. Advanced reactor systems are briefly discussed.

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v. 11 / edited by Ernest J. Henley, Jeffrey  
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Plenum Press, c1979.

On-Line Computers in Nuclear Power Plants -  
A Review P.135-232  
M. W. Jervis

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D. O. Pickman, J. H. Gittus,  
and K. M. Rose

Practical Usage of Plutonium in Power P.331-398  
Reactor Systems

K. H. Puechl P.469-560  
Nuclear Energy Centers  
M. J. McNelly

How to Stabilize and Rationalize the Nuclear  
Licensing Process. Michael R. Kursch.

Public Utilities-Fortnightly. v. 103, no. 11,  
May 24, 1979. p.28-32.

*Effective improvement of the nuclear licensing process will require some legislative initiatives looking to significant administrative and procedural changes, says the author of this article, who during service at the federal Department of Energy was directly involved in the development of the "Nuclear Siting and Licensing Act of 1978." Further, and even more importantly, in his view, real improvement can take place only if there is a clear and authoritative declaration of national nuclear policy.*

ENERGY FOR THE LONG RUN: FISSION OR FUSION?, by  
G.I. Kulcinski, C. Kessler, J. Holdren, W. Hafele.  
American Scientist, vol. 67, no. 1, Jan./Feb. 1979,  
p.78-89.

*Factors such as hazards, technological costs, and development time are the significant points of comparison for the two most likely long-term energy sources*

14287 NUCLEAR POWER PLANT CONSTRUCTION DELAY

09913

KEY WORDS: Computer applications; Construction; Construction management; Coordination; Delay time; Management methods; Nuclear power plants

ABSTRACT: Fifteen separate interviews were conducted with 49 design and construction staff personnel representing five organizations. The results indicated that the most important items in the design-construction cycle of a nuclear power plant are overall coordination, equipment availability, design-construct lead-time, and handling of design changes. Coordination encompasses activities necessary to handle all the other high impact delay cases. Use of computerized systems facilitates storing, handling, and sorting of the data for the many different tasks of the coordinating teams. The southeastern utilities have taken major steps in development and implementation of management information systems and innovative project control systems. The Tennessee Valley Authority and Duke Power Company have made impressive progress in objective identification and system implementation. Other companies have requested their design-construct contractors to develop and use computer-based systems for scheduling, procurement, and startup testing.

REFERENCE: Rad, Parviz F., "Delays in Construction of Nuclear Power Plants," *Journal of the Energy Division, ASCE*, Vol. 105, No. EY1, Proc. Paper 14287, January, 1979, pp. 33-46

Nuclear Power-Option for th World

Transactions of the EMC'79 Conference of the European  
Nuclear Society held May 6-11, 1979, Hamburg, Germany

Volume 31 of the American Nuclear Society

American Scientist, v. 67, no. 1  
p. 78-89

Jan.-Feb.  
1979

**ENERGY FOR THE LONG RUN: FISSION OR FUSION?**  
G.L. Kulcinski, G. Kessler, J. Holdren, and  
W. Hafele. (Factors such as hazards, technological  
costs, and development time are the significant  
points of comparison for the two most likely  
long-term energy sources).

**NUCLEAR ENERGY FOR THE UNITED STATES**  
W. Kenneth Davis

Energy, vol. 4, no. 6, Dec. 1979, pp. 1053-1062.

**Abstract**—The historical trend toward increasing electrification is expected to continue, requiring substantial increases in U.S. electric power generating capacity. Nuclear power and coal are expected to be the only alternatives capable of making a major contribution to meeting this demand for the next several decades. This paper examines what nuclear could do to assure the United States of adequate supplies of energy at reasonable prices through the turn of the century and beyond. The approach used was to determine how rapidly nuclear generating capacity could be expanded if a national commitment was made to solve the licensing, regulatory and political problems which are currently discouraging utilities from making further nuclear commitments. It was concluded that a total of 550 GWe of nuclear capacity could be in operation by the year 2000. Achieving this desirable goal would require a strong commitment by government and industry to work together to replace the current adversary relationship with one of mutual cooperation.

**Nuclear Power: On the Razor's Edge.** The Honorable  
Morris K. Udall.

**Public Utilities-Fortnightly.** v. 103, no. 11,  
May 24, 1979, p. 13-15.

*A prominent Congressman, who concedes that he has sometimes entertained serious doubts about the viability of the nuclear energy industry, writes in this article about the future that he foresees for nuclear energy as a source of electricity for U. S. consumers. He sees it as a kind of "bridge" between an era characterized by fast depletion of fossil fuels and a future era when reliance may be placed on renewable energy technologies. But for the next twenty-five years, he says in sober and dispassionate tones, "nuclear" must be given a chance to prove that it is a safe, dependable, and affordable source of commercial energy.*

**FISSION POWER: AN EVOLUTIONARY STRATEGY**, by Harold  
A. Feiveson, Frank von Hippel, and Robert H.  
Williams.

Science, vol. 203, no. 4378, January 1979, p. 330-337.

**Summary.** Motivated by concerns about the difficulty of safeguarding the large flows of plutonium in a breeder reactor fuel cycle, we explore the resource and economic implications of a strategy in which there is no nuclear weapons-usable material in fresh reactor fuel. The strategy involves the deployment of already developed types of advanced converter reactors which, unlike the breeder, can be operated effectively on proliferation-resistant once-through fuel cycles. Advanced converter reactors could be much more uranium-efficient on once-through fuel cycles than current systems and therefore could compete economically with breeders up to very high uranium prices. If necessary, the uranium requirements of an advanced converter reactor system could be reduced much further with the recycling of isotopically denatured uranium, but any commitment to a closed fuel cycle would be unnecessary for many decades.

**Microelectronics and Reliability**,  
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M. F. HASHMI - Reliability of Large Equipment and Systems of Nuclear Power Plants  
S. BASU & R. ZEMDEGS - Method of Reliability Analysis of Control Systems  
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Anthony V. Nero, Jr. Berkeley :**  
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William S. Farmer, U.S. Nuclear Regulatory Commission. *K21*

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ANALYSIS FOR COMPLEX SYSTEMS. C. L. Cate, D. P. Wagner and J. B. Fussell, University of Tennessee *P25*

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Nuclear power in Asia  
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TIME TO PLAN FOR THE NEXT GENERATION OF NUCLEAR  
TECHNOLOGY  
Joseph S. Nye  
The Bulletin of the Atomic Scientists  
Vol. 33, no. 8, October 1977,  
p. 39-41.

38 Time to Plan for the Next Generation  
of Nuclear Technology  
Joseph S. Nye  
The Carter administration's case for proliferation

NUCLEAR POWER AND PUBLIC POLICY  
Sir Brian Flowers  
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Vol. 7, no. 8, August 1977,  
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Physics in Technology, v.8, no.4, July 1977.

### 152 Nuclear power generation

Sir JOHN HILL

The problems of nuclear power are, in practice, very different from those commonly portrayed. Here the Chairman of the UKAEA and British Nuclear Fuels answers the critics of nuclear power on the vital issues of safety, proliferation and theft

Energy, v.2, 1977, p.465-71.

### THE POTENTIAL CONTRIBUTION OF NUCLEAR ENERGY TO U.S. ENERGY REQUIREMENTS†

C. F. ZIMMERMANN

Department of Agricultural Economics

and

R. O. POHL

Department of Physics, Cornell University, Ithaca, NY 14853, U.S.A.

(Received 15 March 1977)

**Abstract**—The relative contribution of nuclear energy to the cumulative total primary energy use in the United States in the period 1975 to 2000 has been estimated for several growth scenarios. If the nuclear capacity grows as recently forecast by ERDA, and if the total primary power use grows by 2%/yr. as recently recommended by the FEA, nuclear energy will contribute 10.8% to our cumulative primary energy use.

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Some current engineering topics  
by M. Amano

IN NUCLEAR P. 755  
POWER PLANT COMPONENTS.

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International Conference on Cybernetics and Society, Washington, D.C., 1977.

Stochastic Models of Nuclear Power Plant Size Distribution, D. Sahal, Portland State University, Portland, Oregon. 250

International data on size of 119 nuclear power plants are analyzed. Arguments are advanced as to why their size distribution is expected to be considerably skewed. The resulting stochastic models are consistent with the fact that there are essentially no reactor physics limitations on the neutron density than can be accepted in a multiplying assembly. The results of the study suggest that the observed plant size distribution is determined by the three parameter version of the law of proportionate effect. The implications of the results for planning the growth of nuclear power are discussed.

### COMPARING COAL AND NUCLEAR GENERATING COSTS

Charles L. Rudasill

EPRI Journal

Vol. 2, no. 8, October 1977,

p. 14-17.

What is the truth about comparative generating costs of coal and nuclear fuel? A new EPRI study, adjusted for regional differences, provides a good yardstick.

### STATISTICAL UTILITY THEORY FOR COMPARISON OF NUCLEAR VERSUS FOSSIL POWER PLANT ALTERNATIVES. S. Garribba and A. Ovi

A statistical formulation of utility theory is developed for decision problems concerned with the choice among alternative strategies in electric energy production.

Nuclear Technology, Vol. 34, no. 1, June 1977  
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Offshore and underground power plants.  
 Robert Noyes, Ed.  
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Energy, v.2, 1977, p.211-39.

### STATUS OF HELIUM-COOLED NUCLEAR POWER SYSTEMS

GILBERT MELÈSE-d'HOSPITAL and MASSOUD SIMNAD  
General Atomic Company, San Diego, CA 92138, U.S.A.

(Received 7 October 1976)

**Abstract**—Helium cooled nuclear power systems offer a great potential for electricity generation when their long-term economic, environmental, conservation and energy self-sufficiency features are examined. The high-temperature gas-cooled reactor (HTGR) has the unique capability of providing high-temperature steam for electric power and process heat uses and/or high-temperature heat for endothermic chemical reactions. A variation of the standard steam cycle HTGR is one in which the helium coolant flows directly from the core to one or more closed cycle gas turbines. The effective use of nuclear fuel resources for electric power and nuclear process heat will be greatly enhanced by the gas-cooled fast breeder reactor (GCFR) currently being developed. A GCFR using thorium in the radial blanket could generate sufficient U-233 to supply the fuel for three HTGRs, or enough plutonium from a depleted uranium blanket to fuel a breeder economy expanding at about 10% per year. The feasibility of utilizing helium to cool a fusion reactor has been included in most research studies on thermonuclear fusion and is also discussed in this paper. This paper summarizes the status of helium-cooled nuclear energy systems as a basis for assessing their prospects.

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### REASONS U.S. MAY NOT BE NO. 1 IN NUCLEAR ENERGY MUCH LONGER

Report from EUROPEAN CAPITALS

U.S. News & World Report, July 11, 1977,  
vol. LXXXIII, no. 2, p. 52-55

As Americans delay, Europe is plunging ahead in atomic power. Associate editor Jack McWethy tells what he saw on visits to major sites.

NUCLEAR ENERGY FOR THE THIRD WORLD.  
K. Gottstein.  
Bull. Atomic Scientists, v.33, no.6, June 1977,  
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There is no way of withdrawing from the atomic age; if the atom is to serve the cause of peace, not war, all nations must relinquish a measure of their sovereignty

DOE TO SPEED REACTOR LICENSING  
Power, v. 121, no. 9, September 1977  
p. 53-55.

NRC criticized for stretch of lead-time. Carter's plan fosters thorium breeder while emphasizing the current light-water-reactor designs

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NUCLEAR ISSUES: WEIGHING THE PROS AND CONS

Dr. G.A. Pon  
Ashrae Journal  
Vol. 19, no. 8, August 1977,  
p. 25-28.

*The development of nuclear energy has become an area of dispute which is commanding significant attention in the media and in the area of public debate. It is important, therefore, that we lay out the issues and grasp a perspective before they become so obscured by emotion and rhetoric that rational dialogue becomes difficult.*

*As the Plenary Session speaker at ASHRAE's 1977 Annual Meeting in Halifax, NS, Dr. G. A. Pon addressed the more important issues surrounding the use of nuclear power.*

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POWER SYSTEMS

Session Chairman: H. B. Hamilton, University of Pittsburgh

DEVELOPMENT OF A MATHEMATICAL SIMULATION OF THE HIGH CORE  
AUXILIARY COOLING SYSTEM. W. D. Leach, A. J. Spurgin and R. D. Person,  
Illinois Power Company

COMPARISON OF PRESSURIZED WATER REACTOR SYSTEM MODEL WITH  
TEST RESULTS AND EVALUATION OF NONLINEAR EFFECTS. K. F. Cooper,  
Westinghouse Nuclear Energy Systems and J. T. Cam, Westinghouse Nuclear  
Energy Systems and University of Pittsburgh

RELIABILITY RISK METHODOLOGIES IN NUCLEAR POWER SYSTEMS

Session Organizer: Adel A. El-Bassioni, Carnegie-Mellon University  
Session Chairman: Frank Baloh, Westinghouse Electric Corporation

DEVELOPMENT OF APPROACHES FOR ACCEPTABLE LEVELS OF RISK. W. D.  
Rowe, U.S. Environmental Protection Agency

RELIABILITY AND SAFETY METHODOLOGY FOR AN ANALYSIS OF THE CLINCH  
RIVER BREEDER REACTOR PLANT. J. B. Fussell, C. L. Gate and D. P. Wagner,  
University of Tennessee

TIGER IN THE FAULT TREE JUNGLE. P. Rubel, Oak Ridge National Laboratory

RELIABILITY ANALYSIS, ITS VALUE TO THE NUCLEAR INDUSTRY. Otto Draper,  
General Electric Corporation

SHUTDOWN SYSTEM RELIABILITY DUTY CYCLE. Adel A. El-Bassioni, Carnegie-  
Mellon University, Frank Baloh and W. H. Horton II, Westinghouse Electric  
Company

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NUCLEAR - RESOURCES & AVAILABILITY

THE MAIN CAUSES OF FUEL ELEMENT FAILURE IN WATER-COOLED POWER REACTORS. F. Garzarolli, R. Von Jan, H. Stehle.

Atomic Energy Review, vol 17, no 1, March 1979, p. 31-128.

ABSTRACT. The fuel failures observed in water-cooled power reactors (PWR, BWR, HWR) are classified according to the underlying mechanisms, i.e. hydriding, pellet-clad interaction (PCI), corrosion, clad collapsing, Zircaloy growth, rod and assembly bowing and fretting wear. The historical development of fuel designs and failure rates is briefly reviewed. Over the last decade the average fuel rod failure rate has dropped to near 0.02% and the majority of failures are at present caused by particular incidences. The present technological understanding of these failure types and their interpretation are presented in more detail. Hydriding, clad collapsing, unanticipated growth and fretting have mainly been caused by inadequate design or manufacturing in the early days and should not be a problem in future. PCI, external corrosion at high burnup and rod and assembly bowing are more generic mechanisms and need further consideration. Experience from the continued operation of defective fuel rods has confirmed that the selection of materials is also adequate for safe behaviour in the defective state.

THORIUM CYCLES AND PROLIFERATION, by Amory B. Lovins. The Bulletin of the Atomic Scientists, vol. 35, no. 2, February 1979, p.16-22.

This paper analyzes several prevalent misconceptions about nuclear fuel cycles that breed fissile uranium-233 from thorium.

ROLE FOR THORIUM IN THE NUCLEAR WORLD, by R. F. Turner. Power, vol. 123, no. 2, February 1979, p.96-98.

**Role for thorium** in the nuclear world. Current installment in the series on the nuclear fuel cycle explores the advantages offered by thorium, a fertile rather than fissile material

ALTERNATIVE METHOD OF MAKING RECYCLE FUEL: IMPREGNATION OF LOW DENSITY PELLETS. M. A. Feraday, D. D. Cotnam.

Ceramic Bulletin, vol 58, no 12, 1979, p. 1189-1192.

TR 163.2  
.A6  
v.3  
Annual review of energy, v. 3 / Jack M. Hollander, editor ; Melvin K. Simmons, David O. Wood, associate editors. — Palo Alto, Calif. : Annual Reviews, 1979. 544 p.  
Includes bibliographical references and index.  
ISBN 0-8243-2303-3  
1. Power resources—Addresses, essays, lectures. 2. Energy conservation—Addresses, essays, lectures.

THE EVOLUTION OF THE NUCLEAR DEBATE: THE ROLE OF PUBLIC PARTICIPATION. Dorothy Nelkin and Susan Fallows 275

TJ American Power Conference, 40th, Illinois  
 5 Institute of Technology, 1978.  
 .A55 Proceedings of the American Power Con-  
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 held in Chicago on April 24-26, 1978] /  
 [sponsored by] Illinois Institute of  
 Technology. -- Chicago : Illinois Insti-  
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**Microelectronics and Reliability, Jan.**  
**v.17, no.1. 1978**

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 analysis to determine what this minimum availability  
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TT Annual review of energy, v. 3 / Jack M.  
 163.2 Hollander, editor ; Melvin K. Simmons,  
 .A6 David O. Wood, associate editors. —  
 v.3 Palo Alto, Calif. : Annual Reviews, 1978.  
 544 p.

Includes bibliographical references  
 and index.  
 ISEN 0-P243-2303-3  
 1. Power resources—Addresses, essays,  
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**WEAPONS PROLIFERATION AND CRITERIA FOR EVALUATING  
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R.C. Dahlberg.  
 Bull. Atomic Scientists, v.34, no.1, Jan.1978, p.38-42.

An evaluation of various fuel cycle alternatives  
 with regard to safeguards, costs, and other  
 considerations.

TJ American Power Conference, 40th, Illinois  
5 Institute of Technology, 1978.  
.A55 Proceedings ...c1978  
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Nuclear Power and Nonproliferation—An Optimistic View ..... 74  
MYRON B. KRATZER, International Energy Associates Limited,  
Washington, D.C.

THE NUCLEAR FUEL CYCLE IN JAPAN.  
Koichi Kawakami.  
Bull. Atomic Scientist, v.34, no.6, June 1978, p.17-19.

Energy, v.2, 1977, p.323-63.

### CONSIDERATIONS ON THE LARGE-SCALE DEPLOYMENT OF THE NUCLEAR-FUEL CYCLE†

R. AVENHAUS, W. HÄFELE and P. E. McGRATH‡  
IIASA, Schloss Laxenburg, A-2361 Austria

(Received 24 November 1976)

**Abstract**—In papers by Häfele, Manne and Schikorr, strategies for a transition from fossil to nuclear fuels are considered for a model society of 250M people with an asymptotic energy consumption of 10kW thermal per capita. In the final state, a purely nuclear energy production system, based on only two reactor types, was assumed to cover all electric and non-electrical energy demands of the model society.

It is the purpose of this paper to evaluate the whole nuclear fuel cycle belonging to the asymptotic nuclear energy-production system. In order to achieve this, all normal operational and accidental risks connected with the nuclear material throughputs are analyzed. Thus, an idea of the relative importance of the different hazards is obtained; furthermore, the basis for a comparison of the nuclear option with alternative options (which is the subject of forthcoming work) is given. With this purpose in mind, only orders of magnitude are considered throughout the paper; in addition, the argumentation is restricted to the level of expected values.

Following the introduction, the mass flows of nuclear material through the nuclear fuel cycle are analyzed. The methodology used is then developed. The normal operation releases of radioactivity are considered and possible modes of accidental radioactive releases are analyzed; the problem of a final waste storage is treated separately because of its unique nature. Different kinds of sabotage and blackmail, including the construction of a nuclear explosive device, are next analyzed; finally, all calculations are summarized. In conclusion, a number of decision-oriented assessments are identified that must be made when the large-scale deployment of nuclear energy is considered.

Nuclear Technology, v.35, no.2  
Fuel systems - Reactors, Nuclear

Sept  
1977

### COATED PARTICLE FUELS. (Special Issue).

Topics include:

Fabrication  
Pyrocarbon  
Performance and performance modeling  
Fission Product Release  
Advanced and Improved Fuels and Applications

THE NUCLEAR FUEL CYCLE: AN APPRAISAL.  
Study Group on Nuclear Fuel Cycles and Waste  
Management.  
Phys. Today, v.30, no.10, Oct.1977, p.32-39.

The APS Study Group  
finds existing technology and  
straightforward extensions sufficient  
for managing nuclear wastes,  
but unresolved economic, institutional  
and political questions cloud the  
commercial use of plutonium.

NUCLEAR - BREEDER

TJ  
163.2  
.A6  
v.3  
Annual review of energy, v. 3 / Jack M. Hollander, editor ; Melvin K. Simmons, David O. Wood, associate editors. — Palo Alto, Calif. : Annual Reviews, 1978. 511 p.  
Includes bibliographical references and index.  
ISEN 0-P243-2303-3  
1. Power resources—Addresses, essays, lectures. 2. Energy conservation—Addresses, essays, lectures.

ALTERNATIVE BREEDER REACTOR TECHNOLOGIES. Bernard I. Spinrad

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PROGRESS IN LIQUID - METAL FAST BREEDER REACTOR SAFETY RESEARCH AND DEVELOPMENT - AN OVERVIEW OF THE ISSUES.

M. H. Fontana  
Progress in Nuclear Energy, Vol. 2, No. 3, 1978, p. 199-218.

Safety research and development (R & D) for Liquid-Metal Fast Breeder Reactors (LMFBR) has been underway at least since 1951 and has expanded enormously in the U.S., France, Germany, Britain, Russia, Italy, and Japan since about 1968 when these countries assigned top priority to the LMFBR as the advanced energy generation device of the near future. Although transactions and proceedings of several symposia have been published, there is a need for a concise overview of the R & D being directed toward an understanding of the factors affecting LMFBR safety. This paper attempts to fill this need; it is planned as the first of a series in which each succeeding article will review in depth a specific area of research.

WATER LEAKS IN SODIUM - HEATED FAST REACTOR BOILERS.

D. J. Hayes  
Physics in Technology, Vol. 9, No. 3, May 1978, p. 96-100.

The problems of water leaks in sodium-cooled reactors is a challenge in fast-reactor design. Mr Hayes looks at some of the constraints on plant design which may result from considerations of leak behaviour and practical limitations in leak detection

THE BREEDER - NOW OR NEVER, by P. M. Murphy

Mechanical Engineering, vol. 100, no. 9, September 1978, p. 22-33

RADIATION RISKS FROM PLUTONIUM RECYCLE

Richard G. Cuddihy, Roger O. McClellan, Mark D. Hoover, Virgil L. Dugan, Leon D. Chapman and James R. Wayland  
Environmental Science & Technology  
Vol. 11 no. 13 December 1977  
p. 1160-1165

According to simulation studies, plutonium released from advanced fuel cycles may increase the risk of lung cancer, but similar risks also exist with coal combustion

AICHE Symposium Series, v.75, no.191 1979

NUCLEAR ENGINEERING QUESTIONS: POWER, REPROCESSING, WASTE, DECONTAMINATION, FUSION. R.D. Walton, Jr., ed.

American Institute of Chemical Engineers

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SLOW BREEDER  
James G. Busse  
Popular Science, vol. 212, no. 4, April 1978, p. 89-91 and 200-202

Converting nuclear power plants to operate on thorium could provide a huge new reserve of energy

REASON ENOUGH FOR THE BREEDER?  
Machine Design  
Vol 50, no. 3, February 9, 1978, p. 26-32.

Breeder technology is not new in the U.S. The government has operated experimental and special-purpose breeders for a number of years. A major use of special-purpose breeders is to produce weapons-grade plutonium. One of these reactors, located at Hanford, Wash., and designated "N", was reactivated late last year and is operating at three times its former production rate to produce plutonium for the new MIRV-equipped ICBM warheads.

THE LMFBR - AN INTERNATIONAL EFFORT.  
Kenneth M. Horst  
IEEE Transactions on Power Apparatus and Systems, Vol. PAS-97, No. 2, March/April 1978, p. 529-535.

Review of the operating experience and current status of the twenty LMFBR projects around the world establishes that substantial progress has been made in the development of the LMFBR as an alternative long-time energy source displaying high efficiency in the use of natural resources.

A DECISION ANALYSIS OF THE U.S. BREEDER REACTOR PROGRAM, by Alan S. Manne and Richard G. Richels.  
Energy, vol. 3, no. 6, December 1978, p.747-767.

**Abstract**—Past modeling efforts have failed to reach a consensus on breeder R & D strategy. These failures have led some to question the usefulness of benefit-cost analysis for a problem as complex and as politicized as this one has become. Our paper examines some of the major weaknesses of past benefit-cost analyses and then reformulates the breeder investment decision in a decision tree framework. Decision analysis is used to evaluate alternative R & D strategies that range from accelerating the current effort to abandoning the entire program.

Breeder benefits are assessed through ETA-MACRO, a model of interactions between the energy sector and the rest of the U.S. economy. A dynamic non-linear optimization procedure is used to examine how breeder timing could depend upon alternative assumptions with respect to: (a) uranium supply, (b) energy demand growth, (c) environmental constraints upon coal and shale oil production, and (d) the availability of alternative energy sources.

Subjective probabilities have been estimated through a Delphi questionnaire on the critical uncertainties. Each individual's responses have been used independently to calculate an optimal strategy. A fairly simple rule-of-thumb has emerged from this experiment. If a respondent believes that the probability of positive benefits ( $P$ ) exceeds 0.03, there are positive expected dollar benefits from any breeder development program. If  $P$  is less than 0.03, however, the expected economic benefits of such a program would be negative. The costs of the R & D program would then exceed their actuarial value.

PHYSICS OF LIQUID METAL FAST BREEDER REACTOR SAFETY.  
Richard Wilson

Rev. Mod. Phys. Vol. 49, no. 4, October 1977, p893-924

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LEAK DETECTION OF STEAM OR WATER INTO SODIUM IN STEAM GENERATORS OF LIQUID - METAL FAST BREEDER REACTORS.

R. Hans, K. Dumm

Atomic Energy Review, Vol. 15, No. 4, Dec. 1977, p. 611-699.

TJ American Power Conference, 40th, Illinois  
5 Institute of Technology, 1978.  
.A55 Proceedings ...c1978  
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ORIGINAL PAGE IS  
OF POOR QUALITY

BT  
163.2 Greater Los Angeles Area Energy Symposium, Los Angeles, 1979.

.G74  
1979 Greater Los Angeles Area Energy Symposium  
: Tuesday, May 23, 1979 ... Los Angeles,

• An Overview of Liquid Metal Fast Breeder Reactors—Dr. C. W. Saylor. *R141*  
Atomics International

Fast Breeder reactor power plants in the 1000-1200 MWe range are being built overseas and are being designed in this country. While these reactors have many characteristics in common, a variety of different approaches have been adopted for some of the major features. Some of those alternatives are discussed here.

(Los Angeles  
Council of Engineers Scientists  
Proceedings Series; v. 4)

SAFETY AND RELIABILITY: ANALYSIS OF A BREEDER REACTOR.  
J.R. Fussell, et al.  
Simulation, v.29, no.4, Oct.1977, p.121-24.

*This paper outlines a University of Tennessee independent study of the safety and reliability of the Clinch River Breeder Reactor Plant in Oakridge, Tennessee. The study uses several kinds of models, and analytical computer programs, one of which (BACFIRE) is briefly described and illustrated.*

ENGINEER'S MEMO STIRS DOUBTS ON CLINCH RIVER BREEDER.  
D. Shapley.  
Science, v.197, July 22, 1977, p.350-52.

42-page document by Burns and Roe, Inc., the architect-engineering firm on the project, is a devastatingly critical of CRBR's management and argues that safety concerns have been sorely neglected.

NUCLEAR POWER WITHOUT NUCLEAR BOMBS  
Meyer Steinberg

New Scientist, July 7, 1977, vol. 75, no. 1059,  
p. 14-16

The solution to the world's energy problems in terms of the breeder-reactor-plus-fuel-reprocessing economy is beset with major problems--technological, military, and environmental. This article argues the case for a radical alternative: nuclear power based on fuels obtained from the irradiation of fertile material with neutrons produced by a linear accelerator beam.

TO BREED OR NOT TO BREED.  
Government R&D Rept., v.8, no.2, July 15, 1977,  
p.4-6.

COMPARATIVE BREEDING CHARACTERISTICS OF FUSION AND FAST REACTORS. Peter Fortescue

Expressions are developed to allow ready comparison of a hybrid fission-fusion plant and a fast breeder with respect to the number of thermal reactors that their fissile production could support, both for their feed requirements and for the new inventory needs of an expanding industry.

Science, Vol. 196, no. 4296, 17 June 1977, p. 1326-1329

Q Advances in instrumentation, v. 31, pts. 1-4;  
184 proceedings of ISA Conference and Exhibit,  
.A5 Houston, Texas, October 11-14, 1976. --  
v.31 Pittsburgh : Instrument Society of America,  
pt.1-4 c1976.  
4 v. : ill. ; 29 cm.

WATER-TO-SODIUM LEAK DETECTION, L. R. Boyd and K. Y. Eng P.N.-891.-

CLINCH RIVER BREEDER REACTOR PLANT -- PRIMARY CONTROL ROD DRIVE SYSTEM, B. T. Hudson and M. Vuckovich ... P.N.-892..m, -1-

DETECTION OF LIQUID METAL TO GAS LEAKS IN LMFBR'S, J. A. Morejon ..... P.N.-893.....

NUCLEAR - FUSION

Physics Today, v.32, no.5.

May  
1979

**MAGNETICALLY CONFINED FUSION. Special Issue.**

**Recent progress in tokamak experiments P.25**

Ion temperatures, confinement times and densities are now looking good  
Masanori Murakami and Harold P. Eubank

**Alternate concepts in magnetic fusion P.36**

Non-toroidal geometries may give rise to fewer engineering difficulties  
Francis F. Chen

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Fissile materials bred in a fusion reactor would extend our resources  
Hans A. Bethe

**Diagnostics for fusion experiments P.52**

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Charles B. Wharton

Plasma and the Controlled Thermonuclear Reaction  
by P.L. Kapitza

Science, Vol. 205, No. 4410, 7 September 1979, p. 959-964

A REALISTIC ALTERNATIVE FOR PRACTICAL FUSION POWER.  
Robert W. Bussard.

AIAA Student Journal, vol 17, no 2, Summer 1979.  
p. 24-26, 48.

*A new approach to practical fusion power was conceived in 1976 and promised to be less expensive and quicker to demonstrate than the mainline efforts. With the necessary funding, RIGGATRON power plants could be a major source of energy as early as 1990.*

OVERCOMING FUSION'S CHALLENGE: WHAT IT IS AND  
HOW WE'RE TACKLING IT WITH MAGNETIC CONFINEMENT.  
Edwin E. Kintner.

AIAA Student Journal, vol 17, no 2, Summer 1979.  
p. 20-23.

*Fusion is one of the "inexhaustible energy sources," releasing more energy per pound than any other fuel. It is also, however, one of the least economic at the present time, and it requires much research and refining.*

UN-150,917 1979  
FUSION ENERGY GLOSSARY. M.O. Whitson, ed.  
Apr.1979. 18p.

Department of Energy, DOE/TIC-10192  
Oak Ridge, Tenn.,  
Technical Information Center

Dictionaries - Thermonuclear reactions  
Power sources, Nuclear - Fusion

CIRCUITS AND SYSTEMS CONCEPTS IN ENERGY RESEARCH.  
Special Issue.

3 THE EVOLUTION OF A LARGE LASER CONTROL SYSTEM—  
FROM SHIVA TO NOVA

Gregory J. Suski and Frederick W. Holloway

The Nova laser system is a 200 terawatt laser facility under construction at Lawrence Livermore Laboratory. Its current operational predecessor, the 30 terawatt Shiva laser, is controlled and diagnosed via a network of 50 computers. Although the highly distributed Shiva control system has proven effective and reliable, the need for more integrated process control on Nova is leading to a more centralized architecture. An overview of these control systems is presented and their differences are discussed.

NSO-12802# Oak Ridge National Lab., Tenn. Computer Sciences  
Div

ECONOMICS OF FUSION DRIVEN SYMBIOTIC ENERGY  
SYSTEMS

J. P. Renier, T. J. Hoffman, and J. G. Martin 1979 7 p refs  
Presented at ANS Ann. Meeting, Atlanta, Ga. 3 Jun. 1979 Pre-  
pared jointly with Lowell Univ., Mass.  
(Contract W-7405-eng-26)  
(CONF-790602-50) Avail: NTIS HC A02/MF A01

The economic analysis of symbiotic energy systems in which U233 (to fuel advanced converters burning U233 fuel) is generated in blankets surrounding fusing D-T plasma's depends on factors such as the plasma performance parameters, ore costs, and the relative costs of Fusion Breeders (CTR) to Advanced Fusion Converters. The analysis also depends on detailed information such as initial, final makeup fuel requirements, fuel isotopics, reprocessing and fabrication costs, reprocessing losses (1%) and delays (2 years), the cost of money, and the effect of the underutilization of the factory thermal installation at the beginning of cycle. The results are presented of calculations of overall fuel cycle and power costs, ore requirements, proliferation resistance and possibilities for grid expansion, based on detailed mass and energy flow diagrams and standard US INFCE cost data and introduction constraints, for realistic symbiotic scenarios involving CTR's (used as drivers) and denatured CANDU's (used as U233 burners). The results are compared with those obtained for other strategies involving heterogeneous LMFBR's which burn Pu to produce U233 for U233-burners such as the advanced CANDU converters (MEU233-CANDU).  
DOE

THE HYLIFE CONCEPT: ELECTRICITY FROM LASER FUSION.

"

Energy and Technology Review, October 1979, p. 8-18.

*The energy released in inertial fusion reactions appears in the form of fast neutrons, x rays, and energetic charged particles emitted in bursts. Converting this energy into electric power is difficult because fusion radiation damages structural materials and because the pulse characteristics imply thermal cycling and fatigue. A practical reactor design must therefore include methods for shielding the structure and beam-handling components from radiation damage and for minimizing the pulsed effects. It is also necessary to include lithium, in which neutrons produced in the fusion reactions can form tritium to replace that burned in the fusion pellet.*

*We have developed a concept to convert repetitively pulsed energy releases to net electric power. In this design lithium flows in free jets through the reaction chamber, shielding the first structural wall from radiation damage, breeding tritium, yet minimizing the wall stress resulting from the impact of accelerated lithium. The structural wall, consequently, can be made of a common ferritic steel, which can last for the life of the power plant. This design also significantly reduces the amount of residual radioactivity.*

Fusion research—the temperature rises. Micheal  
Kenward.

New Scientist. v. 82, no. 1156, May 24, 1979,  
p.627-630.

A fascinating scientific challenge that could solve all our energy problems—that is how fusion researchers see their work. Researchers have increasing confidence that the next generation of experiments will answer most of the remaining scientific questions. Then come the engineering difficulties.

NBC-16543# Illinois Univ., Urbana Fusion Studies Lab  
**DIRECT ENERGY CONVERSION SYSTEMS**  
G H Miley 1978 11 p refs Presented at the Meeting on  
the Technology of Controlled Thermonuclear Fusion, Santa Fe,  
N Mex., 9 May 1978  
(Contract EY-76-S-02-2218)  
(COO-2218-117; CONF-780508-73) Avail NTIS  
HC A02/MF A01

The potential importance of direct energy conversion to the  
long-term development of fusion power is discussed with stress  
on the possibility of alleviating waste heat problems. Two  
approaches to direct conversion, i.e., direct collection and magnetic  
expansion are reviewed. DOE

### FUSION REACTORS IN OUR FUTURE?

Michael Baum  
Dimensions, vol.62, no. 4, April 1978, p. 14-19

The light doesn't last long—about four millionths  
of a second—but during that period you are looking  
into a model of the heart of a nuclear fusion reactor.

The device is called a *theta pinch*, (see box) and  
William Rowan and James Roberts of the National  
Bureau of Standards are using it to study some of  
the atomic processes that will take place in a fusion  
reactor. They do this in an ordinary physics laboratory,  
without ever coming close to starting a nuclear  
reaction. They do it by an elegant sort of "model-  
ing" in which relatively low temperatures (1 000 000  
degrees Celsius) represent unimaginably high tem-  
peratures (100 000 000 degrees Celsius) and small,  
light ions\* become scale models of large, heavy ions.

Power sources, Nuclear - Fusion 1979

ENERGY.  
Optical Spectra, vol. 13, no. 1, January 1979, p.28-9

A hybrid laser fusion breeder reactor could play a  
key role in the energy future of the United States  
and the world.

The development of controlled nuclear fusion.  
R.S. Pease.

Atomic Energy Review. v. 16, no. 3, September  
1978, p.519-546.

ABSTRACT. The high temperature conditions needed in a controlled nuclear fusion  
reactor are now being approached in experiments using magnetic fields to confine and isolate  
the plasma, especially in systems of the tokamak type. The underlying reasons for the successes  
are discussed and it is concluded that the remaining advances needed in temperature and  
thermal insulation may well be achieved in new large tokamak experiments now under con-  
struction. Comparable progress is being made also in inertial confinement systems; key experi-  
ments on achieving the required super-high densities with high-powered pulsed laser systems  
are about to commence. To achieve fusion reactors will require the combination of three  
major disciplines; plasma physics, electromechanical engineering and nuclear engineering.  
Proposals have been made for an international study group to be set up under the IAEA auspices  
to consider technical objectives and the nature of the next large fusion device which could be  
constructed internationally, and in which this synthesis could be attempted.

American Scientist, v.67, no.1  
p.78-89

Jan.-Feb.  
1979

ENERGY FOR THE LONG RUN: FISSION OR FUSION?  
G.L. Kulcinski, G. Kessler, J. Holdren, and  
W. Hafele. (Factors such as hazards, technological  
costs, and development time are the significant  
points of comparison for the two most likely  
long-term energy sources).

THE EVOLUTION OF A LARGE LASER CONTROL SYSTEM--  
FROM SHIVA TO NOVA. Gregory J. Suski and  
Frederick W. Holloway.

IEEE Circuits and Systems, vol 1, no 3, September 1979  
p. 3-10.

The Nova laser system is a 200 terawatt laser facility  
under construction at Lawrence Livermore Laboratory.  
Its current operational predecessor, the 30 terawatt Shiva  
laser, is controlled and diagnosed via a network of 50  
computers. Although the highly distributed Shiva control  
system has proven effective and reliable, the need for  
more integrated process control on Nova is leading to a  
more centralized architecture. An overview of these  
control systems is presented and their differences are discussed.

55813 (LA-7592-MS, pp 3.1-3.28) Development of fusion energy: present and future. Apr 1979.

In Production of synthetic gas from nuclear energy sources. The current program status is reviewed. The magnetic fusion program, TFTR, and the inertial confinement program are discussed. Some technological requirements are also described. (MOW)

- TK Intersociety Energy Conversion Engineering  
2896 Conference, 14th, Boston, 1979.  
.155 Proceedings of the 14th Intersociety  
1979 Energy Conversion Engineering Conference,  
Boston, Massachusetts, August 5-10, 1979.  
-- Washington, D. C. : American Chemical  
Society, c1979.
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Engineering Aspects of Demonstration Fusion  
Power Reactors, G. Casini, M. Biggio,  
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#### ADVANCED LASERS FOR FUSION APPLICATIONS.

W. F. Krupke & E. V. George

Optical Engineering, Vol. 17, No. 3, May/June  
1978, p. 239-246.

Advanced Lasers subsystems performance requirements for a fusion power reactor are presented and analyzed in the context of an energy-storage laser medium. Three types of energy-storing laser media are identified: 1) the Group VI atoms, 2) selected rare-earth doped solids, and 3) rare-earth molecular gases. The operating principles, basic parameters, and conceptual designs for high energy amplifiers are outlined for 1) atomic selenium pumped photolytically with rare-gas excimer radiation, 2) thulium-doped glass pumped with XeF excimer radiation, and 3) terbium chelate vapor pumped with KrF excimer radiation.

#### AEROSPACE AIDS FUSION POWER CONCEPT.

Clarence A. Robinson, Jr.

Aviation Week & Space Technology, Vol. 108, No. 24,  
June 1978, p. 61-68

Washington—Aerospace technology development approach is being applied to the fusion physics field in the disposable modular Tokamak concept designed to produce fusion power units for commercial power application as early as 1988. The concept also embodies a future weapons system application.

Commercial power plant application would follow experiments of the device, called a Riggatron by International Nuclear Energy Systems Co. (Inesco), the

ology, Vol. 108, No. 24,

developer. Two prototype fusion power machines called Phibex (physics ignition and burn experiment) No. 1 and No. 2 would be tested in 1982 at Los Alamos Scientific Laboratory, N. M.

The Riggatron has been dubbed the "throwaway Tokamak" in Congress, and it faces an uncertain future because it is caught up in a battle between the Office of Management and Budget, Energy Dept.'s Office of Fusion Energy and fusion energy laboratories developing much larger fusion devices aimed at commercial power (AWAST May 22, p. 15; Apr. 3, p. 13).

#### LASER FUSION.

C. Martin Stickley

Physics Today, Vol. 31, No. 5, May 1978, p. 50-59

Will a series of nuclear explosions in miniature pellets of hydrogen, ignited to fusion by laser-light beams, become a long-term method for supplying the world's energy needs?

AICHE Symposium Series, v.75, no.191 1979

NUCLEAR ENGINEERING QUESTIONS: POWER, REPROCESSING, WASTE, DECONTAMINATION, FUSION. R.D. Walton, Jr., ed.

American Institute of Chemical Engineers

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THERMONUCLEAR FUSION AND NUCLEAR POWER ENGINEERING.  
E. P. Velikhov, B. B. Kadomtsev, & V. V. Orlov  
Thermal Engineering, Vol. 24, No. 11, April 1978,  
p. 22-28

The investigations into controlled thermonuclear fusion were started about 25 years ago. Even at that time it was clear that thermonuclear fusion opens up an approach to a new, almost inexhaustible source of energy - nuclear energy of light elements.

Scientists working in the field of controlled thermonuclear reaction are confident that practical application of fusion will be attained in the current century.

SHIVA: THE NEXT STEP TO FUSION POWER.  
G. Bylinsky.  
Fortune, v.97, no.2, Jan.30,1978, p84-87.

The giant laser apparatus at Livermore could open the door to an inexhaustible energy source.

ARGUS LASER SYSTEM: PERFORMANCE SUMMARY  
W.W. Simmons, D. R. Speck and J. T. Hunt  
Applied Optics, vol. 17 no.7, April 1, 1978, p. 999-1005

The Argus Nd:glass laser system, presently operating as an experimental facility for laser experiments, is described. The laser consists of a master oscillator and two identical amplifier chains 20-cm output aperture. Argus is presently capable of delivering more than 4 TW of power in short (psec) pulses, or more than 2 kJ of energy in 1-nsec pulses, to 100-µm targets. Short pulse performance obtained by increased aperture filling and implementation of image relaying with high vacuum spatial filters is described. Experimentally recorded near-field and far-field data for several levels are presented and discussed in terms of the limiting effects of nonlinear beam instabilities upon spot intensity.

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## THE TOKAMAK: MODEL T FUSION REACTOR

Don Steiner and John F. Clarke

Science

Vol. 199 no. 4336 March 31, 1978

p. 1395-1402

*Summary.* During the past several years there have been significant scientific and technological advances related to the tokamak magnetic confinement scheme. These are summarized in the context of a recent tokamak reactor design study which emphasizes reduced size, higher power density, and enhanced plant reliability and maintainability relative to earlier tokamak reactor design studies. The direct plant cost of the proposed reactor is estimated to be in the range \$1000 to \$1500 per electrical kilowatt. A three-phase strategy for demonstrating tokamak fusion power generation at a committed site is outlined. It is estimated that implementation of the three-phase program would require about 20 years and a total escalated expenditure of \$10 billion to \$15 billion. The tokamak power plant described here is not viewed as definitive but rather as a point of departure in the development of a plan to demonstrate tokamak power generation.

## HIGH SPEED WAVEFORM MEASUREMENTS IN LASER FUSION RESEARCH.

Hale Farley.

Research Development, v.29, no.1, Jan.1978,  
p.42-

The extremely fast nature of the pulses involved in laser fusion research poses stringent performance requirements on state-of-the-art electronics

## GLASSES FOR HIGH-POWER FUSION LASERS

Marvin J. Weber

Energy and Technology Review

Vol. no. September 1977

p. 16- 25

New fluoride-base glasses with low refractive indices will facilitate an early demonstration of the scientific feasibility of inertial confinement fusion.

## ATOMIC AND MOLECULAR DATA FOR CONTROLLED THERMO-NUCLEAR FUSION

A. Lorenz

Physics Reports, vol. 37C, no. 2, February 1978,

p. 56-254

R.S. PEASE. Address of welcome

M.F.A. HARRISON. The role of atomic and molecular processes in fusion research

Review paper A1: J.T. HOGAN, Atomic and molecular data needs, priorities, and accuracies for Tokamak beam

Review paper A2: H. VERNICKEL, Data needs for plasma surface interaction

Review paper A3: M.L. WATKINS, Data needs, priorities and accuracies for plasma modelling

Review paper A4: H.W. DRAWIN, Plasma impurities and cooling

Review paper A5: R.W.P. McWHIRTER, Data needs, priorities and accuracies for plasma spectroscopy

Report of the working group on international cooperation

Report of the working group on atomic collision data

Report of the working group on the requirements of atomic structure data

Report of the working group on surface interaction data for fusion devices

## FUSION ENERGY IN CONTEXT: ITS FITNESS FOR THE LONG TERM

John P. Holdren

Science, vol. 200, no. 4338, April 14, 1978, p.168-180

*Summary.* Long-term limits to growth in energy will be imposed not by inability to expand supply, but by the rising environmental and social costs of doing so. These costs will therefore be central issues in choosing long-term options. Fusion, like solar energy, is not one possibility but many, some with very attractive environmental characteristics and others perhaps little better in these regards than fission. None of the fusion options will be cheap, and none is likely to be widely available before the year 2010. The most attractive forms of fusion may require greater investments of time and money to achieve, but they are the real reason for wanting fusion at all.

LASER-FUSION EXPERIMENTS UTILIZING A  $4\pi$  ILLUMINATION SYSTEM.

E.K. Storm, et al.

J. Appl. Phys., v.49, no.3, Mar.1978, p.959-64.

NEUTRAL BEAMS FOR MAGNETIC FUSION

Bick Hooper

Energy and Technology Review

Vol. no. September 1977

p. 1-8

High-energy, high-intensity neutral beams have been developed to the point where they can heat plasmas to the thermonuclear temperatures needed in magnetic fusion reactors.

MIRROR FUSION TEST FACILITY

Franklin P. Dixon

Energy and Technology Review

Vol. no. October 1977

p. 1-8

Work is under way at LLL on the Mirror Fusion Test Facility, an advanced device for fusion experiments, which is designed to increase  $n\tau$  by a factor of 10 and ion temperature by a factor of 4.

ENGINEERING LIMITATIONS OF FUSION POWER PLANTS

W. E. Parkins

Science

Vol. 199 no. 4336 March 31, 1978

p. 1403-1408

This article does not deal with the difficulty or probability of success of plasma confinement, but instead focuses on engineering aspects of proposed full-scale plants believed to be of critical importance to the future of fusion power.

ZONE-PLATE CODED IMAGING OF THERMONUCLEAR BURN.

N.M. Ceglio

Energy and Tech. Rev., January 1978, p.1-8.

A Fresnel zone-plate imaging technique has been developed that provides high-resolution images of the thermonuclear burn region in laser fusion experiments.

WASTE MANAGEMENT CONSIDERATIONS FOR FUSION POWER REACTORS

T. E. Botts and J. R. Powell

Nuclear Technology

Vol. 37 no. 2 Feb. 1978

p. 129-137

*To estimate the waste management needs of a fusion power reactor, a scheme for handling radioactive waste from a fusion plant has been devised. The handling scheme proceeds with radioactive waste, primarily from blanket replacement, being stored on-site; waste in cooled and shielded casks is then isolated off-site; finally, the materials are recycled. Using activities and component lifetimes supplied by designers, several conceptual fusion power reactors have been analyzed and their waste streams compared to fission reactors with regard to total activity, specific activity, and lifetimes of activity.*

STRUCTURAL AND MECHANICAL DESIGN OF TOKAMAKS,

by W. C. Young, and I. N. Sviatoslavsky

Journal of Engineering for Power, vol. 100, no. 3,

July 1978, p. 405-411

*The UWMAK series of reactor studies have assessed the technological problems associated with the design and construction of a working power reactor. A procedure has been developed to evaluate the quality of magnet design by a comparison to a minimum mass system established by the virial theorem. Failure and fault analyses and material selection for the many diverse environments are critical for long term reliability. Overall structural compatibility and multipurpose use of structural components are also emphasized.*

#### HEAVY-ION BEAM INERTIAL-CONFINEMENT FUSION

by Richard C. Arnold

Nature, vol. 276, no. 5683, November 1978, p. 19--23

*This is a survey article covering the current status of inertial-confinement fusion driven by heavy-ion accelerator systems. Although developed only since 1975, system designs of this type appear to provide a convincing basis for developing commercial power from inertial-confinement fusion.*

#### FUSION POWER WITH PARTICLE BEAMS, by Gerold Yonas.

Scientific American, vol. 239, no. 5, November 1978  
p. 50-61.

Efforts to duplicate the fusion process on a controlled basis have centered principally on magnetic-confinement schemes, in which the hot gaseous fuel (a mixture of deuterium and tritium, two heavy isotopes of hydrogen) will be held within the reactor vessel by means of strong magnetic fields, and to a lesser extent on an inertial-confinement scheme that will rely on powerful laser beams to implode tiny pellets of deuterium and tritium. In the past few years my

colleagues and I at the Sandia Laboratories in Albuquerque, N.M., and a larger group of investigators at the I. V. Kurchatov Institute of Atomic Energy in Moscow have undertaken a different approach to fusion by inertial confinement. Instead of laser beams we have employed intense beams of electrons (and more recently ions) generated by very-high-current, very-high-voltage electric pulses.

#### DIAGNOSTICS FOR THE LASER FUSION PROGRAM--PLASMA PHYSICS ON THE SCALE OF MICRONS AND PICOSECONDS, by David T. Attwood.

IEEE Journal of Quantum Electronics, vol. QE-14, no. 12, December 1978, p. 909-923.

*Abstract*—Diagnostic techniques are reviewed in the context of insights they provide to physical processes dominating the implosion of laser fusion targets. Specific examples chosen from recent experiments demonstrate that adequate diagnostic techniques, resolved to microns and picoseconds, have been developed for the demanding requirements of laser driven "exploding pusher" targets. Future diagnostic needs are related to the special problems foreseen with "ablatively driven" high density implosions.

#### PRINCETON TOKAMAK HEATS UP THE RACE FOR FUSION POWER, by Edward Edelson.

Popular Science, vol. 213, no. 6, December 1978,  
p. 69.

**A 60-million-degree plasma brings science closer to an unlimited source of power**

#### ASSESSMENT OF SURFACE HEATING PROBLEMS IN LASER FUSION REACTORS.

S.I. Abdel-Khalik and T.O. Hunter.

J. Heat Transfer, v.100, no.2, May 1978, p.311-318.

*The surface-heating problems associated with the pulsed photon and ion irradiations of the first walls and liners of inertially-confined fusion reactor cavities are investigated. Analytical models for predicting the thermal response of these surfaces as a function of the different design and operational parameters of the system and the nature of the incident irradiations are developed. The effectiveness of residual gas as a means for protecting the wall from the ions and soft X-rays is assessed.*

#### THE JET PROJECT.

A. Gibson.

Phys. Technol., v.9, 1978, p.162-168.

With the decision to site the JET experiment at Culham, the EEC has made a major commitment to its fusion programme over the next decade. One of the chief physicists in the JET design team describes the project and outlines the proposed experimental programme

BT  
163.2 Greater Los Angeles Area Energy Symposium, Los Angeles, 1979.

.674 Greater Los Angeles Area Energy Symposium  
1979 : Tuesday, May 23, 1978 ... Los Angeles,

• Fusion: Status of Research — Dr. Steven Hardwell, Fusion Energy Foundation

P.104

During the last 18 months the informed consensus in the fusion energy community has changed quite drastically, with the result that all signs point towards the possibility of economic production of electrical energy from nuclear fusion before the end of the 1990's. The experimental and engineering progress over the past year in both magnetic and laser fusion has been astounding; the rate at which development continues is now determined only by budgetary considerations. With sufficient funding, a commercial demonstration reactor could be on line by 1989-90.

N80-12583# Department of Energy, Washington, D. C. Office of Fusion Energy

UNITED STATES MAGNETIC FUSION ENERGY PROGRAM

S. O. Dean Aug 1978 176 p

(DOE/ET-0072) Avail: NTIS HC A09/MF A01

The following topics are discussed: (1) policy; (2) magnetic fusion energy program; (3) physics proof-of-principle programs; (4) major scaling experiments; (5) energy producing experimental reactors: design studies and long lead time technology development; (6) commercialization: reactor designs and systems studies; and (7) enhancement studies. DOE

TK  
7000 Institute of Electrical and Electronics Engineers, Region 5.  
.1256 Energy '79...cl'979.  
1979 Includes bibliographical references.

Energy Storage for Tokamak Reactor Cycles

C. H. Buchanan, General Electric Co. P.1

Flywheel Energy Storage System for JT-60 Toroidal Field Coil P.11

H. Kishimoto, R. Shimada, S. Tamura, Japan Atomic Energy Research Institute, Tokai, Japan; S. Ito, Y. Sawada, H. Takano, T. Furusawa, K. Kimura, Tokyo Shibaura Electric Company, Ltd., Yokohama, Japan

AEROSPACE AIDS FUSION POWER CONCEPT.

Clarence A. Robinson, Jr.

Aviation Week & Space Technology, Vol. 108, No. 24, June 12, 1978, p. 61-66.

Washington—Aerospace technology development approach is being applied to the fusion physics field in the disposable modular Tokamak concept designed to produce fusion power units for commercial power application as early as 1988. The concept also embodies a future weapons system application.

Commercial power plant application would follow experiments of the device, called a Riggatron by International Nuclear Energy Systems Co. (Inesco), the developer. Two prototype fusion power machines called Phibex (physics ignition and burn experiment) No. 1 and No. 2 would be tested in 1982 at Los Alamos Scientific Laboratory, N. M.

N78-29642# Pacific Gas and Electric Co. San Francisco, Calif. IMPLICATIONS OF THE FUSION POWER SOURCE TO THE ELECTRIC UTILITY INDUSTRY

Nov 1978 144 p refs Presented at EPRI Executive Seminar on Fusion, San Francisco, Calif., 11 Oct. 1977

(Contract ES-77-G-05-5576)

(EPRI-ER-943-54, Conf-771071-Summ) Avail: NTIS HC A07/MF A01

The viewpoints and plans of the utility industry and the fusion community with respect to thermonuclear power plants are examined. Basic background material concerning the fusion process is emphasized including the current status and future plans of the fusion research and development effort. DOE

## MATERIALS FOR FUSION REACTORS.

James L. Scott

Metal Progress, Vol. 114, No. 2, July 1978,  
p. 40-49.

**MATERIALS PROBLEMS** in fusion systems for commercial power rival those of plasma physics in difficulty. The structural first wall experiences an especially hostile environment of high neutron fluences, high temperatures, and large cyclic thermal stresses. The 14 MeV (2.2 pJ [ $2.2 \times 10^{-12}$ J]) neutrons produced by fusion reactions produce high concentrations of helium and hydrogen as well as the conventional displacement damage commonly associated with fusion reactors. The limited data thus far obtained on structural alloys indicate that radiation predictably causes swelling and loss of ductility. Changes in composition and microstructure can ameliorate those responses. A wide variety of alloys, including stainless steels, high-nickel alloys, and columbium (niobium), vanadium, and titanium alloys are being investigated as candidate materials.

While the structural first wall is an especially challenging materials problem, it is by no means the only one. Other important areas include limiters that intercept the plasma before it strikes the walls, electrical insulation, neutron moderators, shielding, and components for superconducting magnets. A materials development program spanning decades will be required to realize the goal of commercial fusion power.

Power sources, Nuclear - Fusion  
Optical Engineering, v 17, no 3  
p. 191-246

May-June  
1978

## INDUSTRIAL APPLICATIONS OF HIGH POWER LASERS.

248 Advanced Lasers for Fusion Applications, W. F. Krupke, F. V. George

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.A3  
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Advances in cryogenic engineering, v.23 /  
edited by K. D. Timmerhaus. -- New York :  
Plenum Press, 1979.  
xviii, 747 p. : ill.

### Cryogenic Applications—Laser Fusion

- A New Method for Producing Cryogenic Laser Fusion Targets, J. R. MILLER, *Los Alamos Scientific Laboratory, University of California* ..... 669
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- Cryogenic Pellets for Laser-Fusion Research—Theoretical and Practical Considerations, T. M. HENDERSON and R. J. SIMMS, *KMS Fusion, Inc.*, and E. B. JACOBS, *Robert B. Jacobs Associates, Inc.* ..... 682
- Point-Contact Conduction-Cooling Technique and Apparatus for Cryogenic Laser Fusion Pellets, T. M. HENDERSON, R. B. JACOBS, D. L. MUSINSKI, R. J. SIMMS, and G. H. WUTTKE, *KMS Fusion, Inc.* ..... 690
- Cryogenic Handling of Polymeric Laser-Fusion Pellets, T. M. HENDERSON, D. L. MELMOTH, D. L. MUSINSKI, T. R. PATINSON, and G. H. WUTTKE, *KMS Fusion, Inc.* ..... 699
- Equilibrium Constants for the Hydrogen Isotopic Self-Exchange Reactions in the 4.2- to 50-K Temperature Range, J. W. PYPER and P. C. SOUERS, *Lawrence Livermore Laboratory, University of California* ..... 705

SPECIAL ENGINEERING PROBLEMS OF TFTR, by D. E. Lee  
Journal of Engineering for Power, vol. 100, no. 3,  
July 1978, p. 417-423

*Design of the TFTR presents special engineering problems as a result of constraints posed by the physics requirements of the fusion experiments. The ratio of plasma major and minor radii and the associated magnetic field strength required to achieve desired plasma conditions, the required confinement time, the two-component plasma concept, the complications of providing shielding from the 14 MeV neutrons and the necessity to control the inventory of tritium fuel, all constitute problems which, often, in actuality, must be approached as materials problems. The complex, precision structures must satisfy various criteria, for example, low magnetic permeability, high electrical resistivity, resistance to neutron activation and high damage tolerance. Another constraint in the engineering design of TFTR is the requirement to optimize access to machine components for maintenance and repair. Many of the problems associated with accessibility have been resolved: the vacuum vessel has been designed as a ten-segment vessel, the igloo shielding of the machine is composed of interlocking blocks of boron-loaded concrete, the center column is designed in three segments. Current engineering emphasis is on finalizing design of the toroidal field coils, lower poloidal field coils, vacuum vessel liners and limiters, and peripheral systems such as the vacuum pumping system and arrangement of diagnostics.*

TOKAMAK REACTORS, by R. G. Mills  
 Journal of Engineering for Power, vol. 100, no. 3,  
 July 1978, p. 412-416

*The physical properties of nuclear fusion reactions govern the fuel choice and the selection of the operating plasma temperature. Scientific feasibility, or energy break-even, is one objective of the current research program. Engineering and economic feasibilities will depend on achievable plasma densities at thermonuclear temperatures and on technological questions of achievable magnetic field, effects of radiation damage, and mechanical design problems. A pure fusion reactor will have stringent requirements on its performance parameters. If achieved, it should provide clean, safe, abundant economic power, but from rather large central stations. Hybrid fission/fusion systems put far less stringent requirements on the plasma performance. They simplify the fission lattice design. They may provide a superior method for burning the vast reserves of uranium-238.*

MIRROR FUSION REACTORS  
 Energy and Technology Review, September 1978, p. 31-41

We have carried out conceptual design studies of fusion reactors based on the three current mirror-confinement concepts: the standard mirror, the tandem mirror, and the field-reversed mirror. Recent studies of the standard mirror have emphasized its potential as a fusion-fission hybrid reactor, designed to produce fuel for fission reactors. We have designed a large commercial hybrid and a small pilot-plant hybrid based on standard mirror confinement. Tandem mirror designs include a commercial 1000-MWe fusion power plant and a nearer term tandem mirror hybrid. Field-reversed mirror designs include a multicell commercial reactor producing 75 MWe and a single-cell pilot plant.

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Topical Meeting on Inertial Confinement Fusion,  
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DIRECT ENERGY CONVERTERS: EFFICIENCY AND COST ESTIMATES FOR TWO ELECTROSTATIC CONCEPTS, by Myron A. Hoffman  
Journal of Energy, vol. 2, no. 5, September 1978, p. 293-302

This study is concerned with two specific types of electrostatic direct energy converters for direct recovery of a large fraction of the plasma ion energy from magnetic-mirror-type fusion reactors. Simplified equations are presented for each of the important loss mechanisms in both single-stage direct converters and multistage "venetian blind"-type direct converters. These equations can be used to estimate the efficiency and electric power output of the direct converter subsystem. Scaling relations for the cost of each major component in the direct converter subsystem are also given; these include the vacuum tank, direct converter (DC) modules, the DC power conditioning equipment, cryogenic vacuum pumping system, and the thermal bottoming plant. Examples of cost-effectiveness studies for two specific reference direct converter designs are presented in terms of the specific capital costs (i.e., the capital cost per unit of electric power produced) for the direct converter subsystem. These examples show that relaxation of the requirement for small charge exchange losses can significantly reduce the specific capital costs of the direct converter subsystem.

TK 9204 .S87 1977  
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An introduction to controlled thermonuclear fusion / M. O. Hagler, M. Kristiansen. Lexington, Mass. : Lexington Books, 1977.  
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The Present Status of Fusion Power, by F. R. Scott... p. 422

NUCLEAR FUSION: FOCUS ON TOKAMAK. Don Steiner.  
IEEE Spectrum, v.14, no.7, July 1977, p.32-38.

US engineers and physicists will team to attempt commercial demonstration by the year 2000.

TJ 163.2 .N47  
New options in energy technology / sponsored by the American Institute of Aeronautics and Astronautics, Edison Electric Institute, IEEE Power Engineering Society. -- New York : American Institute of Aeronautics and Astronautics, c1977.  
149 p. : ill. ; 29 cm.  
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Possible Impact of Laser Fusion on the Utility Industry - H. J. GOMBERG p. 68.

Adapting the Experience of DOD/Industry to Developing Fusion Power Reactors - W. C. GOUGH and W. B. BRIGGS ..... p. 69.....

NUCLEAR PROCESS HEAT FOR COAL GASIFICATION  
AND HYDROGEN PRODUCTION.

K. F. Knoche

Progress in Energy and Combustion Science, Vol. 4,  
No. 2, 1978, p. 63-72.

This article deals with research and development programs for nuclear coal gasification, nuclear latent heat transport and hydrogen production using nuclear process heat. Nuclear coal gasification and nuclear latent heat transport is operated on a pilot plant basis by different research organisations and companies in West Germany. Hydrogen production by means of nuclear process heat has been investigated so far both experimentally and theoretically on a more fundamental basis by companies and research organisations in the US, Italy, Japan, West Germany and other countries.

QC 791.7 European Conference on Controlled Fusion and  
Plasma Physics, 8th, Prague, 1977.

.E97 1977 Eighth European Conference on Controlled  
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slovakia, 19-23 September 1977 : proceed-  
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THE POTENTIAL OF CONTROLLED NUCLEAR FUSION.

R.S. Pease.

Contemp. Phys., v.18, no.2, 1977, p.113-135.

AIChE Symposium Series, v.73, no.168

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HEAT TRANSFER IN THERMONUCLEAR POWER SYSTEMS.  
Warren E. Stewart, James M. Williams, Max W.  
Carlson et al., eds. (Presented at the 16th  
National Heat Transfer Conference in St. Louis,  
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Warren E. Stewart, James M. Williams, Max W. Carbon and Dai-Kai Sze, eds. (Papers presented at 16th National Heat Transfer Conf. in St. Louis, Mo., Aug. 9, 1976).

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OPTICAL MATERIALS AND THE GREAT LEAP FUSION-  
WARD.

J. A. Weiss

Optical Spectra, vol. 11, no. 5, May 1977,  
p. 39-42

Improvement of optical materials emerges as the  
method of choice for increasing the performance  
of fusion laser systems.

144 The potential of controlled nuclear fusion  
R S PEASE

Advances in magnetic confinement of  
high-temperature matter place the goal of  
controlled fusion within sight. The Director  
of the British Culham Laboratory reviews  
here recent progress towards achieving the  
thermal insulation and plasma conditions  
required to realize the potential of  
thermonuclear fusion

45 TMX: A NEW FUSION PLASMA EXPERIMENT.  
Energy & Technology Review, July 1977, p.1-9

56 The primary goal of the magnetic fusion energy  
63 program at LLNL is the development of a technically  
and economically feasible approach to the generation  
of fusion energy. Results from our earlier 2XIIIB ex-  
periment lead us to believe that a fusion power plant  
based on a mirror system is technically feasible,  
69 assuming a favorable extrapolation to plasmas of  
reactor size. Achieving economic feasibility is more  
77 difficult. For power-producing applications, a reactor  
needs a large  $Q$ , the ratio of fusion power output to  
the power injected to sustain the system. In a conven-  
tional mirror reactor, the fusion power is only about  
equal to the power injected by the neutral  
beams—that is,  $Q$  is only about unity. A new idea, the  
tandem mirror concept described in this article,  
promises to increase this gain, enhancing  $Q$  by at  
least a factor of 5.

Energy & Technology Review, Aug. 1977

## LASER FUSION PROGRAM OVERVIEW

### LASER FUSION TARGETS

Our exploding-pusher targets have achieved record thermonuclear conditions. Targets that compress D-T to high densities are now being tested.

### THE SOLID-STATE LASER PROGRAM

Since 1972 our solid-state laser program has progressed from laser operation at 0.04 TW to 4.6 TW, and we are nearing demonstration of 20-TW pulses with Shiva.

### DIAGNOSIS OF LASER FUSION TARGETS

A program of reproducible, well-diagnosed experiments has established our understanding of exploding-pusher targets.

### ADVANCED LASERS FOR POWER PRODUCTION

We are looking beyond our present research lasers to high-efficiency systems that would be appropriate for power-producing fusion reactors.

### APPLICATIONS OF LASER FUSION

The liquid-lithium waterfall reactor is one promising concept for laser fusion power.

#### U.S. ELECTRON BEAM TESTS TRIGGER FUSION.

W.C. Wetmore.

Aviation Wk. & Space Tech., v.107, no.1, July 4, 1977, p.22-24.

Sandia Labs have used powerful electron beams to create miniature thermonuclear fusion reactions, opening up a new approach to controlled fusion for powerful commercial applications.

TJ  
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Perspectives on the energy crisis : technical, regulatory, environmental, economic, prospective. / advisory editors, Howard Gordon, Roy Meador. — Ann Arbor, Mich. : Ann Arbor Science Publishers, c1977.

2 v. : ill. ; 29 cm.

Includes bibliographies and index.

FUSION ENERGY . . . . . 291

(By Roy Meador, From *Future Energies*, reprinted by Ann Arbor Science Publishers, Inc., 1976. Fusion Energy Update, 1977)

A scientific dream or a future answer to the energy dilemma of mankind? Fusion energy may be the first now, though developing technology might transform it into the latter sometime during the 21st century. Timetables are difficult to establish. But intensive research continues cooperatively among many nations. The expectation of fusion scientists is to prove feasibility in the 1980's and to accomplish controlled fusion reactions during the first quarter of the next century. How much is science fiction, how much is science prophecy, when fusion efforts and prospects are described? This book excerpt and update give details of current progress and planned research. Expanded international investments in fusion technology are progressively occurring.

### THE CHEMICAL ENGINEERING SIDE OF NUCLEAR FUSION. POWER.

E.F. Johnson.

AICHE J., v.23, no.5, Sept. 1977, p.617-631.

It is widely recognized that chemical engineering has important roles to play in the development of national and worldwide energy resources through optimal utilization of fossil fuel reserves. It is much less appreciated that there are crucial chemical engineering problems in the development of energy production from other sources. In particular, the successful development of nuclear fusion power generating systems will require the solution of many problems that are uniquely suited to chemical engineers.

This paper presents a brief overview of the fusion development program for magnetically confined fusion power reactors and an identification of the major technological problems remaining to be solved.

ORIGINAL PAGE IS  
OF POOR QUALITY

HEAT TRANSFER IN THERMONUCLEAR POWER SYSTEMS.  
W.E. Stewart, et al.  
AIChE Sym Ser., v.73, no.168, 1977.

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REVIEW OF HEAT TRANSFER PROBLEMS ASSOCIATED WITH  
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Optical Engineering Problems Associated with Construction of the Shiva Laser Fusion Facility . . . . 106  
R. O. Godwin, E. S. Bliss, J. A. Glaze, W. C. O'Neal, H. G. Patton, M. A. Summers, E. P. Wallerstein,  
University of California, Lawrence Livermore Laboratory *p.106-110*

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Alexander J. Glass, Lawrence Livermore Laboratory

Optical Design Considerations for Laser Fusion Reactors *p.117-127* ..... 117  
Michael J. Monsler, James A. Maniscalco, Lawrence Livermore Laboratory, University of California

International Magnetism Conference, Los Angeles, 1977.  
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1 v. in various pagings : ill. ; 29 cm.  
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31-2 SUPERCONDUCTING MAGNET DEVELOPMENT FOR TOKAMAKS (Invited) 5  
J.W. Luton and M.S. Lubell  
Oak Ridge National Laboratory  
Oak Ridge, Tennessee

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Experimental aspects of laser and elec-  
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CONTROLLED THERMONUCLEAR FUSION REACTORS, P. L. Walstrom *PN-510*

Pulsed Power for Fusion.

T. H. Martin.

Sandia Labs., Albuquerque, N.Mex. 1976, 12p CONF-  
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SAND-76-5863 Price code: PC A02/MF A01

A review which traces the development of high power pulsed  
accelerators from the original inception at the Atomic  
Weapons Research Establishment, Aldermaston, England, for  
Bremsstrahlung output, through the low impedance accelera-  
tors, to the double-sided accelerators for fusion will be given.  
Proto II is presently being assembled at Sandia and prelimina-  
ry testing on the Marx has been completed. Examples of vari-  
ous techniques will be shown from Sandia accelerators.  
Requirements for accelerators capable of achieving fusion  
levels will be developed and problem areas outlined. The diode  
insulator flashover problem presently limits the maximum cur-  
rent available from the accelerators. (ERA citation 02:023822)

- QC World survey of major facilities in controlled  
791 fusion research. -- 3d ed. -- Vienna : Inter-  
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LASER IMPLOSION DYNAMICS.

California Univ.  
Lawrence Livermore Lab.

UCRL-52000-76-12

NUCLEAR - PROCESS HEAT

**Nuclear Technology, v.38,  
no.2.**

**Mid-Apr.  
1978**

**LOW-TEMPERATURE NUCLEAR HEAT.** (First International Meeting held at Helsinki Univ. of Technology, Otanieni, Finland, Aug. 21-24, 1977. Sponsored by Finnish Nuclear Society, European Nuclear Society, and the American Nuclear Society).

**Finnish Nuclear Society  
European Nuclear Society**

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Lyczkowski, editors. — New York : American  
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vi, 294 p. : ill. ; 28 cm. — (AIChE sym-  
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**SYNTHETIC CARBONACEOUS FUEL AND FEEDSTOCK  
USING NUCLEAR POWER, AIR, AND WATER**  
M. Steinberg and S. Baron

International Journal of Hydrogen Energy, vol.  
2, no. 2, 1977, p. 189-207

NUCLEAR - TRANSPORTATION APPLICATIONS

79A41913# ISSUE 17 PAGE 3131 CATEGORY 5 RPT#:  
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DOCUMENT

**UTTL:** Nuclear aircraft innovations and applications  
**AUTH:** A/MUEHLBAUER, J. C.; B/THOMPSON, R. E. PAA:  
A/(Lockheed-Georgia Co., Marietta, Ga.);  
B/(Westinghouse Electric Corp., Advanced Energy  
Systems Div., Pittsburgh, Pa.)  
American Institute of Aeronautics and Astronautics,  
Very Large Vehicle Conference, Arlington, Va., Apr.  
26, 27, 1979, 15 p.  
**MAJS:** /\*AIRCRAFT CONFIGURATIONS/\*AIRCRAFT DESIGN/\*MILITARY  
AIRCRAFT/\*NUCLEAR PROPULSION  
**MINS:** / BRAYTON CYCLE/ ENERGY TECHNOLOGY/ REACTOR DESIGN  
**ABA:** V.T.  
**ABS:** Determination of the minimum weight nuclear propulsion  
cycle and aircraft configuration, identification of  
technologies and innovations for enhancing mission  
accomplishment, and evaluation of alternate mission  
applications in the framework of the Innovative  
Aircraft Design Study (IADS) program are discussed.  
Parametric studies of four aircraft configurations  
showed the minimum weight configuration to be one  
which carries the payload and reactor in the fuselage  
and uses a canard surface for horizontal control. A  
Bi-Brayton propulsion cycle with a gas cooled reactor  
and dual mode engines offers the potential for the  
lightest weight nuclear aircraft. While sea control,  
cruise missile carrier, tanker, and airborne command  
post are prospective alternate mission applications,  
the nuclear powered cruise missile carrier aircraft  
(NuCMCA) concept provides unique strategic  
capabilities.

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ASME PAPER 79-GT-119 CNT#: F33615-77-C-0116  
79/03/00 10 PAGES UNCLASSIFIED DOCUMENT

**UTTL:** Nuclear Bi-Brayton system for aircraft propulsion  
**AUTH:** A/PIERCE, B. L. PAA: A/(Westinghouse Electric Corp.,  
Advanced Energy Systems Div., Pittsburgh, Pa.) SAP:  
MEMBERS, \$1.50; NONMEMBERS, \$3.00  
American Society of Mechanical Engineers, Gas Turbine  
Conference and Exhibit and Solar Energy Conference,  
San Diego, Calif., Mar. 12-15, 1979, 10 p.  
**MAJS:** /\*AIRCRAFT ENGINES/\*BRAYTON CYCLE/\*GAS TURBINE ENGINES  
/\*NUCLEAR PROPULSION  
**MINS:** / CLOSED CYCLES/ ENGINE DESIGN/ GAS COOLED REACTORS/  
HEAT EXCHANGERS/ WEIGHT REDUCTION  
**ABA:** (Author)  
**ABS:** Recent studies have identified and shown the  
desirability of a new system concept for nuclear  
aircraft propulsion utilizing a modification of a  
closed-cycle gas turbine. This system concept, the  
Bi-Brayton system concept, permits coupling of a gas  
cooled reactor to the power transmission and  
conversion system in a manner such as to fulfill the  
safety criteria while eliminating the need for a high  
temperature intermediate heat exchanger or shaft  
penetrations of the containment vessel. This system  
has been shown to minimize the component development  
required and to allow reduction in total propulsion  
system weight. This technical paper presents a  
description of the system concept and the results of  
the definition and evaluation studies to date.  
Parametric and reference system definition studies  
have been performed. The closed-cycle Bi-Brayton  
system and component configurations and weight  
estimates have been derived. Parametric evaluations  
and cycle variation studies have been performed and  
interpreted. The technical paper discusses the  
application of this new closed cycle gas turbine  
system to aircraft propulsion.

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DOCUMENT

UTTL: Dynamics of nonuniform plasma fluxes in gaseous core nuclear propulsion systems  
AUTH: A/ZHUKOV, V. P.; B/KREER, R. I.; C/ULANOV, G. M.  
PAA: C/(Institute of Control Sciences, Moscow, USSR)  
International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, 16 p.  
MAJS: /\*GASEOUS FISSION REACTORS/\*NONUNIFORM PLASMAS/\*NUCLEAR PROPULSION/\*PLASMA DYNAMICS/\*PLASMA PROPULSION  
MINS: / FLUX (RATE)/ FREQUENCY RESPONSE/ MAGNETOHYDRODYNAMIC STABILITY/ TRANSFER FUNCTIONS  
ABA: F.G.M.  
ABS: The dynamics of a nonuniform plasma flux in the fuel element of a gaseous-core nuclear propulsion system is studied to evaluate how such a flux affects the dynamics of the entire propulsion system. The effect of hydrodynamical flux nonuniformity on the stability of the system is considered, along with the influence of magnetic-field strength on the fuel-element dynamic responses. An attempt is made to describe the results obtained concerning the most important dynamical effects in the nonuniform flux. It is concluded that: (1) the dynamical properties of a nonuniform flux are significantly different from those of a uniform flux; (2) the dynamical effects of a nonuniform flux can render a gaseous-core nuclear propulsion system unstable; and (3) increased magnetic-field strength suppresses these effects and, consequently, can be used to stabilize the propulsion system.

**Nuclear pulse propulsion: A historical review of an advanced propulsion concept**

By: Anthony R. Martin and Alan Bond

J. of the British Interplanetary Society, Vol. 32, No. 3,  
Aug. 1979, P. 283-310

The nuclear pulse propulsion concept, whereby nuclear explosions (fission or fusion) are used to impart momentum to a space vehicle, is reviewed. The principles behind the concept are discussed, and the external system (explosions taking place outside the vehicle) and the internal system (explosions taking place inside the vehicle) are compared.

Capabilities of nuclear pulse systems are examined, demonstrating the great advantage this system has over other concepts, in terms of high exhaust velocities (specific impulse) and large thrust to mass ratios and hence capability for short mission times.

The various studies that have been carried out on the concept over the past 25 years are described and a bibliography, the most comprehensive produced to date as far as the authors are aware, is given.

In view of the great potential of the system, amply confirmed by the past work, it is suggested that effort be expended on a programme to develop nuclear pulse propulsion as a means of exploiting the Solar System.

79A33835# ISSUE 13 PAGE 2329 CATEGORY 5 RPT#:  
AIAA 79-0852 79/00/00 55 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: Advanced nuclear systems for large aircraft  
AUTH: A/LAYTON, J. P.  
In: Very Large Vehicle Conference, Arlington, Va., April 26, 27, 1979, Technical Papers. (A79-33827  
13-05) New York, American Institute of Aeronautics and Astronautics, Inc., 1979, p. 76-130.  
MAJS: /\*AIRCRAFT DESIGN/\*MILITARY AIRCRAFT/\*NUCLEAR PROPULSION/\*TECHNOLOGICAL FORECASTING  
MINS: / AIRCRAFT CONFIGURATIONS/ AIRCRAFT ENGINES/ AIRSHIPS/ BRAYTON CYCLE/ NUCLEAR REACTORS  
ABA: B.J.  
ABS: Recent advances in nuclear power and propulsion systems as well as aircraft technology have resulted in large military aircraft concepts that promise practical operational aircraft. An approach to the interdependent definition of future military missions and credible nuclear aircraft based on a carefully conceived program of analysis, research, and technology is outlined. Particular consideration is given to advanced nuclear aircraft concepts, including heavier-than-air and lighter-than-air. Aspects of operational safety are emphasized.

79A18725 ISSUE 6 PAGE 964 CATEGORY 20 78/12/30  
4 PAGES UNCLASSIFIED DOCUMENT

**UTTL:** Tomorrow's space propulsion --- Interplanetary flight with nuclear and electric engines

**AUTH:** A/BAKER, D.  
Flight International, vol. 114, Dec. 30, 1978, p. 2319-2322.

**MAJS:** /\*ELECTRIC PROPULSION/\*INTERPLANETARY FLIGHT/\*NUCLEAR PROPULSION/\*SPACECRAFT PROPULSION/\*TECHNOLOGICAL FORECASTING

**MINS:** / CRITICAL MASS/ ION PROPULSION/ LIQUID HYDROGEN/ PROPULSION SYSTEM PERFORMANCE/ PROPULSIVE EFFICIENCY/ ROCKET ENGINES/ SPACE ELECTRIC ROCKET TESTS/ SPECIFIC IMPULSE/ WORKING FLUIDS

**ABA:** A.A.

**ABS:** The paper discusses near future interplanetary flight propulsion systems which must necessarily be more efficient than today's chemical rockets. Though the latter have the great advantage of being cheaper to operate. Alternatives to the conventional chemical propulsion systems are presented, particularly nuclear and electric rocket motors, with some of their technical characteristics. One of the more significant advantages of the nuclear motor is its effectiveness for specific impulses between 750 sec and 1200 sec, whereas a chemical engine is good for specific impulses of up to only 430 sec. The electric motor has the advantage of needing no exhaust nozzle and, more importantly, of having a long running time. The magnitude of the electric motor's thrust, however, is very small. NASA's work on nuclear and electric propulsion systems is discussed in some detail, noting the NERVA and SERT projects. A nuclear motor has been developed by NASA which would increase planetary payload weight by 80 percent. NASA has also developed an 8 cm electric motor with a specific impulse of 3000 sec. Finally, mention is made of the usage of electric motors by ESA in the Ariane project for 1980.

79A11306 ISSUE 1 PAGE 43 CATEGORY 20 RPT#: IAF  
PAPER 78-233 78/10/00 15 PAGES UNCLASSIFIED  
DOCUMENT

**UTTL:** Advanced propulsion systems and solar system spaceships

**AUTH:** A/HUDSON, G. C. PAA: A/(Foundation, Inc., St. Paul, Minn.)  
International Astronautical Federation, International Astronautical Congress, 29th, Dubrovnik, Yugoslavia, Oct. 1-8, 1978, 15 p.

**MAJS:** /\*ENGINE DESIGN/\*NUCLEAR PROPULSION/\*SPACECRAFT CONFIGURATIONS/\*SPACECRAFT PROPULSION

**MINS:** / FISSION FUELS/ NUCLEAR FUSION/ SOLAR SYSTEM

**ABA:** (Author)

**ABS:** A study project has produced a preliminary conceptual design for an advanced nuclear-powered solar-system spaceship with characteristic mission velocities ranging from 120,000 feet per second (36.6 km/sec) to greater than 500,000 ft/sec (152.4 km/sec). The performance of this reusable single-stage spaceship is dependent upon a hybrid pulsed fission/fusion rocket engine configured to allow both high-thrust and high-specific-impulse operation at power levels from a few thousand to more than one hundred thousand megawatts thermal power. The engine is based upon the use of small pellets of fission/fusion fuel mixture which release energy following ablation-driven compression to ultrahigh densities by a relativistic-electron-beam trigger device.

79A26512\* ISSUE 9 PAGE 1692 CATEGORY B4  
78/11/00 5 PAGES UNCLASSIFIED DOCUMENT

**UTTL:** Nuclear power sources in outer space --- spacecraft propulsion legal aspects

**AUTH:** A/HOSENBALL, S. N. PAA: A/(NASA, Washington, D.C.)

**CORP:** National Aeronautics and Space Administration, Washington, D. C.  
Journal of Space Law, vol. 6, Fall 1978, p. 119-123.

**MAJS:** /\*NUCLEAR PROPULSION/\*OUTER SPACE TREATY/\*SPACE LAW/\*SPACECRAFT PROPULSION

**MINS:** / COSMOS SATELLITES/ RADIATION HAZARDS/ UNCONTROLLED REENTRY (SPACECRAFT)/ UNITED NATIONS

**ABA:** B.J.

**ABS:** Legal problems associated with nuclear power sources in space are discussed with particular reference to the Cosmos 954 incident. Deliberations of the Legal and Scientific and Technical Subcommittees on the Peaceful Uses of Outer Space on this subject are discussed.

78N29106# ISSUE 20 PAGE 2626 CATEGORY 7 RPT#:  
AD-A054672 WAES-TNR-234 CNT#: F33615-77-C-0116  
78/03/00 107 PAGES UNCLASSIFIED DOCUMENT

UTTL: Nuclear Bi-Brayton system for aircraft propulsion  
study TLSP: Final Report, 1 Jul. 1977 - 31 Jan. 1978

AUTH: A/THOMPSON, R. E.; B/PIERCE, B. L.; C/CALVO, R.;  
D/CHRISTENSON, J. A.; E/COE, H. D.

CORP: Westinghouse Electric Corp., Pittsburgh, Pa. CSS: (Advanced Energy Systems Div.) AVAILNTIS SAP: HC  
A06/MF A01

MAJS: /\*AIRCRAFT ENGINES/\*BRAYTON CYCLE/\*NUCLEAR PROPULSION  
/\*TURBOFAN ENGINES

MINS: / ENGINE DESIGN/ EXPERIMENTAL DESIGN/ GAS TURBINES

ABA: GRA

ABS: Parametric and reference system definition studies were performed with respect to a new concept for a nuclear aircraft propulsion system. Also studied was a possible method for increasing the payload of a nuclear powered aircraft during wartime. The Bi-Brayton System concept for nuclear propulsion of aircraft has been examined and found to be feasible. The system has been shown to be one which minimizes the component developments required and one which can make effective use of reactor technologies that already exist. Cycle variants and component characteristics were parametrically evaluated and a reference system defined. Weight estimates indicate that with optimized reactor and shielding, the total powerplant and fuel weight for the Innovative Aircraft Design Study Task 2 reference aircraft could be reduced from that predicted for a NuERA liquid metal cooled reactor system coupled to an open Brayton cycle turbofan engine. The Bi-Brayton system combined with a compact gas-cooled (NERVA derivative) reactor was found to be a desirable system for nuclear aircraft propulsion and is recommended for consideration in any further studies of nuclear propelled aircraft.

78A18922 ISSUE 6 PAGE 939 CATEGORY 20 77/06/00  
7 PAGES In ITALIAN UNCLASSIFIED DOCUMENT

UTTL: Gas core nuclear reactors for space propulsion

AUTH: A/REIBALDI, G.  
L'Aerotecnica - Missili e Spazio, vol. 56, June 1977,  
p. 97-103. In Italian.

MAJS: /\*NUCLEAR PROPULSION/\*REACTOR DESIGN/\*SPACECRAFT  
PROPULSION

MINS: / NUCLEAR ELECTRIC PROPULSION/ SPACECRAFT POWER  
SUPPLIES/ SPECIFIC IMPULSE

ABA: J.M.B.

ABS: Gas core nuclear reactors, capable of providing hydrogen propellant temperatures of 10,000 to 20,000 K, are studied as a means of efficiently producing high specific impulse for spacecraft propulsion systems. Attention is given to the open-cycle space Radiator-Cooled Gas Core Nuclear Reactor and the closed-cycle Light Bulb Gas Core Nuclear Reactor, two designs under development by NASA. Investigations of gaseous fuel limitations, radiative heat transfer problems, and nuclear confinement schemes associated with the designs are reviewed. The possibility of using the gas core nuclear reactor concept for electric power generation is also mentioned.

77A42996 ISSUE 20 PAGE 3380 CATEGORY 20  
77/03/00 7 PAGES In GERMAN UNCLASSIFIED DOCUMENT

UTTL: From Wernher von Braun's first thoughts on nuclear propulsion to subnuclear propulsion of the future

AUTH: A/WINTERBERG, F. PAA: A/(Nevada, University, Reno, Nev.)  
Astronautik, vol. 14, 1st Quarter, 1977, p. 5-11. In German.

ABA: R.D.V.

ABS: The feasibility of propulsion systems based on energy derived from nuclear fission, thermonuclear fusion, antimatter/matter interaction, and a high-G magnetic ramjet system for interstellar travel is evaluated. Prodigious energies associated with quasars and BL Lacertae objects might be tapped by utilizing ultrastrong magnetic fields (10 to 17th or 18th power G) to release subnuclear particle fragments (quarks, magnetic monopoles) of negative gravitational mass. This might be achieved with the aid of X-ray lasers plus some type of superaccelerators. This in turn could lead to the fabrication of ultratough ultrarefractory materials, utilization of repulsive gravitational action (possibly involved in quasars), and reduction of effective takeoff weight by many orders of magnitude.

77A45618 ISSUE 21 PAGE 3555 CATEGORY 20  
77/09/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Rocket propulsion by staged thermonuclear  
microexplosions

AUTH: A/WINTERBERG, F. PAA: A/(Nevada, University, Reno,  
Nev.)  
(International Astronautical Federation, International  
Astronautical Congress, 27th, Anaheim, Calif., Oct.  
10-16, 1976.) British Interplanetary Society, Journal  
(Interstellar Studies), vol. 30, Sept. 1977, p.  
333-340.

MAJS: /\*CONTROLLED FUSION/\*NUCLEAR PROPULSION/\*SPACECRAFT  
PROPULSION/\*THERMONUCLEAR EXPLOSIONS

MINS: / INTERSTELLAR TRAVEL/ NUCLEAR ROCKET ENGINES/ SHOCK  
WAVES

ABA: (Author)

ABS: Staged thermonuclear microexplosions promise (1) very  
large yields and (2) should make possible the ignition  
of thermonuclear reactions leading only to charged  
fusion products. These two properties of staged  
thermonuclear microexplosions should be of great  
importance if applied to rocket propulsion requiring  
(1) a compact fissionless trigger device, (2) a large  
yield and (3) a small amount of neutron radiation, all  
of which reduce the mass of the radiator for the waste  
heat to be removed from the spacecraft. Four possible  
methods for microexplosion staging are presented based  
on (1) a shockwave lens, (2) a shockwave mirror, (3)  
adiabatic Prandtl-Meyer flow, and (4) a sequence of  
magnetic cusps, refocusing the energy on subsequent  
thermonuclear targets. The initial trigger apparatus  
is preferably an electron- or ion-beam generator. The  
presented method may ultimately permit the  
attainability of interstellar space flight, as in the  
Project Daedalus study of the British Interplanetary  
Society, but unlike it, without depending on the  
extremely rare He-3 isotope.

77A13017\*4 ISSUE 3 PAGE 317 CATEGORY 20 RPT#:  
AIAA PAPER 76-1042 76/11/00 12 PAGES UNCLASSIFIED  
DOCUMENT

UTTL: A thrust-sheet propulsion concept using fissionable  
elements

AUTH: A/MOECKEL, W. E. PAA: A/(NASA, Lewis Research  
Center, Cleveland, Ohio)

CORP: National Aeronautics and Space Administration, Lewis  
Research Center, Cleveland, Ohio,  
American Institute of Aeronautics and Astronautics,  
International Electric Propulsion Conference, Key  
Biscayne, Fla., Nov. 14-17, 1976, 12 p.

MAJS: /\*FISSIONABLE MATERIALS/\*NUCLEAR PROPULSION/\*  
SPACECRAFT PROPULSION

MINS: / CALIFORNIUM ISOTOPES/ EXHAUST VELOCITY/ FILM  
THICKNESS/ MISSION PLANNING/ SHEETS/ SOLAR PROPULSION/  
STRESS ANALYSIS/ THERMAL RADIATION/ THRUST-WEIGHT  
RATIO

ABA: (Author)

ABS: A space propulsion concept is proposed and analyzed  
which consists of a thin sheet coated on one side with  
fissionable material, so that nuclear power is  
converted directly into propulsive power. Thrust is  
available both from ejected fission fragments and from  
thermal radiation. Optimum thicknesses are determined  
for the active and substrate layers. This concept is  
shown to have potential mission capability (in terms  
of velocity increments) superior to that of all other  
advanced propulsion concepts for which performance  
estimates are available. A suitable spontaneously  
fissioning material such as Cf-254 could provide an  
extremely high-performance first stage beyond earth  
orbit. In contrast with some other advanced nuclear  
propulsion concepts, there is no minimum size below  
which this concept is infeasible.

IMMOBILISATION OF HIGH LEVEL NUCLEAR REACTOR WASTES IN SYNROC, by A.E. Ringwood, S.E. Kesson, N.G. Ware, W. Hibberson and A. Major. Nature, vol. 278, no. 5701, March 1979, p.219-222.

*The elements occurring in high-level nuclear reactor wastes can be safely immobilised by incorporating them within the crystal lattices of the constituent minerals of a synthetic rock (SYNROC). The preferred form of SYNROC can accept up to 20% of high level waste calcine to form dilute solid solutions. The constituent minerals, or close structural analogues, have survived in a wide range of geochemical environments for periods of 20-2,000 Myr whilst immobilising the same elements present in nuclear wastes. SYNROC is unaffected by leaching for 24 h in pure water or 10 wt % NaCl solution at high temperatures and pressure whereas borosilicate glasses completely decompose in a few hours in much less severe hydrothermal conditions. The combination of these leaching results with the geological evidence of long-term stability indicates that SYNROC would be vastly superior to glass in its capacity to safely immobilise nuclear wastes, when buried in a suitable geological repository. A dense, compact, mechanically strong form of SYNROC suitable for geological disposal can be produced by a process as economical as that which incorporates radwaste in borosilicate glasses.*

14296 EARTHQUAKE RESPONSE OF NUCLEAR FACILITIES

KEY WORDS: Dynamic structural analysis; Earthquakes; Mathematical models; Nuclear power plants; Responses; Safety; Seismic design; Soil-structure interaction; Structural engineering; Time factors

09912

ABSTRACT: Differences between design of nuclear facilities and conventional structures are noted. The seismic design process begins with site investigation. Two design earthquakes, the operating basis earthquake (OBE) and safe shutdown earthquake (SSE), are determined from a study of historical seismicity, geology, and tectonics. The OBE has a reasonable probability of occurrence during the facility design life. The SSE is based on maximum earthquake potential for the site. Conventional structures are commonly designed for earthquake levels corresponding to the OBE. Ductile inelastic behavior is considered acceptable response. Nuclear facilities are designed to remain elastic under the larger SSE loading. Seismic analysis is performed in phases beginning with overall analysis of structure and soil that determines gross motions. Soil-structure interaction is analyzed by either the impedance function approach or finite element method. Response from this analysis is used for more detailed analyses of structures or components. Ultimately all structures and components necessary for safety are seismically qualified by analysis or test.

REFERENCE: Johnson, James J., and Kennedy, Robert P., "Earthquake Response of Nuclear Power Facilities," *Journal of the Energy Division, ASCE*, Vol. 105, No. EY1, Proc. Paper 14296, January, 1979, pp. 15-32

BURYING NUCLEAR TRASH WHERE IT WILL STAY PUT, by Edmund Faltermeier. Fortune, vol. 99, no. 6, March 1979, p.98-104.

Even some opponents of fission power agree that radioactive wastes can be interred safely. The main obstacles are not technical but political.

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THE COSTS OF NUCLEAR ACCIDENTS AND ABANDONMENTS IN RATE MAKING. George A. Avery.

Public Utilities Fortnightly, vol 104, no 10, November 8, 1979. p. 17-23.

*Herewith is a timely discussion of the consequences of a nuclear accident which directly affect an electric utility's cost of service and plant investment, including rate base effects of extended shutdowns or even total abandonments of nuclear generating plants, expenses of responding to an accident and to the damage it causes, and the cost of replacement power. The author also turns his attention to the questions of the necessity and propriety of risk-sharing measures which may enable nuclear electric utilities to cope better with the problems — unique in degree if not in nature — which result from the occurrence of a major nuclear incident. His article is adapted from an address delivered at the 1979 P.U.R. Utility Regulatory Conference in Washington, D. C.*

ACCIDENT ANALYSES PERFORMED FOR THE NORWEGIAN COMMISSION ON NUCLEAR POWER. U. Tveten, D. Thomassen and E. Kvaal.

Progress in Nuclear Energy, vol 4, no 3, 1979, p. 215-254.

**Abstract**—This report is a description of various aspects of the calculation models and the specific data applied for reactor accident risk calculations for Norwegian conditions. The calculations were performed for two sites with the computer program CRAC, which was also used in the American Reactor Safety Study (WASH-1400).

— Release characteristics and probabilities of release are adopted from WASH-1400. Data specific for the two arbitrarily chosen Norwegian sites (e.g. meteorology, population distribution and land characteristics) are used. The applied cost data are also specific for Norway.

The results are presented as complementary cumulative probability distributions of the different types of consequences (i.e. acute fatalities, cancer fatalities, total manrem and economic loss).

This work was performed as part of the work for the Norwegian Government Commission on Nuclear Power. The calculations are also presented in the report from the Commission (also available in English).

NUCLEAR POWER AND RADIOACTIVE WASTE MANAGEMENT, by F.S. Feates, Contemporary Physics, vol. 19, no. 6, Nov. 1978, p.531-542.

**ABSTRACT.** The generation of electrical power by nuclear means leads to a very considerable reduction in the quantities of waste which would result from the use of any other fuel. The wastes possess particular hazards which diminish with time. They are most dangerous during the first 500 years whilst fission products are decaying; subsequently their toxicity is comparable with that of many industrial chemicals which are currently in widespread use. There is no reason to believe that environmentally satisfactory disposal means cannot be found either on or under the ocean bed or below the surface of the earth. Nevertheless, since so little waste is involved considerable care can be devoted to ensure that whatever disposal method is selected is safe. The standards to be adopted are that any disposal method selected will, even in the worst conceivable situation, not lead to a significant increase in the exposure man already receives due to radioactivity arising from natural sources.

THE INFLUENCE OF METEOROLOGICAL PARAMETERS ON THE CONSEQUENCES OF ACCIDENTAL ACTIVITY RELEASES FROM NUCLEAR POWER PLANTS. S. Vogt and W. G. Hubschmann

Nuclear Technology, vol 46, no 2, December 1979, p. 300-305.

*In case of accidental activity releases to the atmosphere, meteorological parameters have a strong influence on the radiological impact to the population. This influence is treated separately and is presented in the form of normalized dose statistics. It is shown that activity deposition on the ground constitutes the predominant exposure pathway and that, consequently, precipitation situations lead to the most critical consequences for the population.*

*The analysis is carried out using a limited number of weather sequences. It is shown that the effect on the results is small if this number is reduced from 1750 to 115, provided that rain is adequately represented. Major differences are found for the maximum dose, but not for the average, the variance, and the fraction by which the threshold dose of acute health effects is exceeded.*

NUCLEAR ENGINEERING QUESTIONS: POWER, REPROCESSING, WASTE, DECONTAMINATION, FUSION. R.D. Walton, Jr., ed.

American Institute of Chemical Engineers  
DECONTAMINATION AND DECOMMISSIONING OF NUCLEAR FACILITIES

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VACUUM TECHNOLOGY FOR MAGNETIC FUSION RESEARCH,  
Energy and Technology Review, February 1979, p.16-46.

*We have been developing advanced vacuum techniques to meet the exacting needs of the magnetic fusion experimental program. To provide the extreme vacuums and large pumping speeds demanded by future magnetic fusion experiments, we are developing argon cryosorption systems capable of pumping mixtures of hydrogen and helium. We are now preparing to build a pump for testing under the conditions expected in a full-scale magnetic fusion reactor.*

GEOLOGIC DISPOSAL OF NUCLEAR WASTES: SALT'S LEAD IS CHALLENGED.

Science, vol 204, no 4393, May 1979, p. 603-610.

From salt beds to the seabed, most proposed geologic media are still very much in the running.

NUCLEAR POWER REACTOR SAFETY. PART 2.  
(Presented at the ENS/ANS International Meeting, Brussels, Belgium, Oct.16-19,1978).

European Nuclear Society  
American Nuclear Society

TECHNOLOGY ASSESSMENT AND NUCLEAR WASTE MANAGEMENT,  
by LaVerne E. Trevorow and Martin J. Steindler.  
Chemtech, vol. 9, no. 2, February 1979, p.88-96.

In what framework can one think fruitfully about a technology as complex as transporting, processing, recycling, and husbanding something as controversial as a radioactive energy source? Trevorow and Steindler tell how it was done at Argonne.

**Nuclear Reactor Safety**

by J.L. Head, A.J.H. Goddard & P.J. Grant

Physics Reports, Vol. 53, No. 4, July 1979, p. 249-339

An account is given of the basic physics and engineering underlying the design of nuclear reactors, descriptions of the types of reactor currently operating, the principles of reactor fault detection and control, safety analysis and hazards assessment. The more serious hypothetical accidents are reviewed for water cooled and gas cooled reactors and for the liquid metal cooled fast breeder reactor. Safety criteria and the siting of nuclear power stations are discussed and illustrated by reference to procedures in the U.K. and a short examination is made of the environmental effects of nuclear power, spent fuel re-processing and the storage of highly radioactive waste.

**ROCK CAVITY CONSTRUCTION OF A NUCLEAR POWER PLANT--A CASE STUDY.** P. CHR. Loken. and J. Bakke, and I. Gloerser.

Nuclear Technology, vol 42, no 2, February 1979. p. 155-162.

*The major findings of a comprehensive study of the major aspects of rock cavity construction of a large nuclear power plant are:*

1. *Current technology is adequate for the realization of such construction.*

2. *A method for estimating the probability of rock fallout and gross cavity instability is presently not available.*

3. *Certain design modifications and amplifications must be made to prevent dependent failures.*

4. *No significant reduction in the immediate radiological effects of Class 9 accidents will result unless special design measures are made for this purpose.*

AICHE Symposium Series, v.75, no.191 1979

**NUCLEAR ENGINEERING QUESTIONS: POWER, REPROCESSING, WASTE, DECONTAMINATION, FUSION.** R.D. Walton, Jr., ed.

American Institute of Chemical Engineers

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LONG-TERM MANAGEMENT OF COMMERCIAL HIGH-LEVEL WASTE

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**NUCLEAR SAFEGUARDS: A CONGRESSIONAL PERSPECTIVE.**  
 L. Weiss.  
*Bull. Atomic Scientists*, v.34, no.3, Mar.1978, p.27-33.

The Indian nuclear test woke Congress up; a Senate staff member reports on congressional efforts since then to provide more stringent controls over U.S. nuclear exports.

46	NUCLEAR POWER AND THE PROLIFERATION ISSUE
47	Walter Marshall Physics in Technology, Vol. 9, No. 3, May 1978, p. 115-127.
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56	The continuing controversy on fuel cycles and the risk of nuclear weapons proliferation and diversion of plutonium has prompted Dr Marshall to reassess the basic arguments for and against the fast reactor. He argues that a policy of incinerating plutonium in a suitable design of fast reactor would not only 'lock up' most of the world's plutonium but would also drastically reduce the stockpile inevitably generated by thermal reactors
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87	NATURAL CONVECTION STUDIES IN NUCLEAR SPENT FUEL SHIPPING CASKS: COMPUTATION AND EXPERIMENT.
88	David W. Larson, David K. Gartling, & Walter P. Schimmel Jr. Journal of Energy, Vol. 2, No. 3, May/June 1978, p. 147-154.
93	
100	Two computational procedures and one experimental method developed to investigate the problem of thermally driven enclosed natural convection are briefly described. The numerical techniques include a finite-difference method (FDM) and a finite-element method (FEM). Use of these methods to solve the coupled conservation equations results in a determination of the temperature and velocity fields for the geometry of interest. The experimental method is an optical procedure (laser holographic interferometry) that yields the temperature field of the thermal convection problem.
105	

**NUCLEAR WASTE DISPOSAL: RADIOLOGICAL PROTECTION ASPECTS**

Marion Hill & Paul Grimwood  
NewsScientist, vol. 78, no. 1102, May 1978, p. 375-377

Of the methods which have been proposed for disposal of high-activity wastes from nuclear power programmes, those which appear to be practicable using current technology are disposal into deep geological formations on land and emplacement on, or under, the ocean floor. All these options are being studied in various countries. Geological disposal on land, in particular, is under intensive investigation in Europe and the United States.

The National Radiological Protection Board (NRPB) has recently completed a preliminary assessment of the potential radiological consequences of geological disposal of vitrified high-level waste\*. Last year NRPB published a similar study relating to disposal on the ocean floor. (see *New Scientist*, vol 73, p 709).

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Nuclear power waste technology / sponsored by the ASME Nuclear Engineering Division : editors, A. A. Mochissi ... [et al.]. — New York : American Society of Mechanical Engineers, c1978.  
vii, 382 p. : ill. ; 26 cm.  
Includes bibliographical references.  
1. Atomic power-plants—Waste disposal.  
2. Atomic power-plants—United States—Waste disposal. I. Mochissi, A. Alan.  
II. American Society of Mechanical Engineers. Nuclear Engineering Division. 621.40'30

**NUCLEAR WASTES: THE SCIENCE OF GEOLOGIC DISPOSAL SEEN AS WEAK.**  
Luther J. Carter  
Science, Vol. 200, No. 4346, June 1978, p. 1135-1137

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Greater Los Angeles Area Energy Symposium, Los Angeles, 1978.

Greater Los Angeles Area Energy Symposium : Tuesday, May 23, 1978 ... Los Angeles,

• Underground Nuclear Power Plant Siting — R. Brown, S and I Engineers P133

The feasibility of placing a nuclear power generating station in an underground "berm-contained" configuration has been examined. The results of the examination from technical, economic and regulatory standpoints are presented, including the affects and methods of controlling accidents more severe than those currently under consideration.

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American Power Conference, 40th, Illinois Institute of Technology, 1978.  
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Radioactive Waste Disposal ..... 69

JOHN M. DEUTCH, United States Department of Energy, Washington, D.C.

Mechanical engineering--Congresses. I. Illinois Institute of Technology, Chicago.

**NUCLEAR WASTE DISPOSAL : THE GEOLOGICAL ASPECTS**  
Neill Chapman, David Gray and John Mather  
New Scientist, vol. 78, no.1110, April 27, 1978  
p.225-227

Concern has crystallised over the issue of "high-level" waste (HLW), the disposal of which by burial deep in rock formations has been mooted as the most feasible option. Such an option is currently the object of research programmes in several countries, including the UK. For example, the recent moratorium on nuclear power development in Sweden, until the major issue of waste disposal is accepted as resolvable, has led to the rapid instigation of both experimental and theoretical studies of geological disposal.

REPORT TO THE AMERICAN PHYSICAL SOCIETY BY THE STUDY GROUP ON NUCLEAR FUELS CYCLES AND WASTE MANAGEMENT  
Review of Modern Physics, v.50, no.1. Part II,  
January 1978, pp.85-8185

Utilization of nuclear fuels and management of nuclear wastes have become major topics of public discussion. Under the auspices of the American Physical Society this study was undertaken as an independent evaluation of technical issues in the use of fissionable materials in nuclear fuel cycles, together with their principal economic, environmental, health and safety implications. Reprocessing and recycling in light water reactors were examined, along with technical measures proposed as possible safeguards; advanced reactor fuel cycles were also studied for their resource and safeguards implications. Much of the work of the group centered on the principal alternatives for disposal of radioactive wastes and control of effluents. The group examined the research and development programs sponsored by government agencies along with associated relationships among agencies and between government and private industry. Available information was also considered on nuclear fuel resources, and on important economic and environmental aspects of the various fuel cycles in order to strive for a balanced comparative study.

**NUCLEAR POWER AND NUCLEAR-WEAPONS PROLIFERATION.**  
Ernest J. Moniz and Thomas L. Neff  
Physics Today, Vol. 31, no. 4, April 1978, p.42-51.

For decades, nuclear power has been considered a major component in the energy supply plans of some countries and an important option for the future in others. Like other energy sources, especially oil, nuclear power has become linked to national security and economic health in many countries; the magnitude of fuel reserves and the assurance of sup-

ply have become issues of intense international concern. However, nuclear power raises an additional issue: its potential for contributing to the acquisition of nuclear weapons by nations or even by terrorist groups. The goals of adequate energy supply and nuclear-weapons nonproliferation are therefore potentially in conflict.

**NUCLEAR WASTE: INCREASING SCALE AND SOCIOPOLITICAL IMPACTS.**

Todd R. La Porte  
Science, Vol. 201, No. 4350, July 7, 1978,  
p. 22-28.

**The shorter-term impacts of large-scale nuclear waste operations should be examined.**

**NUCLEAR WASTE: DISPOSAL OR??**

Ralph V. Carlone  
Aerospace and Electronic Systems, Vol. AES-14,  
No. 4, July 1978, p. 616-622.

This paper originated as two separate reports: *Cleaning Up the Remains of Nuclear Facilities—A Multibillion Dollar Problem*, a report to the Congress by the Comptroller General of the United States, Jun. 16, 1977, (EMD-77-46); and *Nuclear Energy's Dilemma: Disposing of Hazardous Radioactive Waste Safely*, a report to the Congress by the comptroller General of the United States, September 9, 1977, (EMD-77-41).

As presented here, this is essentially the full statement as presented in hearings before the Wisconsin Public Service Commission, Madison, Wisconsin, as part of the Commission's continuing hearings on "advance plans for construction of facilities" as filed with the Commission for review and approval pursuant to Section 196.49, Wisconsin Statutes.

**NUCLEAR POWER—SHORTED BY THE WASTE PROBLEM?**, by Dan Brown  
Chemical Engineering, vol. 85, no. 22, October 1978  
p. 74-76

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**Everyone, it seems, has been caught napping, as spent fuel accumulates at nuclear plants all over the world. But Europeans are making plans to reprocess the material and store end-wastes, while the U.S. has yet to launch a definitive program.**

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**WHAT ARE WE GOING TO DO ABOUT NUCLEAR WASTE?**

by Arthur Fisher.  
Popular Science, vol. 213, no. 6, December 1978,  
p. 90-.

**Will our nuclear programs leave a legacy of disaster for future generations, or are there safe ways to dispose of radioactive refuse?**

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REPORT TO THE AMERICAN PHYSICAL SOCIETY BY THE STUDY  
GROUP ON NUCLEAR FUEL CYCLES AND WASTE MANAGEMENT

Review of Modern Physics, v.50, no.1, Part II,  
January 1978, ppS5-S185

Utilization of nuclear fuels and management of nuclear wastes have become major topics of public discussion. Under the auspices of the American Physical Society this study was undertaken as an independent evaluation of technical issues in the use of fissionable materials in nuclear fuel cycles, together with their principal economic, environmental, health and safety implications. Reprocessing and recycling in light water reactors were examined, along with technical measures proposed as possible safeguards; advanced reactor fuel cycles were also studied for their resource and safeguards implications. Much of the work of the group centered on the principal alternatives for disposal of radioactive wastes and control of effluents. The group examined the research and development programs sponsored by government agencies along with associated relationships among agencies and between government and private industry. Available information was also considered on nuclear fuel resources, and on important economic and environmental aspects of the various fuel cycles in order to strive for a balanced comparative study.

DEVELOPING CRITERIA FOR THE MANAGEMENT OF  
NUCLEAR WASTES

Richard A. Heckman  
Energy and Technology Review  
Vol.           no.           October 1977  
p. 9-18

We are studying the handling, transportation, and storage of high-level radioactive wastes. Our findings will provide a technical basis for Nuclear Regulatory Commission standards and regulations for the management of nuclear wastes.

NUCLEAR WASTE DISPOSAL: NOT IN MY BACKYARD.

Alan Jakimo & Irvin C. Bupp  
Technology Review, Vol. 80, No. 5, March/April  
1978, p. 64-72.

Technology to solve the waste disposal problem is at hand. But while we hammer out safety standards to govern its use, spent fuel continues to accumulate.

NUCLEAR WASTE DISPOSAL: CAN THE GEOLOGIST  
GUARANTEE ISOLATION?

G. de Marsily, E. Ledoux, A. Barbreau,  
and J. Margat

Science, August 5, 1977, vol. 197, no. 4303,  
p. 519 - 527

Parameters governing possible mechanisms of migration  
of radionuclides in geologic formations are discussed.

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Intersociety Energy Conversion Engineering  
Conference, 12th, Washington, 1977.  
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1. Direct energy conversion—Congresses.
2. Energy conservation—Congresses.
- I. American Nuclear Society.

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779164 — Beneficial Utilization of Nuclear Waste—  
1977, G. P. Dix, ERDA, Washington, D.C. .... 1046

NUCLEAR WASTES: POPULAR ANTI-PATHY NARROWS SEARCH  
FOR DISPOSAL SITES.

L.J. Carter.  
Science, v.197, Sept.25,1977, p.1265-66.

Local political attitudes now loom as large as geological criteria in the government's increasingly troubled attempt to find sites for the permanent disposal of radioactive wastes. In fact, the strong popular antipathy aroused in some regions by the possibility that a waste repository might be built there seems to

have led the Energy Research and Development Administration (ERDA)\* to pin much of its hopes on the still sympathetic attitude found in three western states that have long been intimately involved with the atom—Washington, New Mexico, and Nevada.

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.P4P Perspectives on the energy crisis : technical, regulatory, environmental, economic, prospective. / advisory editors, Howard Gordon, Roy Meador. — Ann Arbor, Mich. : Ann Arbor Science Publishers, c1977.  
2 v. : ill. ; 29 cm.

NUCLEAR POWER: THE FIFTH HORSEMAN . . . . . 257

(Excerpts from Worldwatch Paper 6, The Worldwatch Institute, May 1976. Paper written by Denis Hayes)

The author is a notable analyst of energy problems and critic of policies. This evaluation of nuclear power is part of a continuing reexamination. The pressing questions of nuclear safety and radioactive waste disposal resist easy answers. The facts and arguments in this study contribute usefully to a dialogue of persistent concern.

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NUCLEAR OPERATIONS AND THE ENVIRONMENT . . . 263

(By W. P. Bebbington, Atomic Energy Division, E. I. du Pont de Nemours & Company, for the U.S. Atomic Energy Commission)

The Savannah River Plant nuclear activities are analyzed in terms of environmental safety and regular monitoring. Types of radioactive releases, possible accidents, and safety records are included. Conclusion: safe operation at nuclear sites has been outstanding. This has not been the result of good luck, but of knowledge and conscientious safety practices.

TWO HISTORICAL STATEMENTS ON NUCLEAR ENERGY . . . . . 287

1. Scientists' Statement on Energy Policy.
2. Invitation from the Committee for Nuclear Responsibility.

These two much-quoted documents represent divergent points of view on nuclear energy. One group, including numerous Nobel Laureates, support nuclear expansion efforts. The other group, also with its Nobel winners, opposes for the reasons given. It is said that from the debate among reasonable men, truth emerges. On nuclear energy, the debate still proceeds.

THE DISPOSAL OF RADIOACTIVE WASTES FROM FISSION REACTORS.

Bernard L. Cohen

Scientific American, vol. 236, no. 6, June 1977, p. 21-31

High level radioactive wastes can be stored satisfactorily in deep geological formations.

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Nuclear power reactor safety / E. E. Lewis. New York : Wiley, c1977.  
xvi, 630 p. : ill. ; 24 cm.  
'A Wiley-Interscience publication.'  
Includes index.  
1. Nuclear reactors -- Safety measures. 2. Nuclear reactors -- Accidents. I. Title.  
621.4835 77-21360 0-471533-35-1  
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HIGH-LEVEL AND LONG-LIVED RADIOACTIVE WASTE DISPOSAL.  
E.E. Angino.  
Science, v.198, Dec.2,1977, p.885-890.

*Summary.* No uniform international approach for handling the problem of high-level radioactive waste disposal exists. All the while, the volume of these wastes continues to grow. The only viable solution to the disposal problem is a geologic one. Burial of these wastes in solid form for long periods of time in mined cavities in salt or Precambrian crystalline rock formations is technically possible. Several steps in the burial process have already been demonstrated in Germany. The problem becomes more serious as the number of countries committed to the use of nuclear energy grows. If one considers the problems of seismic stability and worldwide distribution of salt deposits, the overwhelming need for an international solution to the waste disposal problem seems obvious.

RADIOACTIVE WASTES: A COMPARISON OF U.S. MILITARY AND CIVILIAN INVENTORIES.

H. Krugmann and F. von Hippel.  
Science, v.197, 1977, p.883-885.

*Abstract.* Contrary to widespread belief, the accumulated inventory of fission products generated by the still small U.S. civilian nuclear power industry may already be comparable to that generated in the past by U.S. military nuclear programs. Although the volumes of the military wastes are very large, they are on the average almost 100 times more dilute than projected commercial high-level wastes.

THE COST EFFECTIVENESS OF REMOTE NUCLEAR REACTOR SITING.

F Niehaus and H.J. Otway.

Nuc. Technology, v.34, Aug.1977, p.387-

*By using an idealized model, the reduction in potential radiation risks, as a function of increasing distance between nuclear power plant and load center, was compared to the corresponding increase in power transmission costs. Based on the U.S. Nuclear Regulatory Commission guideline of \$1000/man-rem, remote siting was not found to be a cost-effective risk-reduction method. However, this guideline applies only to the biological risks of radiation exposure, explicitly excluding measures of the relevant social values. It is suggested that methodologies from many disciplines can be applied within the risk assessment framework to allow the inclusion of value measures in public decisions that regulate the integration of technological and social systems.*

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NUCLEAR ENERGY FORECASTS AND THE INTERNATIONAL SAFEGUARDS SYSTEM

Thomas L. Brewer

Technological Forecasting and Social Change  
Vol. 11 no. 1 1977 p. 9-23.

This paper assesses the impact of the increasing use of nuclear energy on the international safeguards system, and it identifies and assesses options for coping with the anticipated impact. A review of nuclear energy forecasts indicates a need for substantial increases in the financial and personnel resources of the safeguards system over the next decade. The requisite financial increases are probably within the limits of political feasibility, but the personnel needs may become problematic. There is also likely to be a continuing decline in confidence in the effectiveness of the system because of perceptions of inadequate resources and methods. There are several options that could reduce the projected technical and political pressures on the system: a postponement of plutonium recycle; improved materials measurement accuracies; immediate increases in the IAEA inspections staff. There are also options that would supplement the safeguards system and alleviate the pressures on it: multinational fuel cycle centers; a suppliers' cartel-like arrangement, and an International Nuclear Materials Custodial Authority.

N77-24924\*# California Univ., Berkeley. Inst. of Governmental Studies

SPACE DISPOSAL OF NUCLEAR WASTES. VOLUME 1: SOCIO-POLITICAL ASPECTS

T. LaPorte, G. I. Rochlin, D. Metlay, and P. Windham Dec. 1976 252 p refs

(Grants NsG-2160, NCA-2-OR-050-603)

(NASA-CR-153219) Avail: NTIS HC A12/MF A01 CSCI 18G

The history and interpretation of radioactive waste management in the U.S., criteria for choosing from various options for waste disposal, and the impact of nuclear power growth from 1975 to 2000 are discussed. Preconditions for the existence of high level wastes in a form suitable for space disposal are explored. The role of the NASA space shuttle program in the space disposal of nuclear wastes, and the impact on program management, resources and regulation are examined. Author