NASA SP-7043 (05)

ENERGY

A CONTINUING BIBLIOGRAPHY

WITH INDEXES

AUGUST 1975

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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IAA (A-10000 Series)	A75-10001—A75-19576
STAR (N-10000 Series)	N75-10001—N75-15600

Previous publications announced in this series/subject category include:

Energy: A Special Bibliography NASA SP-7042
(Coverage Jan. 1, 1968 through Dec. 31, 1973)

Energy: A Continuing Bibliography NASA SP-7043(01)
(Coverage Jan. 1, 1974 through Mar. 31, 1974)

Energy: A Continuing Bibliography NASA SP-7043(02)
(Coverage Apr. 1, 1974 through Jun. 30, 1974)

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(Coverage Jul. 1, 1974 through Sep. 30, 1974)

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(Coverage Oct. 1, 1974 through Dec. 31, 1974)

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NASA SP-7043 (05)

ENERGY

A Continuing Bibliography

With Indexes

Issue 5

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced from January 1 through March 31, 1975 in:

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*

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AUGUST 1975
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INTRODUCTION

This issue of *Energy: A Continuing Bibliography with Indexes* (NASA SP-7043(05)) lists 337 reports, journal articles, and other documents announced between January 1, 1975 and March 31, 1975 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of this continuing bibliography was published in May 1974 and succeeding issues are published quarterly.

The coverage includes regional, national and international energy systems; research and development on fuels and other sources of energy; energy conversion, transport, transmission, distribution and storage, with special emphasis on use of hydrogen and of solar energy. Also included are methods of locating or using new energy resources. Of special interest is energy for heating, lighting, for powering aircraft, surface vehicles, or other machinery.

Each entry in the bibliography consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged in two major sections, *IAA Entries* and *STAR Entries* in that order. The citation, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR* including the original accession numbers from the respective announcement journals. This procedure, which saves time and money, accounts for the slight variation in citation appearances.

Five indexes—subject, personal author, corporate source, contract number, and report number—are included. The indexes are of the cumulating type throughout the year, with the fourth quarterly publication containing abstracts for the fourth quarter and index references for the four quarterly publications.

AVAILABILITY OF CITED PUBLICATIONS

IAA ENTRIES (A75-10000 Series)

All publications abstracted in this Section are available from the Technical Information Service, American Institute of Aeronautics and Astronautics, Inc. (AIAA), as follows: Paper copies are available at $5.00 per document up to a maximum of 20 pages. The charge for each additional page is 25 cents. Microfiche[1] are available at the rate of $1.50 per microfiche for documents identified by the "#" symbol following the accession number. A number of publications, because of their special characteristics, are available only for reference in the AIAA Technical Information Service Library. Minimum airmail postage to foreign countries is $1.00. Please refer to the accession number, e.g. (A75-10763), when requesting publications.

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GENERAL AVAILABILITY

All publications abstracted in this bibliography are available to the public through the sources as indicated in the *STAR Entries* and *IAA Entries* sections. It is suggested that the bibliography user contact his own library or other local libraries prior to ordering any publication inasmuch as many of the documents have been widely distributed by the issuing agencies, especially NASA. A listing of public collections of NASA documents is included on the inside back cover.

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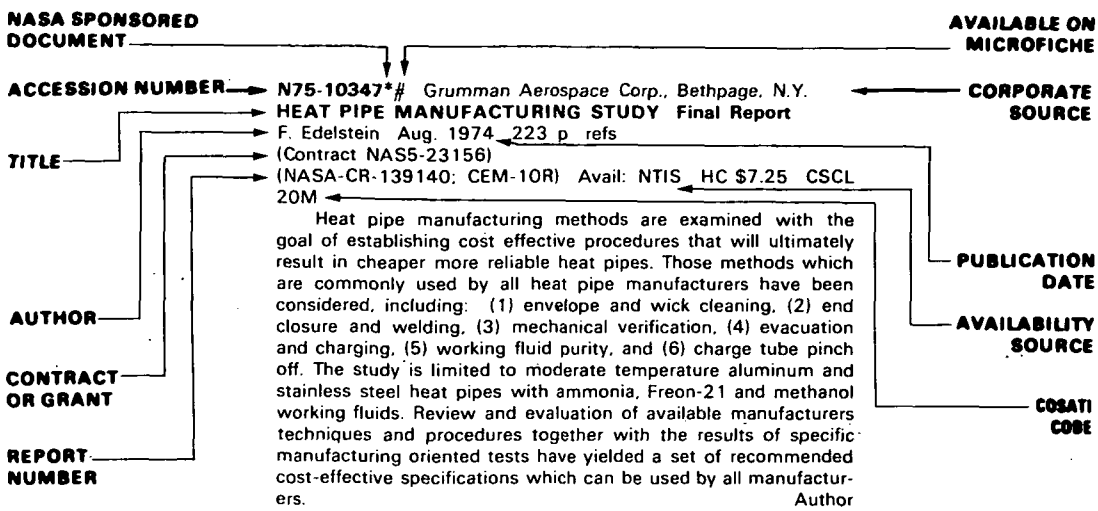

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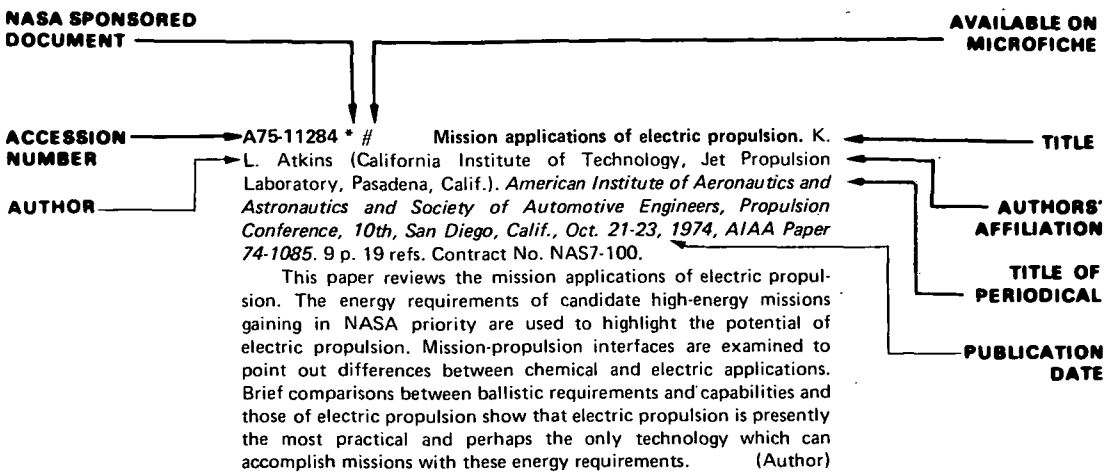

A Listing of Energy Bibliographies Contained in This Publication:

ENERGY

A Continuing Bibliography (Issue 05)

AUGUST 1975

IAA ENTRIES

A75-10259 # **Powerplant energy management.** N. Epstein (General Electric Co., Airline Programs Div., Cincinnati, Ohio). *American Institute of Aeronautics and Astronautics and Society of Automotive Engineers, Propulsion Conference, 10th, San Diego, Calif., Oct. 21-23, 1974, AIAA Paper 74-1066.* 7 p.

Current methods and future developments are reviewed that are aimed at improving the pilot's ability to schedule and control engine thrust in accordance with aircraft power requirements during various flight regimes. These methods vary from normal manual control by the pilot's throttle to a fully automated push-button system implemented by a combination of electronic and hydromechanical devices. Estimates of potential savings in fuel to result from optimum thrust management are presented for modern wide-body transports. Also, modifications in current normal operational/airport practices are suggested, and their impact on fuel consumption is examined.

M.V.E.

A75-10262 # **Combustion dynamics research for 'Project Independence'.** L. R. Lawrence, Jr. and G. S. Lewis, Jr. (USAF, Office of Scientific Research, Arlington, Va.). *American Institute of Aeronautics and Astronautics and Society of Automotive Engineers, Propulsion Conference, 10th, San Diego, Calif., Oct. 21-23, 1974, AIAA Paper 74-1069.* 9 p. 27 refs.

The paper presents areas of research in combustion dynamics that aim to produce cheap, available energy with low required energy input and low pollution. Future fuel sources, and the problems connected with the utilization of these sources in a conventional combustion process are reviewed. For mid-term technology, three government sponsored programs are discussed, one of which is the NASA Experimental Clean Combustor Program developed to examine full-scale low-emission combustors through staged fuel injection.

T.S.

A75-10263 # **MHD energy conversion systems.** J. F. Holt and D. W. Swallom (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, Ohio). *American Institute of Aeronautics and Astronautics and Society of Automotive Engineers, Propulsion Conference, 10th, San Diego, Calif., Oct. 21-23, 1974, AIAA Paper 74-1071.* 7 p.

An open cycle MHD generator burning liquid hydrocarbon fuel with cesium-seeded gaseous oxygen has produced 200 KW at a mass flow rate of 0.6 kg/sec. A dc-dc converter operating at 2000 Hz has been developed to convert the 1000 volt generator output to 50,000 volts. From current test results the potential enthalpy extraction efficiency of MHD generators in the 10 Mw category can be expected to be at least 12%. Commercial MHD power systems with exhaust driving a turbine can have a total cycle efficiency considerably greater than today's power stations. (Author)

A75-10264 # **Nuclear propulsion technology transfer to energy systems.** J. H. Altseimer, J. D. Balcomb, W. E. Keller, and W. A. Ranken (California, University, Los Alamos, N. Mex.). *American Institute of Aeronautics and Astronautics and Society of Automotive Engineers, Propulsion Conference, 10th, San Diego, Calif., Oct. 21-23, 1974, AIAA Paper 74-1072.* 11 p. 24 refs. AEC-NSF-supported research.

At Los Alamos, space technology has been applied to terrestrial energy problems. Four examples illustrate this transfer process: (1) heat pipe technology developed for space power supply systems cooling is being adapted to the methanation of synthetic natural gas from coal, (2) high temperature materials from the Rover nuclear engines are being adapted to an excavation concept based on melting rocks or soils, (3) high temperature graphite fuel technology is being applied to high temperature gas cooled reactors and, (4) cryogenic hydrogen and helium technology is being applied to superconducting electric power transmission and storage systems. An overview description of the above projects is presented in the hopes of stimulating thinking with regard to the transfer of space technology to terrestrial energy problems. (Author)

A75-10437 **Oil exploration needs for digital processing of imagery.** F. F. Sabins, Jr. (Chevron Oil Field Research Co., La Habra, Calif.). *(American Society of Photogrammetry, Annual Convention, St. Louis, Mo., Mar. 11, 1974.) Photogrammetric Engineering,* vol. 40, Oct. 1974, p. 1197-1200.

Survey of the applications of digital image processing in the oil industry. The four major types of imaging sensors employed in oil exploration are aerial photography, thermal infrared, side-looking radar, and Earth Resource Technology Satellite (ERTS). ERTS imagery, because of its availability in a digital format and its use in reconnaissance studies, is shown to have the greatest potential in future digital processing. Well suited for exploration reconnaissance, ERTS imagery is characterized by broad regional coverage, acceptable resolution, and minimum image distortion. A discussion of the objectives and requirements of future image processing is included.

T.S.

A75-10476 **Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings.** Conference sponsored by ASME, IEEE, AIChE, ANS, SAE, ACS, and AIAA. New York, American Society of Mechanical Engineers, 1974. 1356 p. Members, $60.; nonmembers, $70.

Aerospace-power systems and applications are considered along with developments related to solar power, hydrogen energy systems, energy conservation implementation, thermal battery technology, and aspects of fusion and nuclear power. Other areas discussed include biomedical power systems, transportation power systems, coal and shale utilization, and geothermal energy conversion. Questions of MHD power generation are also investigated, giving attention to the MHD power generation system with directly fired coal, the development of a theoretical method for predicting the performance of hydrogen-oxygen MHD generators, and a new steam engine cycle.

G.R.

A75-10477 * Electrical power generation subsystem for Space Shuttle Orbiter. M. F. Blaski (Rockwell International Corp., Space Div., Downey, Calif.) and S. L. Owens (NASA, Johnson Space Center, Houston, Tex.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 1-9.

The requirements, capabilities, and design of the Space Shuttle Orbiter electrical power generation (EPG) subsystem are presented. The Orbiter EPG subsystem is designed to have the flexibility to supply the basic Orbiter electrical loads and the power requirements of the payloads which, in some cases, are completely dependent on the Orbiter for both power and heat rejection. These needs are supplied by three hydrogen/oxygen fuel cell powerplants (FCPs), having the capability of providing a total of 14 kW average and up to 24 kW peak in the basic Orbiter configuration. Kits permit dedication of one FCP to the payload by providing an additional reactant tank pair for a seven-day mission and additional heat rejection capability. (Author)

A75-10481 * Solar electric propulsion spacecraft power subsystem for an Encke comet rendezvous mission. E. N. Costogue (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: Intersociety Energy Conversion Engineering Conference. 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 36-42. Contract No. NAS7-100.

This paper presents the preliminary functional description of a solar electric propulsion spacecraft power subsystem for an Encke comet rendezvous mission in the 1980s. This description has been derived from the study of the mission requirements and constraints and the study of integrating a solar electric propulsion module with an existing spacecraft. Tradeoff studies performed in the process of selecting power subsystem parameters and performance characteristics are described. The power subsystem designs draw heavily on the designs for existing spacecraft and technology being developed in the electric propulsion research and development program supported by NASA. (Author)

A75-10484 Technology considerations for Organic Rankine Cycle Electric Power Systems. J. E. Boretz (TRW Systems Group, Redondo Beach, Calif.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 61-67. 6 refs.

The present work discusses qualitatively the performance, life, and reliability of Organic Rankine Cycle Electric Power Systems (ORCEPS), treating the various cycle characteristics, design margins, environmental factors, operational modes, and potential for commonality. Basic relations describing thermal efficiency of ideal and actual Rankine cycles are set forth, and Carnot and actual Rankine cycle efficiencies are compared for various ORCEPS working fluids. The ORCEPS system operates in a closed cycle fashion with turbine back pressures in the 4 to 10 psia range. Under these conditions, the system is capable of satisfactory operation in a zero-gravity environment. Use of proven, multifoil, compliant, self-energizing hydrodynamic bearings using process fluid lubrication assures ORCEPS system operating life of five years and longer. Modularity, dissipative control, and throttling/by-pass control are three major approaches available for achieving commonality with the ORCEPS electric power systems. P.T.H.

A75-10485 * NASA objectives for improved solar power plants. E. M. Cohn (NASA, Washington, D.C.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 68-74. 10 refs.

The present work describes the principal goals for the main effort of NASA's research and development of solar photovoltaic cells and arrays. These are (1) to reduce array costs from $270/watt to $90/watt (no change in volume) or to $41/watt (high volume production), (2) raise power density from 66 watts/kg to 110 watts/kg, and (3) minimize dynamic interaction problems. The first two goals can be accomplished by increased cell efficiency, reduced cell thickness, the development of a multiple ribbon growth process, and automation of cell production. To minimize dynamic interaction between array and spacecraft, module flexibility will be increased. P.T.H.

A75-10486 Solar cell and array standardization for Air Force spacecraft. H. J. Killian, E. Wade, H. T. Sampson (Aerospace Corp., El Segundo, Calif.), and J. F. Wise (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, Ohio). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 75-79. 10 refs.

The present work discusses some of the benefits and penalties associated with standardization of solar cells and arrays for spacecraft with different missions. Chief advantages would lie in lower procurement costs, improved reliability since 'lessons learned' can be implemented rapidly throughout all programs, and reduced delivery times due to stockpiling of standard hardware items. A procedure used for estimating possible design penalties arising from the use of standard cell and array technology is described, and it is shown that the array area and weight penalties that would be typically involved in the use of a standard solar cell would be at most 10%. Some proposed military standards for the design of spacecraft dc power systems, solar arrays, and solar cells are briefly described. P.T.H.

A75-10496 RTG technology development - Where we are/where we are going. N. Goldenberg (AEC, Space Nuclear Systems Div., Washington, D.C.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 144-146.

Recent advances in RTG (radioisotope thermoelectric generator) technology show promise of doubling current efficiencies. Existing conversion technology is reviewed and compared with technologies currently in development. The status and projections of the selenide thermoelectric program is presented. The objective of the heat source technology program is discussed and the concept of 'no identifiable failure mechanism' defined. The increased emphasis on noble metal technology is examined. (Author)

A75-10497 A modular heat source for curium-244 and plutonium-238. P. F. Aller and R. J. Miskuff (Teledyne Isotopes, Timonium, Md.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 147-151. 12 refs.

Description of a radioisotope thermoelectric generator (RTG) heat source which can be fueled either by curium-244 or by plutonium-238. A modular heat source is described which contains 15 heat source modules stacked end to end, with each module containing two capsules. Each of these capsules contains 155 watts BOL (beginning of life) thermal inventory with curium fuel or 129 watts BOL thermal inventory with plutonium fuel. In a comparison between the proposed modular heat source and the SNAP 19 Pioneer heat source the modular heat source is found to show improved performance. In addition, the modular heat source is shown to fulfill other stated design requirements. A.B.K.

A75-10503 * Performance testing of thermoelectric generators at JPL. P. Rouklove and V. Truscello (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New

York, American Society of Mechanical Engineers, 1974, p. 177-184. Contracts No. AT(03-4)-959; No. NAS7-100.

Results of life tests of thermoelectric generators ranging in output power from 800 microwatts to 170 watts. Emphasis is placed on the results obtained from tests of three advanced prototypes - a high-performance generator, a transit-type generator, and a ring converter. In addition, the results of life tests of a number of generators representing Nimbus, Pioneer, and Viking technology are presented. A.B.K.

A75-10504 * SNAP-19 Viking RTG flight configuration and integration testing. W. M. Brittain and S. T. Christenbury (Teledyne Isotopes, Energy Systems Div., Timonium, Md.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 185-192. NASA-sponsored research.

The Viking-75 mission environments and lander interface requirements which influence the design of the RTG (radioisotope thermoelectric generator), as well as RTG-related constraints are discussed. The baseline RTG design evolved from these considerations is presented with particular emphasis on the design features which make the Viking RTG unique. These features include a gas management system employing a separate gas reservoir to maintain the RTG hot junction and heat source temperatures within a desired range throughout the various mission phases, as well as a specially profiled housing/radiator assembly which facilitates both ground cooling of the RTGs prior to launch and thermal control of the lander after landing. Also presented is the expected RTG electrical performance when subjected to the various mission environments/requirements, such as 'power-up' operations in Mars orbit just prior to the entry, and thermal cycling on the Martian surface after landing. (Author)

A75-10505 Operational testing of the high performance thermoelectric generator /HPG-02/. F. A. Russo (Teledyne Isotopes, Energy Systems Div., Timonium, Md.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 193-196. Contract No. AT(29-2)-2960.

This paper describes the activities and observations leading to the successful development of the HPG-02, a thermoelectric generator of 165 watts output and specific power of greater than 2 watts per pound. Test results showing the temperature equalization effects of the heat pipes on the heat rejection surfaces and the attendant power performance characteristics are presented. In addition, experimental data on relevant long term heat pipe and thermoelectric tests are presented to support the predicted behavior of this generator. It is concluded that the HPG-02 provides an 'off-the-shelf' state of the art power source capable of providing at least 130 watts for five years. (Author)

A75-10506 A 10% efficient economic RTG design. A. R. Lieberman and W. E. Osmeyer (Teledyne Isotopes, Energy Systems Div., Timonium, Md.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 197-203. 9 refs.

Description of the reference design for an economic curium-244 fueled radioisotope thermoelectric generator (RTG), noting its predicted performance and presenting related information concerning the selenide thermoelectrics and the radiator heat pipes employed. The reference design described is an RTG with 400 watts(e) end-of-mission output and features a modular heat source design capable of accepting curium-244 or plutonium-238 fuel, a completely sealed high-efficiency thermoelectric subsystem, a two-piece aluminum fin/housing assembly, and radiator heat pipes for minimal heat rejection area and weight. It is shown that an economic RTG design based on the selenide thermoelectric materials technology has a potential for system efficiencies up to between 13 and 14% at specific powers greater than 11 W/kg. A.B.K.

A75-10507 Cost effective designing for the economic RTG. F. A. Schumann and W. J. Barnett (Teledyne Isotopes, Energy Systems Div., Timonium, Md.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 204-208.

Results of cost tradeoff studies with regard to the Economic Radioisotope Thermoelectric Generator (ERTG), which is to be fueled with curium-244 or plutonium-238 for generation of 400 watts of electrical power at end of mission. Following some comments on the radiation levels and cost of curium-244 and plutonium-238 fuel, a study is made of the possibility of cost reduction through increases in system efficiency, and the results of tradeoff studies to achieve thermal control and a reduction of radiator operating temperature are presented. A.B.K.

A75-10508 Light-weight radioisotope thermoelectric generator design. A. Schock (Fairchild Space and Electronics Co., Germantown, Md.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 209-221. 9 refs. Contract No. AT(49-15)-3063.

Design concepts to reduce RTG weights are described. These concepts are in the area of the isotope heat source, the thermoelectric converter, and the radiator. Their effectiveness is demonstrated by means of an illustrative design for a 360-watt, plutonium-fueled generator with spring-loaded selenide elements. The generator, including necessary safety provisions for various abort modes, has an EOM specific power of 5 to 6 watt/lb. (Author)

A75-10514 Solar farms utilizing low-pressure closed-cycle gas turbines. H. B. Palmer (Pennsylvania State University, University Park, Pa.) and S. C. Kuo (United Aircraft Research Laboratories, East Hartford, Conn.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 264-270.

A critical examination is presented of the previously proposed solar farm concept in which solar flux concentrated by a focusing mirror enters a high-temperature glass pipe through a narrow window. The pipe contains a thin slab of graphite that absorbs the radiation and transfers it as thermal energy to a flowing gas (helium) which exits from the pipe at high temperature into the inlet of a closed-cycle gas turbine. Consideration is given to the mirror-concentrator (for which a somewhat novel device is proposed), the collector pipe, and the gas turbine performance, with special attention to probable losses and achievable efficiency of solar conversion. It is found that flux losses between the top of the atmosphere and the pipe window provide the most serious limitation on the output of the system. The total conversion efficiency (solar to electrical) relative to the flux at the top of the atmosphere is estimated to lie between 4.5 and 5.9%, for seemingly realistic assessments of losses and other performance factors. (Author)

A75-10515 Evaluation of central solar tower power plant. C. R. Easton, R. W. Hallet, Jr., S. Gronich, and R. L. Gervais (McDonnell Douglas Astronautics Co., St. Louis, Mo.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 271-276. NSF-supported research.

A baseline design for heliostat, receiver, tower, and energy transport subsystems for a solar tower power plant has been defined down to the major component level. Preliminary manufacturing plans have been prepared for component fabrication, assembly, and installation. Capital costs have been estimated for the baseline design. The major cost element, other than the power plant, is the heliostat and its supportive equipment. The complete collector system is estimated to cost between $3 and $4/square foot ($30 to $40/square

meter) installed. This corresponds to a levelized, fixed-charge cost for generating energy of 15 to 20 mills/kwhe exclusive operation, maintenance, and plant parasitic load costs, which is competitive with current oil prices and many become competitive with coal at prices projected to the midpoint of operation of the solar power plant. (Author)

A75-10516 The hot deeps of the Red Sea as a potential heat source for thermoelectric power generation. A. Brandstetter and A. Ginzburg (Tel Aviv University, Tel Aviv, Israel). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 277-280. 10 refs.

The hot brine phenomenon in the central Red Sea is described and its potential exploitation discussed within the general context of 'thermal sea power'. Thermoelectric generation via high power density thermopiles is considered as a possible conversion method and a conceptual design of a megawatt size thermoelectric unit is presented and analyzed. Heat input from other hot water sources is also envisioned. (Author)

A75-10517 A planning methodology for the analysis and design of wind-power systems. I. G. Dambolena, F. C. Kaminsky, and R. F. Rikkers (Massachusetts, University, Amherst, Mass.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 281-287. 8 refs.

Review of the results obtained from the analysis of a specific wind-power system for the New England area performed by means of a described computer-based planning model designed to aid in the cost evaluation and performance simulation of alternative wind-power systems. Based on the low-cost promise of these results, it is argued that further research on wind-powered systems should be pursued and that similar planning models should be developed for the evaluation of other alternative energy systems. M.V.E.

A75-10518 A wind energy conversion system based on the tracked-vehicle airfoil concept. R. E. Powe, H. W. Townes, E. H. Bishop, and D. O. Blackketter (Montana State University, Bozeman, Mont.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 288-297. 20 refs. NSF Grant No. GI-39415.

A unique momentum interchange device for extraction of energy from the wind is described. It is shown that the maximum possible energy extraction with this tracked-vehicle airfoil device is greater than that for a conventional windmill. A comprehensive mathematical model is developed for the device, and this model is programmed for solution on a digital computer. This program is written so that wind spectrum data for any geographic location can be used to determine the monthly energy output for that location. Results from this program indicate that this device could make significant contributions to electrical power requirements. For example, a system 8 km long and consisting of airfoils 12 meters in length with a 3-meter chord could supply the electrical energy needs of about 15,000 people. These results are presented in a form which indicates the effect of changing various design parameters. (Author)

A75-10520 Economics analyses of solar energy utilization. G. R. Woodcock and D. L. Gregory (Boeing Co., Seattle, Wash.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 306-316. 30 refs.

In the light of recent engineering studies, some of the major economic and technical problems facing the commercial utilization of solar power are reviewed, and technical approaches are discussed that offer promise for an eventual solution of these problems. Of the various solar/thermal options examined, faceted concentrators with a central tower-mounted absorber are among the most promising. The development of solar energy is shown to be nearing the stage wherein pilot plants will be needed to establish design practicality and cost confidence. M.V.E.

A75-10522 Metal hydrides for thermal energy storage. G. G. Libowitz (Allied Chemical Corp., Morristown, N.J.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 322-325. 8 refs.

Because of the ease of reversibility of metal-hydrogen reactions and the relatively high heats of formation of metal hydrides, it is proposed that these materials be used for storage of thermal energy in solar power applications. A major advantage of using metal-hydrogen systems over other thermal storage materials is the ability to control the rate of heat evolution. The relationships between storable energy and heats of formation and dissociation pressures of hydrides are discussed and applied to several specific hydride systems. The factors to be considered in developing new alloy hydrides are examined. (Author)

A75-10523 A prototype solar powered, Rankine Cycle system providing residential air conditioning and electricity. D. R. Prigmore and R. E. Barber (Barber-Nichols Engineering Co., Denver, Colo.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 326-333. Research supported by Honeywell and NSF.

A75-10524 Solar augmented home heating heat pump system. J. C. Corman (General Electric Co., Schenectady, N.Y.), J. G. McGowan, and W. D. Peters (Massachusetts, University, Amherst, Mass.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 334-340. 12 refs.

A75-10525 Heat mirrors for solar-energy collection and radiation insulation. J. C. C. Fan, T. B. Reed, and J. B. Goodenough (MIT, Lexington, Mass.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 341-346. 12 refs. USAF-sponsored research.

Heat mirrors that reflect the infrared while transmitting the visible spectrum have important applications as transparent thermal insulators for high-temperature furnaces, solar-energy collectors, and windows in buildings. The criteria for a good heat-mirror material vary with the particular application. Generalized figures of merit are developed and used to compare the properties of Drude mirrors with a variety of representative materials. Thin films of highly reflecting metals are contrasted with compounds having a large transparency in the visible and high IR reflectivity. Effects of non-normal incidence of solar energy on the performance of heat mirrors are also discussed. (Author)

A75-10527 Hot side heat exchanger for an ocean thermal difference power plant. R. H. Kirchhoff, J. G. McGowan, J. W. Connell, and D. Seluk (Massachusetts, University, Amherst, Mass.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 354-361. 10 refs.

This paper reports the results of a study to use the kinetic energy of the Gulf Stream to pump the evaporators of an ocean thermal difference power plant. The internal frictional flow in the exchanger was matched to the external potential flow to develop the flow model. The model was merged with a previously developed

Rankine cycle analysis of the plant. Results are presented in terms of boiler core volume as a function of the cycle parameters. Natural pumping is compared to mechanical pumping. Overall power plant size and effects of the varying Gulf Stream velocity are also presented. (Author)

A75-10530 * Status of JPL solar powered experiments for terrestrial applications. R. K. Yasui and J. V. Goldsmith (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 377-388. Contract No. NAS7-100.

Results of an ongoing program set up to evaluate solar terrestrial photovoltaic power sources. The results of this program, which now includes a solar array encapsulant and materials test and a solar-powered buoy study, are updated, and the results of efforts to study the dynamic interaction of a solar photovoltaic array and a water electrolysis system coupled to produce hydrogen are reported for the first time. A.B.K.

A75-10531 Operating experiences with terrestrial solar battery systems in Japan. Y. Baba (Sharp Corp., Nara, Japan). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 389-391.

Results of experiments on the operation of solar battery panels consisting of arrays of modules made of silicon wafers. The results obtained concern the solar battery power, the capacity of the storage battery, the reliability of the solar battery modules, and the reliability of the design of the solar battery and storage battery. A.B.K.

A75-10532 * The generation of hydrogen by the thermal decomposition of water. J. E. Funk (Kentucky, University, Lexington, Ky.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 394-399. 18 refs. Grant No. NGR-18-001-086.

Development of an approach to the evaluation of the thermal efficiency of the process of water splitting to produce hydrogen. A way of viewing thermochemical processes - both overall and step-by-step - is suggested, and some recent work on a process evaluation technique is described which provides internal checks on the thermodynamic data and calculates, in addition to the efficiency, many important process parameters. A.B.K.

A75-10533 Nuclear energy requirements for hydrogen production from water. J. B. Pangborn and D. P. Gregory (Institute of Gas Technology, Chicago, Ill.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 400-404. 15 refs.

Comparative study of the efficiency of the production of hydrogen from water by thermal decomposition using nuclear energy and by nuclear-based electricity production followed by electrolysis. It is shown that high-temperature gas-cooled reactors will be required to make thermochemical hydrogen production more attractive than electrolysis. An estimate is made of the nuclear power capacity required for an economy based on the use of hydrogen as a 'universal' fuel. A.B.K.

A75-10535 Hydrogen cycle peak-shaving for electric utilities. R. A. Fernandes (Niagara Mohawk Power Corp., Syracuse, N.Y.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 413-422. 23 refs.

Consideration of the use of hydrogen-cycle peak-shaving as a means for meeting peak electric load demand while providing additional system benefits. The proposed system consists of an electrolyzer, a hydrogen storage facility, and an electric conversion system such as a fuel cell, or MHD or gas-turbine generator. System data which should be considered in evaluating economic and operating advantages of competing methods of meeting peak energy demands are cited, and peak and average daily load curves at critical switching, subtransmission, and distribution stations are presented for the system considered. Certain factors determining the amount of peak-shaving capacity that can be installed are considered. A.B.K.

A75-10536 Hydrogen for the electric utilities - Long range possibilities. M. Lotker (Northeast Utilities, Hartford, Conn.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 423-427. 6 refs.

Examination of the long-range possibilities for hydrogen in the electric utility industry. It is shown that the industry's present technical and financial structure makes it uniquely qualified to meet the demands of the hydrogen economy and that hydrogen holds several attractions for the industry in fulfilling its obligations to the public to provide reliable, inexpensive, and clean energy. Possible obstacles to utility venture in this area are also discussed. A.B.K.

A75-10537 Energy storage for utilities via hydrogen systems. J. M. Burger, P. A. Lewis (Public Service Electric and Gas Co.), R. J. Isler, F. J. Salzano (Brookhaven National Laboratory, Upton, N.Y.), and J. M. King, Jr. (United Aircraft Corp., Pratt and Whitney Aircraft Div., East Hartford, Conn.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 428-434. 15 refs. *AEC-sponsored research.*

An energy storage concept incorporating hydrogen for use on electric utility systems is discussed, where hydrogen is produced electrolytically with off-peak power, stored, and subsequently reconverted to electricity at peak demand periods. An experimental 12.5 kW system now being operated by Public Service Electric and Gas Company is described. The use of metal hydrides for bulk storage of hydrogen is emphasized and several conceptual designs are discussed. Interface, integration and tradeoffs between components of the entire energy storage system are considered. A storage system cost of $350 per kW electric at an efficiency of 40 to 55% appears to be a practical goal. (Author)

A75-10538 Closed loop chemical systems for energy transmission, conversion and storage. R. E. Hanneman, H. Vakil, and R. H. Wentorf, Jr. (General Electric Co., Schenectady, N.Y.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 435-441.

The basic characteristics, advantages and disadvantages of closed-loop chemical systems for energy transmission, conversion and storage are reviewed, along with the criteria for the selection of promising cycles, materials, and solutions to engineering problems. Several new cycles are described, and a promising system based on hydrogen-oxygen-carbon constituents is discussed in detail. M.V.E.

A75-10540 Energy carriers in space conditioning and automotive applications - A comparison of hydrogen, methane, methanol and electricity. H. Davitian (Cornell University, Ithaca, N.Y.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 454-462. 27 refs.

Consideration of hydrogen, methane, methanol, and electricity as energy-carrier substitutes for petroleum and natural gas, whose

forthcoming replacement as energy sources by fission, fusion, solar, and geothermal energy produced in large stationary power plants creates the need for alternative energy carriers. Space conditioning and automotive transportation are the two energy-carrier application areas discussed, and several methods of employing each energy carrier in each application are investigated. The comparison is based on the net efficiency of energy use and the operating costs for each method of utilization computed on the basis of technology anticipated to be available in the year 2000. M.V.E.

A75-10541 Oxides of nitrogen control techniques for appliance conversion to hydrogen fuel. N. R. Baker (Billings Energy Research Corp., Provo, Utah). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 463-467. 7 refs.

Various methods are presented for converting existing domestic appliances to use hydrogen fuel, with minimal oxides of nitrogen /NO(x)/ production. Results of experiments with mixtures, quenching distances, and burner temperatures are reported. A novel conversion method with minimum expense, time and NO(x) is described. The results of the study were applied to a Winnebago mobile home, as a demonstration of the concepts developed. (Author)

A75-10542 The use of hydrogen in commercial aircraft - An assessment. E. M. Dickson, T. J. Logothetti, J. W. Ryan, and L. W. Weisbecker (Stanford Research Institute, Menlo Park, Calif.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 468-478. 30 refs. NSF-sponsored research.

A review of the main technical and economic considerations pertinent to the use of hydrogen in commercial aircraft indicates that a hydrogen-fueled aviation system makes a great deal of sense, though many technical, institutional, social, environmental, and economic issues need to be understood more clearly before private or public decisions to support a hydrogen-based commercial aviation industry would be justified. The prospects of switching aviation to hydrogen seem much better than those for switching automobiles. M.V.E.

A75-10546 Small coal burning gas turbine for modular integrated utility systems. A. P. Fraas (Oak Ridge National Laboratory, Oak Ridge, Tenn.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 499-507. 13 refs. Research sponsored by the U.S. Department of Housing and Urban Development.

Summary of a series of design studies pertaining to small coal-burning gas turbines for modular integrated utility systems. The effects of major parameters on both the capital cost and the thermal efficiency are discussed. The principal problems in the development of such systems are shown to be associated with the fluidized bed combustion chamber. These problems include the possibility of excessive corrosion, the reliability of the coal-feed and fly-ash-removal equipment, and the extent to which the system can be operated partially unattended. M.V.E.

A75-10547 Potential of Rankine engines to produce power from waste heat streams. R. E. Barber (Barber-Nichols Engineering Co., Denver, Colo.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 508-514. 17 refs.

The utilization of waste heat streams in an organic Rankine cycle system is discussed for the production of useful electrical or shaft power. Following a review of heat recovery Rankine cycle systems and a description of procedures for estimating the potential power output of heat sources, an economic study of the Rankine cycle system is presented. The system is shown capable to produce power at a real cost below that of a coal-fired steam unit and to pay off the capital costs in less than three years based on the current minimum value of electricity (2.2 cents/kW-hr). M.V.E.

A75-10548 Energy from urban wastes. B. L. Pollack and J. C. Uhrmacher (Maryland Environmental Service, Md.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 525-530. 12 refs.

Discussion of some of the technological and economic aspects of energy recovery from urban wastes. About 100 to 200 million tons of domestic solid wastes are generated each year with an average heating value of 5500 Btu/lb as collected. Special attention is given to the treatment of nonhomogeneous waste, including shredding, shredding and separation, gas pyrolysis, oil pyrolysis, and anaerobic digestion, as well as to such homogeneous wastes as waste oil, used tires, and sewage sludge. M.V.E.

A75-10549 Independent energy systems for better efficiency. O. W. Marshall, R. T. Morash, and R. J. Barber (Roesel Laboratories, Bradenton, Fla.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 531-537. 16 refs.

The advantages of on-site power systems in residential and commercial applications are pointed out. A design method for such systems is described. It uses existing engines, coupled with a new variable speed, constant-frequency electrical power generator and super-flywheel energy storage. Projected costs show the typical system can pay for itself in 12 years and have an economic life of 20 years. M.V.E.

A75-10550 A heat pump powered by natural thermal gradients. D. A. Williams and J. B. Tiedemann (Alaska, University, College, Alaska). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 538-540.

Use of natural thermal gradients to heat a dwelling at a higher temperature than that of the natural source is illustrated by a numerical example involving a three-stage aqua-ammonia absorption system operating between sea water and cold air. With a large water storage pond, solar energy can provide year-round heating in subarctic regions. (Author)

A75-10551 * The Energy Systems Optimization Computer Program /ESOP/ developed for Modular Integrated Utility Systems /MIUS/ analysis. S. L. Ferden, W. C. Rochelle, R. D. Stallings (Lockheed Electronics Co., Inc., Houston, Tex.), A. E. Brandli, and C. F. Lively, Jr. (NASA, Johson Space Center, Houston, Tex.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 541-546. 21 refs.

A significant energy and cost savings can be obtained by integrating various utility services (space heating and cooling, electrical power generation, solid waste disposal, potable water, and waste water treatment) into a single unit which provides buildings or groups of buildings with these services. This paper presents a description of a computer program, called the Energy Systems Optimization Program (ESOP). This program predicts the loads, energy requirements, equipment sizes, and life-cycle costs of alternative methods of meeting these utility requirements. The program has been used extensively for performing energy analyses of Modular Integrated Utility Systems (MIUS). (Author)

A75-10553 **Thermal energy storage devices suitable for solar heating.** H. G. Lorsch (Pennsylvania, University, Philadelphia, Pa.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 572-577. 8 refs. NSF Grant No. GI-27976.

Comparison of thermal energy storage devices suitable for space heating by solar energy and using latent heat or sensible heat. Operational penalties for sensible heat storage due to reduced solar collector performance with rising storage temperatures are included in the analysis, as is the cost of the heat exchanger required for latent heat storage. Equal cost conditions for latent and sensible heat storage systems are determined as functions of raw material costs and the temperature swing allowed in the sensible heat storage tank. M.V.E.

A75-10554 **Fuel energy systems - Conversion and transport efficiencies.** A. E. Uhl (Bechtel, Inc., San Francisco, Calif.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 578-587. 8 refs.

The efficiency of various existing fuel-transport combinations is analyzed on the basis of systems optimized in accordance with conventional economic restraints. The efficiency is expressed in terms of fuel energy units consumed per ton-mile of fuel transported for the dominant fuel types, transport methods, and batch quantities. It is shown that transportation modes which use the least fuel while moving high volumes of cargo seem headed for a growing role in the country's transportation future. M.V.E.

A75-10556 * **Two-watt radioisotope power generators for underwater applications.** R. S. Caputo and V. C. Truscello (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 637-645. Contract No. NAS7-100.

Materials and design considerations are discussed for a low-cost, reliable radio-isotope-fueled thermoelectric generator for use in an undersea application. Plutonium has been selected as fuel, and the generator has to meet design goals of 2 watts after 20 years with a direct output voltage of 6-8 volts. The pressed and sintered form of Bi2Te3 appears to be the most appropriate thermoelectric material. Both fibrous and multilayer foil insulation could be used with proper processing and quality control, but there is less risk with fibrous type insulation. Min-K 1400 is recommended with a nitrogen cover gas. The heat source recommended is a three-layer capsule using T-111 for both the liner and strength member with an outer liner of Hastelloy-C. P.T.H.

A75-10557 **A review of thermal battery technology.** B. H. Van Domelen and R. D. Wehrle (Sandia Laboratories, Albuquerque, N. Mex.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 665-670. 22 refs.

Review of the evolution of thermal battery technology from World War II to the present. The topics discussed include first applied work with thermal cells, the transfer of this laboratory technology to the United States, the development of the initial cup technology by the U.S., and the evolution of this technology to the later pellet technology. (Author)

A75-10559 **Development and performance of a miniature, high-voltage thermal battery.** R. P. Clark and E. V. Forsman (Sandia Laboratories, Albuquerque, N. Mex.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 678-683. AEC-supported research.

A miniature, high-voltage, thermally activated battery has been developed. This battery weighs 41 grams, occupies a volume of 16.4 cu cm, and contains two separate 500-v channels, each designed to charge a 5.25 microfarad capacitor within 300 milli-seconds and remain operational under a 640-kohm load for a minimum of 28 seconds over the temperature range from +16 to +71 C. The electrochemical system utilizes a calcium anode, LiCl-KCl molten salt electrolyte, a CaCrO4-K2CrO4 mixture as the depolarizer or active cathode material, and an iron cathode. The depolarizer and electrolyte, along with a silica binder, are formed into homogeneous pellets, and these pellets are stacked alternately with calcium-iron bimetal disks in beryllium oxide tubes to form cell stacks. The cells are activated by an iron-potassium perchlorate pyrotechnic heat source external to the BeO tubes. (Author)

A75-10560 **Development of a thermal battery for emergency radio power under arctic conditions.** G. C. Bowser, Jr. (Catalyst Research Corp., Baltimore, Md.) and C. L. Paxton (U.S. Army, Land Warfare Laboratory, Aberdeen Proving Ground, Md.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 684-687. 5 refs.

A75-10562 **Conceptual design of a series of laser-fusion power plants of 100 to 3000 MW/e/.** A. P. Fraas (Oak Ridge National Laboratory, Oak Ridge, Tenn.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 738-747. 14 refs. AEC-sponsored research.

The present work discusses some reference designs for laser fusion power plants ranging from 100 to 2500 MW(e). The plants were all designed on the premise that the blast, caused by the combustion of a small pellet of frozen deuterium and tritium ignited by a laser beam, would be contained in a spherical vessel in which a swirling pool of liquid lithium would form a vortex with a central cavity. Bubbles of inert gas would be injected into the lithium jets entering the vessel to provide an average void fraction of 2 or 3%. These bubbles will serve to cushion the shock wave from the explosion of the pellet and thus reduce the stresses in the pressure vessel. Initial efforts to design such a vessel were based on scale model tests using conventional explosives in small vessels containing static and swirling water, with and without bubbles. The results of some preliminary calculations on distribution of energy deposition, thermal energy transport, blast wave stresses, and stresses in the pressure vessel are presented. P.T.H.

A75-10563 **Advanced betavoltaic power sources.** L. C. Olsen (Joint Center for Graduate Study, Richland, Wash.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 754-762. 16 refs.

Betavoltaic batteries currently being manufactured utilize silicon junction devices coupled to Pm-147 beta sources. This technology can be characterized by a power density of approximately 1000 microwatts/cu cm, assuming no shielding. In order to achieve acceptable dose-rates, shielding must be added so that the power density is typically reduced to 50 microwatts/cu cm. Greater than 5 microwatts/cu cm is provided for 7 to 9 years. A very significant improvement in the betavoltaic state-of-the-art will result if practical techniques for further reducing the concentration of Pm-146 can be developed. Other advances in betavoltaic energy conversion will result from choosing different semiconductor devices and/or beta emitting material. Pm-147 and H-3 appear to be the most useful isotopes. In both cases, it is desirable to utilize large-band-gap semiconductors. It appears that with advanced devices, Pm-147 and H-3 systems will be capable of providing more than 5 microwatts/cu cm for 20 years. (Author)

A75-10564 **Metal hydride fuel cell power source.** W. G. Taschek (U.S. Army, Mobility Equipment Research and Development Center, Fort Belvoir, Va.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 826-829.

A high-energy-density metal hydride fuel cell power source is being developed to power radio relays or sensors. Ten power sources will be provided for this purpose. Each unit will consist of an acid electrolyte fuel cell stack, a refuelable calcium hydride fuel cartridge, a fan to provide anode gas circulation, and a dc-dc converter. Each unit will be approximately 3-1/4 x 3-3/4 x 11 in. in size, will weigh approximately 3.5 lb and be capable of providing 360 to 400 W-hr at a nominal 28 V dc. (Author)

A75-10565 **Milliwatt fuel cell system for sensors.** R. N. Camp, B. S. Baker (Energy Research Corp., Bethel, Conn.), and E. H. Reiss, Jr. (U.S. Army, Electronics Command, Fort Monmouth, N.J.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 830-835. Grant No. DAAB07-73-C-0227.

The development of a small milliwatt fuel cell system for powering sensors is described. The fuel cell is fueled by hydrogen derived from a solid calcium hydride fuel and oxygen derived from hydrogen peroxide. The fuel cell delivers a steady 100 milliwatts at 6 volts to a DC to DC inverter with an output of about 30 volts. The inverter output charges a small 28 volt nickel-cadmium battery which delivers a steady 2 mA to a sensing load and 430 mA intermittently to a transmitter. (Author)

A75-10566 **Methanol/air acidic fuel cell system.** H. Böhm (Telefunken AG, Frankfurt am Main, West Germany) and K. Maass (Telefunken AG, Hamburg, West Germany). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 836-840.

An acid fuel cell with tungsten carbide anode and charcoal cathode was improved by applying a small amount of platinum to the charcoal cathode. This improved cell yielded 100 mW/sq cm with test electrodes of 5 sq cm area compared with the 60 mW/sq cm achieved on the earlier version. WC/C+Pt cells with a geometric electrode area of 150 sq cm were stacked together in batteries with 10, 20, 30, and 40 cells. The batteries operate with a circulating electrolyte, 2N H_2SO_4, at 50 to 60 C. A scheme for a reactor using this fuel cell is outlined. P.T.H.

A75-10567 **60 watt hydride-air fuel cell system.** B. S. Baker, M. Onischak (Energy Research Corp., Bethel, Conn.), and R. Tripp (Consolidated Controls Corp., Bethel, Conn.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 841-845. Grant No. DAAB07-72-C-0317.

A fuel cell power system delivering 60 watts of regulated 28 VDC power is described. The system operates on hydrogen fuel derived from solid pellets of sodium aluminum hydride and air. The system consists of three basic subsystems, a Kipp Generator, fuel cell stack and power conditioner. It is fully automatic and is designed to operate military communications equipment or charge secondary batteries in the field. A single four-ounce fuel charge operates the unit for four hours. It is estimated the unit can be used for 150 missions before replacement of the fuel cell stack is required. (Author)

A75-10569 **High energy density sintered plate type sealed nickel cadmium battery cells. I - The positive electrode/plaque relationships.** H. N. Seiger, V. J. Puglisi, P. F. Ritterman (Textron, Inc., Heliotek Div., Sylmar, Calif.), and D. F. Pickett (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, Ohio). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 868-872. 7 refs.

Study of the physical and chemical interaction of sintered plaque material and the behavior of highly loaded positive electrodes. The results indicate that the usability of active materials depends considerably on sinter porosity and that there seems to be an upper limit to the loading of active material into the voids in the plaque. M.V.E.

A75-10570 **High energy density sintered plate type nickel-cadmium battery cells. II - Electrochemical impregnation methods to produce nickel oxide electrodes.** V. J. Puglisi, H. N. Seiger (Textron, Inc., Heliotek Div., Sylmar, Calif.), and D. F. Pickett (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, Ohio). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 873-880. 13 refs.

A75-10571 * **A novel negative-limited sealed nickel-cadmium cell.** G. L. Juvinall (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), E. Luksha, and C. J. Menard (Gould Laboratories, St. Paul, Minn.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 881-887. Contract No. NAS7-100.

The use of negative-limited nickel-cadmium cells with adequate charge control is shown to provide an effective means for controlling internal pressure. Cycle test data show that negative-limited cells have somewhat higher ampere-hour degradation rates at higher operating temperatures. The most important advantages of these cells are: (1) lesser heat generation during operation; (2) longer separator life, as a result of operation at lower temperatures; (3) decreased stresses on cell seals due to lower operating pressures; and (4) significant weight savings. M.V.E.

A75-10572 * **Predicted energy densities for nickel-hydrogen and silver-hydrogen cells embodying metallic hydrides for hydrogen storage.** R. W. Easter (NASA, Lewis Research Center, Cleveland, Ohio). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 888-895.

A75-10573 * **Electrically rechargeable redox flow cells.** L. H. Thaller (NASA, Lewis Research Center, Cleveland, Ohio). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 924-928.

Considering the topographical and sizing requirements for a typical pumped water storage installation and the immergence of energy conversion schemes that are time-dependent as to their generating capability, a closer look is being given to nonpumped water storage schemes for storing electricity. An electrochemical bulk power storage concept, called a rechargeable redox flow cell, is described. This scheme, based on pumping a redox couple through a power conversion section, appears to offer high overall efficiency, no cycle life limitations for the electrodes, and deep discharge capability. (Author)

A75-10574 * **Feasibility demonstration of a road vehicle fueled with hydrogen-enriched gasoline.** F. W. Hoehn and M. W. Dowdy (California Institute of Technology, Jet Propulsion Laboratory, Propulsion Div., Pasadena, Calif.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 956-964. 13 refs. Contract No. NAS7-100.

Evaluation of the concept of using hydrogen-enriched gasoline in a modified internal combustion engine in order to make possible the burning of ultralean mixtures. The use of such an engine in a road vehicle demonstrated that the addition of small quantities of gaseous hydrogen to gasoline resulted in significant reductions in exhaust emissions of carbon monoxide and nitrogen oxides as well as in thermal efficiency improvements of the engine performance. M.V.E.

A75-10576 Report on progress in achieving direct conversion of a major fraction of sonic flow kinetic power into electrical power by electrofluid dynamic /EFD/ processes. M. O. Lawson, E. F. Fretter (USAF, Aerospace Research Laboratories, Wright-Patterson AFB, Ohio), and R. W. Griffith (Universal Energy Systems, Medway, Ohio). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 1064-1073. 11 refs.

Previous experiments have shown limitations to the old scaling laws as applied electrofluid dynamic processes. A new approach to scaling is described which is based on the law of similitude for electrical discharges. The scaling technique suggests that the product of the gas density and channel dimension be kept constant, resulting in constant electrical performance but increasing efficiency at high pressure levels. Effects of gas and channel-geometry characteristics are also presented. Experiments are described which verify this scaling approach and which achieve a conversion of 12% of the kinetic power of a Mach-1 flow into electrical power. Further investigations are indicated, directed toward yielding 50% conversion efficiency. (Author)

A75-10577 The MHD power generation system with directly fired coal. L. W. Crawford, K. E. Tempelmeyer, Y. C. L. Wu, J. F. Martin, and J. W. Muehlhauser (Tennessee, University, Tullahoma, Tenn.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 1074-1082. 8 refs. U.S. Department of the Interior Contract No. 14-32-0001-1213.

Detailed description of the experimental and theoretical basis for the conceptual design of an MHD power generation system using directly fired coal. Special attention is given to the problems that may arise from the behavior of the MHD generator in response to coal slag coating. M.V.E.

A75-10578 Development of a theoretical method for predicting the performance of hydrogen-oxygen MHD generators. D. R. Wilson (Texas, University, Arlington, Tex.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 1083-1091. 12 refs.

Description of a method for predicting the performance of a proposed hydrogen-oxygen MHD generator, and review of the results of a parametric investigation of the effects of electrical shorting and wall cooling on performance. The method is based on a coupled core flow-boundary layer model, and is capable of predicting the overall electrical, gasdynamic, and thermal performance of MHD generators operated in either the Faraday or Hall mode. The accuracy of the model was verified by comparing numerical performance predictions with experimental results for both MHD generators and accelerators. M.V.E.

A75-10579 The Harwell thermo-mechanical generator. E. H. Cooke-Yarborough, E. Franklin, J. Geisow, R. Howlett, and C. D. West (Atomic Energy Research Establishment, Electronics and Applied Physics Div., Harwell, Berks., England). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 1132-1136. 7 refs.

Research results on thermal energy conversion are reviewed that have led to the successful development of an efficient heat engine/alternator system capable of delivering several tens of watts of alternating current. The heat engine uses the Stirling cycle. The achieved conversion efficiency of 13% could be substantially improved. The basic simplicity of this generator suggests that it could be developed into an inexpensive small power source with wide applications. M.V.E.

A75-10580 Electrostatic voltage generation from flowing water. J. M. O'Byrne (Massachusetts, University, Amherst, Mass.). In: Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings. New York, American Society of Mechanical Engineers, 1974, p. 1137-1140. 19 refs.

An analysis was conducted on the performance characteristics of a system which generates electrostatic voltages in the range of 40,000 volts, utilizing a very small stream of water. Spark frequency was highly sensitive to flow rate, Reynolds' number was optimized for maximum output voltage, and system geometry variations had little effect upon sparking frequency. Performance was insensitive to relative humidity and atmospheric charge. Equipment is being miniaturized to demonstrate applications in electrostatic cooling for fire prevention, for illumination, and for unexplained explosions. (Author)

A75-10596 # Combustion R&D - Key to our energy future. A. K. Oppenheim (California, University, Berkeley, Calif.) and F. J. Weinberg (Imperial College of Science and Technology, London, England). *Astronautics and Aeronautics,* vol. 12, Nov. 1974, p. 22-31. 38 refs.

Internal-combustion engines using hydrocarbon fuels are expected to continue to play a predominant part in the field of transportation during the 1980s. The pollution of the atmosphere accompanying the use of hydrocarbons in the internal-combustion process poses a crucial problem. One approach to alleviate conditions somewhat before more fundamental solutions become available would be to reduce the amount of pollutants emitted from the engine by modifying the combustion process. It is, therefore, recommended to conduct fundamental combustion studies as a basis for such a modification. The current state of knowledge regarding the reactions taking place in the internal combustion engine is examined and approaches are considered to extend this knowledge as a basis for an improvement of combustion technology. G.R.

A75-10840 # Gas turbine engines - A state-of-the-art review. *Aircraft Engineering,* vol. 46, Sept. 1974, p. 6-11, 13-15.

Developments in each of the three Rolls Royce aircraft engine divisions is described. The Rolls Royce Derby Engine Division, by improving the airflow over the rear of the engine and between the pylon-mounted engine and the Tri-Star's wing, has designed a new afterbody with a 15 degree half-cone angle, that will provide a further 1.5 to 3% reduction in fuel consumption over that of the 11 degree afterbody. The RB 199 three-shaft reheated turbofan, developed by the Rolls Royce Bristol Engine Division gives a high thrust with reheat for compact maneuver and supersonic acceleration while having low fuel consumption. The Small Engine Division of Rolls Royce is working jointly with two other European companies to develop a small gas turbine engine, the EPM/ESM 600, for light fixed-winged aircraft and small helicopters. The engine will be in the 600hp range. It will have a minimum of parts, a specific fuel consumption, and a maximum interchangeability of parts between turboprop and turboshaft. T.S.

A75-11069 Steady state free convection in an unconfined geothermal reservoir. P. Cheng (Hawaii, University, Honolulu, Hawaii) and K. H. Lau (Hawaii, University, Hilo, Hawaii). *Journal of*

Geophysical Research, vol. 79, Oct. 10, 1974, p. 4425-4431. 16 refs. NSF Grant No. GI-38319.

Review of the experimentally investigated effects of various parameters on the movement of seawater, the upwelling of the water table, and the pressure and temperature distributions in a geothermal reservoir. The results of the study include the finding that, in an unconfined geothermal reservoir, the pressure is almost hydrostatic. M.V.E.

A75-11107 # **A design parameter for assessing wicking capabilities of heat pipes.** F. C. Yip (Department of Communications, Communications Research Centre, Ottawa, Canada). *Canadian Aeronautics and Space Institute and American Institute of Aeronautics and Astronautics, Joint Meeting, Toronto, Canada, Oct. 30, 31, 1974, AIAA Paper 74-1266*. 10 p. 32 refs.

The increasing use of heat pipes as efficient thermal power transfer devices for the thermal control of high power communication satellites suggests that there is a need for some parametric index to compare the thermal characteristics of different heat pipe structures. It is shown that the maximum heat transfer rate sustainable by a heat pipe with a given working fluid is proportional to a wick parameter which is a function of the wick geometry and structural design alone. Expressions for this wick parameter are derived and numerical values are tabulated for various wick structures used in heat pipe applications. Validity of this parameter is confirmed by comparison with over 70 measurements gathered from various sources. It is also shown that this wick parameter may be evaluated for heat pipes with composite wick structures, and an example is given. (Author)

A75-11146 **Analysis of conversion efficiency of organic-semiconductor solar cells.** P. H. Fang (Boston College, Chesnut Hill, Mass.). *Journal of Applied Physics*, vol. 45, Oct. 1974, p. 4672, 4673. 5 refs. USAF-NSF-supported research.

The conversion efficiency of solar cells made of organic semiconductors with metallic electrodes on opposite surfaces is calculated on the basis of a model of two diodes connected in series, but with opposite polarity. It is found that the intrinsic conversion efficiency would be two orders of magnitude higher than the conventional value of .00001 to .000001 if the presently used solar-cell configuration of organic semiconductors could be altered to have an Ohmic contact on one surface. (Author)

A75-11195 # **Study of energy distribution in the field of concentration of a solar power plant with a hyperboloid counter-reflector (Issledovanie raspredeleniia energii v pole kontsentratsii geliotekhnicheskoi ustanovki s giperboloidnym kontrotrazhatelem).** D. A. Kirgizbaev and R. A. Zakhidov (Akademiia Nauk Uzbekskoi SSR, Fiziko-Tekhnicheskii Institut, Tashkent, Uzbek SSR). *Geliotekhnika*, no. 4, 1974, p. 13-19. 6 refs. In Russian.

A75-11196 # **Study of channel-type systems for solar-energy radiative heat transport (Issledovanie kanal'nykh sistem luchistogo teploperenosa solnechnoi energii).** A. A. Khudenko (Gosudarstvennyi Komitet po Delam Stroitel'stva Ukrainskoi SSR, Nauchno-Issledovatel'skii Institut Stroitel'nogo Proizvodstva, Ukrainian SSR). *Geliotekhnika*, no. 4, 1974, p. 23-28. In Russian.

Results of a study of channel-type systems for direct heating of industrial premises by solar energy. A description is given of a channel-type system in which a high-power radiative-energy flux is created by a solar-energy concentrator and is then fed into horizontal channels, where it is directed by rotating reflectors to outlets located uniformly over the area of the premises or at points of maximum heat losses. In addition, a scheme for calculating the radiative energy transport through such a channel is presented. An estimate is made of the carrying capacity of channel-type systems for solar-energy radiative heat transport for application to the heating of industrial premises. Values of the carrying capacity of circular open and closed vacuum channels are presented for various channel diameters and longitudinal temperature gradients. A.B.K.

A75-11281 * # **Applications of plasma core reactors to terrestrial energy systems.** T. S. Latham, F. R. Biancardi, and R. J. Rodgers (United Aircraft Research Laboratories, East Hartford, Conn.). *American Institute of Aeronautics and Astronautics and Society of Automotive Engineers, Propulsion Conference, 10th, San Diego, Calif., Oct. 21-23, 1974, AIAA Paper 74-1074*. 15 p. 55 refs. Contract No. NAS1-13291.

Plasma core reactors offer several new options for future energy needs in addition to space power and propulsion applications. Power extraction from plasma core reactors with gaseous nuclear fuel allows operation at temperatures higher than conventional reactors. Highly efficient thermodynamic cycles and applications employing direct coupling of radiant energy are possible. Conceptual configurations of plasma core reactors for terrestrial applications are described. Closed-cycle gas turbines, MHD systems, photo- and thermo-chemical hydrogen production processes, and laser systems using plasma core reactors as prime energy sources are considered. Cycle efficiencies in the range of 50 to 65 percent are calculated for closed-cycle gas turbine and MHD electrical generators. Reactor advantages include continuous fuel reprocessing which limits inventory of radioactive by-products and thorium-U-233 breeder configurations with about 5-year doubling times. (Author)

A75-11283 * # **Interplanetary spacecraft design using solar electric propulsion.** J. H. Duxbury and G. M. Paul (California Institute of Technology, Jet Propulsion Laboratory, Project Engineering Div., Pasadena, Calif.). *American Institute of Aeronautics and Astronautics and Society of Automotive Engineers, Propulsion Conference, 10th, San Diego, Calif., Oct. 21-23, 1974, AIAA Paper 74-1084*. 13 p. 9 refs. Contract No. NAS7-100.

Emphasis of the electric propulsion technology program is now on the application of solar electric propulsion to scientific missions. Candidate planetary, cometary, and geosynchronous missions are being studied. The object of this paper is to describe a basic spacecraft design proposed as the means to accomplish (1) a comet Encke slow flyby, (2) a comet Encke rendezvous, and (3) an out-of-the-ecliptic mission. The discussion includes design differences foreseen for the various missions and indicates those areas where spacecraft design commonality is possible. Particular emphasis is placed on a solar electric propulsion module design which permits an attractive degree of design inheritance from mission to mission. (Author)

A75-11284 * # **Mission applications of electric propulsion.** K. L. Atkins (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *American Institute of Aeronautics and Astronautics and Society of Automotive Engineers, Propulsion Conference, 10th, San Diego, Calif., Oct. 21-23, 1974, AIAA Paper 74-1085*. 9 p. 19 refs. Contract No. NAS7-100.

This paper reviews the mission applications of electric propulsion. The energy requirements of candidate high-energy missions gaining in NASA priority are used to highlight the potential of electric propulsion. Mission-propulsion interfaces are examined to point out differences between chemical and electric applications. Brief comparisons between ballistic requirements and capabilities and those of electric propulsion show that electric propulsion is presently the most practical and perhaps the only technology which can accomplish missions with these energy requirements. (Author)

A75-11286 # **Coal-gas combustion in industrial gas turbines.** E. B. Smith (United Aircraft Research Laboratories, East Hartford, Conn.) and R. J. Mador (United Aircraft Corp., Pratt and Whitney Aircraft Div., East Hartford, Conn.). *American Institute of Aeronautics and Astronautics and Society of Automotive Engineers, Propulsion Conference, 10th, San Diego, Calif., Oct. 21-23, 1974, AIAA Paper 74-1114*. 4 p. 12 refs. U.S. Environmental Protection Agency Contract No. 68-02-1099.

Higher prices and shortages of oil have led to an acceleration of research into the clean burning of coal. The results obtained from a computer model simulating the flow and chemical kinetics of

low-BTU coal-gas in industrial gas turbine combustors are presented in this paper. Operating conditions were computed simulating those anticipated in coal-gas combined cycle powerplants. Nitrogen oxides production is compared with measured data from available combustion tests with oil-gas of similar composition. (Author)

A75-11362 Aluminum nitride and silicon nitride for high-temperature vehicular gas turbine engines. K. Komeya and F. Noda (Toyota Motor Co., Ltd., Toyota, Japan). *Toshiba Review,* July-Aug. 1974, p. 13-18. 19 refs.

The paper discusses hot-pressed, high-strength ceramic materials (silicon nitride and aluminum nitride) produced for vehicular gas turbine engines. Reported is the sintering behavior and some properties of these new materials with results for rotor testing at room temperature using model turbine-like blades. Reviewed are problems involved in overcoming the use of ceramic components in gas turbines as applied to fabrication processes, fracture mechanics, and design. T.S.

A75-11372 # Certain problems of fuel consumption in air transport (Niektore problemy zuzycia paliw w transporcie lotniczym). K. Rzemek. *Technika Lotnicza i Astronautyczna,* vol. 29, Aug. 1974, p. 13-15. In Polish.

Review of the unit kilometer fuel consumption characteristics, and determination of the limits of optimal utilization of aircraft with a view to maximization of available transport capacity. Tables and diagrams are presented which make it possible to compare various types of aircraft from the standpoint of unit consumption of fuel per ton-kilometer as a function of route sections in operation and to determine the optimal routes on which operation of the Il-62, the Il-18, the Tu-134, the An-24, the DC-9-50, and the DC-10 is justified. A.B.K.

A75-11426 Next generation transports will emphasize fuel savings. *Aviation Week and Space Technology,* vol. 101, Oct. 28, 1974, p. 48, 49, 51.

Technology for the minimum energy airplane is reviewed. Special attention is given to an advanced medium-range aircraft that is being developed to lower fuel economics and twin-engine airplanes are considered that will incorporate new wing and structures technology. Improvements in aircraft design include (1) a long duct and thin wall nacelles, (2) the use of aluminum and titanium alloys for reduced stress corrosion and weight and high fatigue life, and (3) advanced airfoils and high lift devices. New concepts for the minimum energy airplane that would embody composites or improve skin and stringer techniques are included. T.S.

A75-11427 Fuel outlook dictating technical transport research. W. C. Wetmore. *Aviation Week and Space Technology,* vol. 101, Oct. 28, 1974, p. 52, 53 (3 ff.).

Technical research priorities for air transport are reviewed. NASA, in its study of energy-efficient aircraft technology, is predicting the use of alternative fuels such as liquefied hydrogen for certain fuel-conservative aircrafts. Other aerodynamic developments including use of a wingtop vortex diffuser, a laminar flow control technique to be applied to the wings and tail surfaces, the idea of a compliant skin-aircraft, and a span-distributed load concept for reducing fuel consumption are discussed. T.S.

A75-11497 Power conversion of energy fluctuations. J. C. Yater. *Physical Review A - General Physics, 3rd Series,* vol. 10, Oct. 1974, p. 1361-1369. 23 refs.

A process is reported by which the fluctuations in the energy of a system which is in thermal equilibrium with a heat reservoir are utilized to obtain a useful form of energy. The energy fluctuations can also be used in a refrigeration cycle. The probability distribution for the diode model introduced by Alkemade (1958) is discussed along with questions of power conversion efficiency and refrigeration performance. Aspects of power-output potential are also investigated. G.R.

A75-11576 Geothermics with special reference to application. O. Kappelmeyer (Bundesanstalt für Bodenforschung, Hanover, West Germany) and R. Haenel (Niedersächsisches Landesamt für Bodenforschung, Hanover, West Germany). Berlin, Gebrüder Borntraeger (Geoexploration Monographs. Series 1, No. 4), 1974. 251 p. 250 refs. $31.40.

The fundamental concept of heat transfer is examined, giving attention to aspects of temperature, heat, storage of heat, heat conduction, heat radiation, heat convection, initial and boundary conditions, and dimensionless quantities. Thermal conditions of the earth's interior and crust are considered, taking into account terrestrial energy sources, energy loss from the earth's interior, temperature and thermal processes in the crust, and the influence of technical operations. Practical applications of geothermics are related to the exploration of geothermal power and prospecting for miscellaneous deposits. Geothermal investigations in deep wells are discussed and tables with various types of data are presented. G.R.

A75-11735 Fusion reactors as future energy sources. R. F. Post (California, University, Livermore, Calif.) and F. L. Ribe (California, University, Los Alamos, N. Mex.). *(Conference on Energy Policies and the International System, Santa Barbara, Calif., Dec. 5-7, 1973.) Science,* vol. 186, Nov. 1, 1974, p. 397-407. 13 refs. AEC-sponsored research.

Questions concerning the place of fusion in planning for the world's energy needs are examined. Conventional energy-producing processes are based on fossil fuels. The energy crisis due to an insufficient supply of these fuels could potentially be permanently solved by the utilization of fusion power which is mainly based on the use of deuterium that is available in practically unlimited quantities. The problems connected with the implementation of a process providing useful power based on nuclear fusion are very great. However, great progress has already been made in solving these problems. It is generally believed that remaining serious scientific issues will be resolved within 10 years. Approaches to fusion power and design details of the current fusion reactor systems are discussed, giving attention to Tokamak reactors, the theta-pinch reactor, and magnetic mirror reactors. G.R.

A75-12115 Energy crisis - Fact or fiction. R. H. Males (Commonwealth Edison Co., Chicago, Ill.). *IEEE Transactions on Industry Applications,* vol. IA-10, Sept.-Oct. 1974, p. 538-543.

It is shown that energy resources are plentiful enough to meet foreseeable needs, but not in the present pattern of use, and not without significant progress in environmental control. The reasons for the current energy crisis are other than lack of energy sources. First, by interference in the pricing system, the government stimulated use of fuels without sufficient incentive for corresponding development of the sources. Second, after environmental problems because all too evident, regulations forced a shift in energy patterns that was more rapid than the economy could accommodate. Third, a legalistic procedure was set in motion which (because of its newness and cumbersomeness) delayed many badly needed developments, such as refineries, nuclear units, and the Alaskan pipeline. Finally, the government failed to develop an energy policy in good time, without which conflicting influences were set in motion. The influence of each of these reasons on the energy crisis is demonstrated by typical examples. V.P.

A75-12198 # GaP p-n junctions and possibilities for their application in the conversion of solar energy into electric (GaP p-n-perekhody i vozmozhnosti ikh primeneniia dlia preobrazovaniia solnechnoi energii v elektricheskuiu). O. Gazakov and P. Khaidarov (Akademiia Nauk Turkmenskoi SSR, Fiziko-Tekhnicheskii Institut, Ashkhabad, Turkmen SSR). *Akademiia Nauk Turkmenskoi SSR, Izvestiia, Seriia Fiziko-Tekhnicheskikh, Khimicheskikh i Geologicheskikh Nauk,* no. 3, 1974, p. 21-25. 6 refs. In Russian.

The basic characteristics of photoelectric converters based on gallium phosphide crystals are discussed. The fact that the maximum

absorption of GaP crystals lies in the center of the spectral distribution of the visible solar radiation points to their potential for converting solar energy into electrical energy. Some basic relations describing the efficiency of photoelements based on GaP are presented. A study of the temperature dependence of the photosensitivity of GaP p-n junctions has shown that photoefficiency increases with temperature, where the opposite is true for all other photoelements. P.T.H.

A75-12416 * An evaluation of discarded tires as a potential source of fuel. L. W. Collins, W. R. Downs, E. K. Gibson (NASA, Johnson Space Center, Houston, Tex.), and G. W. Moore (Lockheed Electronics Co., Inc., Houston, Tex.). *Thermochimica Acta,* vol. 10, Oct. 1974, p. 153-159. 6 refs.

The destructive distillation of rubber tire samples was studied by thermogravimetry, differential scanning calorimetry, combustion calorimetry, and mass spectroscopy. The decomposition reaction was found to be exothermic and produced a mass loss of 65%. The products from the distillation process were a solid residue with a heating value of about -30 MJ/kg, a liquid with a heating value of about -40 MJ/kg, and a combustible gas of undetermined heating value. The gas evolution curves which were obtained indicate that a variety of organic materials are evolved simultaneously during decomposition of the rubber polymer. (Author)

A75-12425 * Solar energy: Technology and applications. J. R. Williams (Georgia Institute of Technology, Atlanta, Ga.). Research supported by NASA. Ann Arbor, Mich., Ann Arbor Science Publishers, Inc., 1974. 134 p. 139 refs. $9.95.

It is pointed out that in 1970 the total energy consumed in the U.S. was equal to the energy of sunlight received by only 0.15% of the land area of the continental U.S. The utilization of solar energy might, therefore, provide an approach for solving the energy crisis produced by the consumption of irreplaceable fossil fuels at a steadily increasing rate. Questions regarding the availability of solar energy are discussed along with the design of solar energy collectors and various approaches for heating houses and buildings by utilizing solar radiation. Other subjects considered are related to the heating of water partly or entirely with solar energy, the design of air conditioning systems based on the use of solar energy, electric power generation by a solar thermal and a photovoltaic approach, solar total energy systems, industrial and agricultural applications of solar energy, solar stills, the utilization of ocean thermal power, power systems based on the use of wind, and solar-energy power systems making use of geosynchronous power plants. G.R.

A75-12734 II-VI photovoltaic heterojunctions for solar energy conversion. A. L. Fahrenbruch, F. Buch, K. Mitchell, R. H. Bube (Stanford University, Stanford, Calif.), and V. Vasilchenko (Stanford University, Stanford, Calif.; Tartuskii Gosudarstvennyi Universitet, Tartu, Estonian SSR). *Applied Physics Letters,* vol. 25, Nov. 15, 1974, p. 605-608. 9 refs. NSF-supported research.

Several different II-VI heterojunctions show possible promise for photovoltaic conversion of solar energy. Two of these are p-CdTe/n-CdS and p-CdTe/n-Zn sub 0.35Cd sub 0.65S, which have a maximum solar efficiency of 17 and 23%, respectively. Specific attention is given to the properties of p-CdTe/n-CdS cells prepared (1) by close-spaced vapor transport of CdTe onto single-crystal CdS, and (2) by two-source vacuum evaporation of CdS onto single-crystal CdTe. Cells with efficiency of 4.0% have been produced without detailed attention to optimization of cell design; these cells have quantum efficiencies as high as 0.85. F.R.L.

A75-12911 Prospects and scientific problems of the utilization of methods of direct electric power generation from chemical fuels /fuel cells/. N. S. Lidorenko and G. F. Muchnik. *(Akademiia Nauk SSSR, Izvestiia, Energetika i Transport,* Mar.-Apr. 1973, p. 15-27.) *Heat Transfer - Soviet Research,* vol. 6, May-June 1974, p. 12-24. 11 refs. Translation.

The principal prospects of the utilization of fuel cells for converting the chemical energy of fuels into electric power are examined. The optimal fields of fuel cell utilization as compared with other energy sources are established. The comparison is carried out on the basis of a number of criteria, including economic considerations. A survey is given of the major problems (theoretical, experimental, engineering) arising in the course of fuel cell development. It is noted that fuel cells can serve as prospective sources for a number of devices due to the high efficiency (up to 70 to 80%), reliability, economical advantages, etc. Their development will result in important advances in related fields of science and technology. F.R.L.

A75-12912 Controlled heat pipes. L. L. Vasil'ev (Akademiia Nauk Belorusskoi SSR, Institut Teplo- i Massoobmena, Minsk, Belorussian SSR). *Heat Transfer - Soviet Research,* vol. 6, May-June 1974, p. 37-41. 9 refs. Translation.

The presently available kinds of controlled heat pipes are discussed in general terms, and several equations which are beneficial to the understanding of the operation of such pipes are given. Heat tubes employing noncondensing gas are used as devices for maintaining certain objects at constant temperature, since they provide constant temperature over a large part of the surface. Centrifugal heat pipes are of great interest. They can be subdivided into two types: rotating heat pipes, and heat pipes with swirled flow of vapor or vapor-liquid mixture, for example, by a swirl generator placed inside the tube. Great promise in controlling heat and mass transfer is held by coaxial heat pipes, in which the thermal energy is transported radially. F.R.L.

A75-12914 An investigation of heat-pipe wick characteristics. Z. N. Kostko. (Low-temperature energy and material transfer under a vacuum, p. 132-140.) *Heat Transfer - Soviet Research,* vol. 6, May-June 1974, p. 132-138. 12 refs. Translation.

This study states the need for determining such properties of heat pipe wicks as the porosity, depth of capillary pumping and permeability. The results are presented of measuring these employing generally used methods for wicks from glass fiber, fiber glass and brass meshes and the results thus obtained are analyzed. (Author)

A75-12986 Energy development; Proceedings of the Energy Sources Conference, Anaheim, Calif., July 14-19, 1974. Conference sponsored by the Institute of Electrical and Electronics Engineers. New York, Institute of Electrical and Electronics Engineers, Inc., 1974. 104 p. Members, $7.50; nonmembers, $10.00.

The impact of advanced batteries on electric power generation, tidal power and its integration into the electric system, and utilization of municipal refuse for the recovery of energy and other resources are among the topics covered in papers concerned with the latest developments in power engineering research. Other topics covered include current expectations for fusion power from toroidal machines, progress in coal gasification, and pumped air storage for electric power generation. M.V.E.

A75-12987 Utilization of solar energy today. S. Karaki, D. S. Ward, and G. O. G. Löf (Colorado State University, Fort Collins, Colo.). In: Energy development; Proceedings of the Energy Sources Conference, Anaheim, Calif., July 14-19, 1974.
New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 5-11. 8 refs.

The current status and prospects of solar energy utilization are reviewed, and the technological and economic factors involved in the various approaches to conversion of solar radiation into usable forms of energy are discussed. The utilization modes considered include solar water heaters, solar distillation, heat engines, direct conversion to electricity, solar furnaces, the use of photosynthesis for the conversion of organic matter to fuels, space heating and cooling, and

electric power generation by thermal conversion. Residential and commercial space heating and cooling are expected to represent the largest uses of solar energy in the near future. Construction of solar electric power plants of any significant size is not likely to occur before the end of the century. M.V.E.

A75-12988 Solar energy conversion and storage systems for the future. R. Ramakumar, H. J. Allison, and W. L. Hughes (Oklahoma State University, Stillwater, Okla.). In: Energy development; Proceedings of the Energy Sources Conference, Anaheim, Calif., July 14-19, 1974. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 12-20. 29 refs. NSF Grant No. GI-39457.

The possible utilization of solar energy in its various manifestations such as heat, winds, tides, and ocean thermal gradients is reviewed. Methods of solar energy collection, conversion, and utilization are examined, along with the solar energy potential. Special attention is given to various systems for meeting the needs of solar energy storage. The systems considered include: (1) thermal energy storage using hot water or hot rocks; (2) potential energy storage by pumping water to a higher elevation, by compressing air or springs; (3) chemical energy storage using hydrogen or secondary batteries; (4) kinetic energy storage as in flywheels; and (5) energy storage in electromagnetic fields using capacitors or superconducting magnets. It is argued that solar energy must play a significant role in solving the energy problem of the world. M.V.E.

A75-12989 Energy storage undergound. F. C. Rogers and A. E. Allen (Harza Engineering Co., Chigaco, Ill.). In: Energy development; Proceedings of the Energy Sources Conference, Anaheim, Calif., July 14-19, 1974. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 21-29. 9 refs.

Underground hydroelectric pumped-storage and underground compressed-air storage utilizing gas turbines are shown to offer feasible energy storage methods that can be implemented by readily available technology. In terms of cost efficiency, these underground storage facilities compare favorably with above-ground energy storage alternatives. Locating major components of energy storage facilities underground promises to reduce drastically the siting problems encountered by equivalent aboveground facilities. M.V.E.

A75-12990 Pumped air storage for electric power generation. W. H. Day, R. K. Alff, and P. M. Jarvis (General Electric Co., Gas Turbine Products Div., Schenectady, N.Y.). In: Energy development; Proceedings of the Energy Sources Conference, Anaheim, Calif., July 14-19, 1974. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 30-36. 6 refs.

Description of an energy storage system which uses off-peak electric power to compress air into an underground storage reservoir by means of a gas turbine compressor and booster. At times of peak electrical demand, the air is expanded through the combustor and turbine, which is then not required to drive its compressor. The generator is sized and coupled alternately to the compressor and turbine so it also acts as a synchronous motor in the pumping mode. The system reduces gas turbine fuel oil consumption per kWh by about half compared to conventional gas turbines and achieves about double the normal net output from the turbomachinery of the size employed. The requirement of above-ground real estate is minimized for this energy storage system, and maximum use is made of proven components from existing gas turbine systems. M.V.E.

A75-12991 The impact of advanced batteries on electric power generation. D. L. Douglas (Gould, Inc., Mendota Heights, Minn.). In: Energy development; Proceedings of the Energy Sources Conference, Anaheim, Calif., July 14-19, 1974.
New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 37-41. 14 refs.

New battery technology and its possible impact on the generation of electric power are discussed. Today's lead-acid battery cannot meet the requirements of electric street vehicles and storage of off-peak electrical energy for use in period of peak demand. Nickel-zinc batteries may be available for electric vehicles within two or three years. Commuter car and delivery van energy and power density requirements will be met by this battery system. Lithium-sulfur, sodium-sulfur, and zinc-chlorine battery systems will not be available before 1985. These promise to meet the performance and cost targets associated with on-road electric vehicles and load-leveling energy storage. The impact on the electric utility industry before the year 2000 is not expected to be considerable. M.V.E.

A75-12992 The FCG-1 fuel cell powerplant for electric utility use. W. J. Lueckel and P. J. Farris (United Aircraft Corp., Pratt and Whitney Aircraft Div., South Windsor, Conn.). In: Energy development; Proceedings of the Energy Sources Conference, Anaheim, Calif., July 14-19, 1974. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 42-46.

A substantial effort is underway to develop a 26 MW fuel cell powerplant for electric utility service. A description of one possible FCG-1 powerplant configuration and its operational characteristics is presented. The potential operational, economic and social benefits which result from using the FCG-1 powerplant as a 'dispersed' power generator to complement large fossil fueled and nuclear powerplants in utility networks are described. Consideration is given to the application and potential of fuel cell powerplants as they might be utilized by utility systems during the early 1980's and the later part of the century. (Author)

A75-12993 Progress in coal gasification. F. C. Schora, Jr., D. J. Tobin, and R. L. Mount (Institute of Gas Technology, Chicago, Ill.). In: Energy development; Proceedings of the Energy Sources Conference, Anaheim, Calif., July 14-19, 1974.
New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 47-54. 11 refs. Research supported by the U.S. Department of the Interior and American Gas Association.

Costing of large-scale substitute natural gas (SNG) programs is compared with that of import-based liquefied-natural-gas facilities of similar capacity. The complexity of coal as an SNG raw material is described. Dynamics of coal conversion to clean-burning SNG are explored, and six commercial candidate processes for SNG production are briefly compared. It is concluded that coal gasification should be exploited as soon as possible on a large scale. M.V.E.

A75-12994 Tidal power and its integration into the electric system. K. E. Sorensen and C. MacLennan (Tidal Power Consultants, Ltd., Montreal, Canada; Harza Engineering Co., Chicago, Ill.). In: Energy development; Proceedings of the Energy Sources Conference, Anaheim, Calif., July 14-19, 1974.
New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p.62-68. 7 refs.

The prospects of tidal power development in the face of the urgent present need for increasing the use of nondiminishing energy sources are discussed, with special attention to the potential of the Bay of Fundy, a site holding forth the promise to become the first such development in the Western Hemisphere. At this site where the world's highest tides occur, the application of new concepts of energy retiming and the use of new types of simplified generating equipment are expected to result in substantial reductions in unit tidal power development costs. M.V.E.

A75-12995 Fusion power research - Where do we stand. W. E. Drummond (Texas, University, Austin, Tex.). In: Energy development; Proceedings of the Energy Sources Conference, Anaheim, Calif., July 14-19, 1974. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 74-76.

The present status of research and currently faced problems in Tokamak-like devices are discussed in the context of possible future fusion reactors. It is shown that there are justifiable ground for optimism in fusion research. In many cases, even the most pessimistic

estimates suggest that thermonuclear reactors are possible. A feasibility experiment, i.e., an experiment which demonstrates the net production of energy, is likely to be started within the next few years. M.V.E.

A75-12996 Current expectations for fusion power from toroidal machines. R. G. Mills (Princeton University, Princeton, N.J.). In: Energy development; Proceedings of the Energy Sources Conference, Anaheim, Calif., July 14-19, 1974. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 77-81. 6 refs. Research supported by the Edison Electric Institute; Contract No. AT(11-1)-3073.

The probability that toroidal magnetic machines may be the first to lead to a viable fusion power system are discussed. It is shown that serious problems still remain unsolved. But increasing government support leads many to expect a scientific feasibility experiment and a demonstration of thermonuclear burning of deuterium-tritium fuel before 1980. M.V.E.

A75-12997 Windpower - Look backward, then move forward confidently. W. E. Heronemus (Massachusetts, University, Amherst, Mass.). In: Energy development; Proceedings of the Energy Sources Conference, Anaheim, Calif., July 14-19, 1974. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 82-88. 15 refs.

Discussion of the potential of wind power utilization, and review of some wind power electricity systems for use in rural areas. Wind power has failed the test of economics when pitted against heat engines for the generation of electricity in the recent past. Now with rising costs of fossil fuels, wind power could be economic. M.V.E.

A75-12998 The Hydrogen Economy - A utility perspective. M. Lotker (Northeast Utilities, Hartford, Conn.), F. J. Salzano (Brookhaven National Laboratory, Upton, N.Y.), and E. Fein. In: Energy development; Proceedings of the Energy Sources Conference, Anaheim, Calif., July 14-19, 1974. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 89-97. 14 refs.

Presented is an overview of the 'Hydrogen Economy', a concept in which sources of primary energy such as coal, uranium, deuterium, and sunlight, are used to make hydrogen, which serves as a synthetic fuel in many sectors of the energy consuming market. Specific techniques for the production, transmission, storage, and utilization of hydrogen are described. The impact on the entire energy economy in general and the utility industry specifically is discussed. (Author)

A75-12999 U.S. energy resources - Outlook for the future. R. A. Budenholzer (Illinois Institute of Technology, Chicago, Ill.). In: Energy development; Proceedings of the Energy Sources Conference, Anaheim, Calif., July 14-19, 1974. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 98-102. 5 refs.

Assessment of the extent and nature of the present energy crisis, and search for courses of action that could alleviate the situation on both a short-term and long-term basis. Reviewed estimates of the number of years of supply remaining for each of the various fuel resources in the United States show that coal and uranium are much more abundant than crude oil and natural gas. For the immediate future, this suggests a gradual shift of all power generation to coal and nuclear energy, thus conserving oil and gas for higher priority uses. For the long range future, it is hoped that fusion power can be achieved commercially. M.V.E.

A75-13067 # **High efficiency thermoelectric generator.** M. Marinescu (Academia Romana, Bucharest, Rumania). *International Power Sources Symposium Committee, International Power Sources Symposium, 9th, Brighton, Sussex, England, Sept. 17-19, 1974, Paper.* 6 p. 5 refs.

A thermoelectric generator consisting of a semiconductor lying between two different metals is described. Operating conditions as well as thermoelectric performances are given and compared with the performance of thermoelectric generators of equal power output operating on the basis of the Seebeck effect. A qualitative analysis to explain the operation of the generator is also given. (Author)

A75-13597 International energy problems and environmental policy. M. J. Deutch. In: Technology today for tomorrow; Proceedings of the Eleventh Space Congress, Cocoa Beach, Fla., April 17-19, 1974. Volume 2. Cape Canaveral, Fla., Canaveral Council of Technical Societies, 1974, p. 7-1 to 7-16.

Aspects of the world-wide energy shortage are examined, giving attention to the dependence of the U.S. and Western Europe on crude oil imports and the economic effects of insufficient oil supplies on unemployment and the balance of payments. Relations between world energy demand and world economy are considered along with an international energy development program, world energy consumption trends, questions of energy and environmental protection, the development of new sources of energy, incentives and constraints in energy, and aspects of environmental policy and energy supply. G.R.

A75-13714 Space power systems - Retrospect and prospect. J. P. Layton (Princeton University, Princeton, N.J.). *International Astronautical Federation, International Astronautical Congress, 25th, Amsterdam, Netherlands, Sept. 30-Oct. 5, 1974, Paper 74-082.* 29 p.

Elements of various space power systems are identified and the regimes of applicability of the primary systems are shown. The trends of space power requirements for United States missions are presented for the past and the future. Solar cells, chemical batteries and other non-nuclear space power elements are identified in terms of state of the art and technology goals. Performance and costs of representative solar array/battery systems are presented. Historical development of nuclear space power and its applications are shown. Available radioisotope generators and prospective economic generators are identified in terms of their comparative performance and costs. Reactor power systems with current uranium zirconium hydride reactors and various power conversion systems are presented in some detail. Advanced performance prospects of thermionic and fast compact reactor power systems are identified. (Author)

A75-13715 Recent advances in components of space power systems. E. S. Rittner (COMSAT Laboratories, Clarksburg, Md.). *International Astronautical Federation, International Astronautical Congress, 25th, Amsterdam, Netherlands, Sept. 30-Oct. 5, 1974, Paper 74-083.* 25 p. 6 refs. Research sponsored by the International Telecommunications Satellite Organization.

The advances in power-system components include silicon solar cells of greatly improved efficiency. The improvement in efficiency is a direct result of the elimination of the dead layer at the surface of the cell. This layer had previously suppressed the response in the blue and violet portion of the solar spectrum. Another development is a sealed rechargeable battery of significantly enhanced performance. The new battery combines a nickel hydroxide electrode with a hydrogen electrode. G.R.

A75-13716 # **Analysis of different systems concerning the energy distribution on board a satellite (Analyse de différents systèmes de distribution d'énergie à bord de satellite).** Mr. Boussuge, Mr. Mouilhayrat, and Mr. Bezaudun (Centre National d'Etudes Spatiales, Toulouse, France). *International Astronautical Federation, International Astronautical Congress, 25th, Amsterdam, Netherlands, Sept. 30-Oct. 5, 1974, Paper 74-084.* 21 p. In French.

Details regarding the power system of satellites are considered, giving attention to day phase and night phase along with questions of voltage control in the case of various systems. Conventional systems and the Maximum Power Point Tracking (MPPT) system are compared, taking into account a mathematical model, variations of the power output maximum as a function of temperature and questions of battery charging. The range of applications of the MPPT system is also discussed. G.R.

A75-13718 **Advances in space power generation.** R. L. Kerr and J. D. Reams (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, Ohio). *International Astronautical Federation, International Astronautical Congress, 25th, Amsterdam, Netherlands, Sept. 30-Oct. 5, 1974, Paper 74-086.* 28 p.

It is pointed out that no single power generation device can meet all of the projected power requirements of future space missions. Advances are, therefore, being sought in solar cells, batteries, and nuclear power systems. Several research and development programs which are currently being sponsored in these areas are discussed, giving attention also to an evaluation of the state-of-the-art and the projected capabilities of other power systems. G.R.

A75-13719 * # **Physics and potentials of fissioning plasmas for space power and propulsion.** K. Thom, F. C. Schwenk (NASA, Washington, D.C.), and R. T. Schneider (Florida, University, Gainesville, Fla.). *International Astronautical Federation, International Astronautical Congress, 25th, Amsterdam, Netherlands, Sept. 30-Oct. 5, 1974, Paper 74-087.* 64 p. 45 refs.

A brief description of two gas core reactor concepts devised for propulsion applications is presented and recent research on the emission of radiation from nonequilibrium fissioning gases is considered. The principles of UF6 and plasma core reactor experiments are discussed. It is expected that the program of nuclear gas core reactor experiments can lead in several years to reactor operation at pressures, temperatures, and power levels of technological significance to terrestrial applications. G.R.

A75-14014 **Prospects for tapping solar energy on a large scale.** R. Ramakumar, H. J. Allison, and W. L. Hughes (Oklahoma State University, Stillwater, Okla.). *Solar Energy,* vol. 16, Oct. 1974, p. 107-115. 21 refs. NSF-supported research.

Two continuous-duty solar energy systems are described - one for the long term future and the other for the immediate future. Some of the unique components for these systems are briefly described, and these include a field modulated generator, aeroturbines and supporting structures, aphodid burner, and electrolysis and energy storage units. An economic analysis is presented which compares the generation costs of solar energy systems with those of conventional systems for a variety of operating conditions. The results show that certain aspects of solar energy conversion can, at present, generate energy at costs competitive with conventional systems and that more favorable conditions can be expected in the near future as fuel costs increase further. P.T.H.

A75-14346 * # **Rating aircraft on energy.** D. V. Maddalon (NASA, Langley Research Center, Aeronautical Systems Div., Hampton, Va.). *Astronautics and Aeronautics,* vol. 12, Dec. 1974, p. 26-43. 18 refs.

Questions concerning the energy efficiency of aircraft compared to ground transport are considered, taking into account as energy intensity the energy consumed per passenger statute mile. It is found that today's transport aircraft have an energy intensity potential comparable to that of ground modes. Possibilities for improving the energy density are also much better in the case of aircraft than in the case of ground transportation. Approaches for potential reductions in aircraft energy consumption are examined, giving attention to steps for increasing the efficiency of present aircraft and to reductions in energy intensity obtainable by the introduction of new aircraft utilizing an advanced technology. The use of supercritical aerodynamics is discussed along with the employment of composite structures, advances in propulsion systems, and the introduction of very large aircraft. Other improvements in fuel economy can be obtained by a reduction of skin-friction drag and a use of hydrogen fuel. G.R.

A75-15054 **The heat pipe - Its development, and its aerospace applications.** D. A. Reay (International Research and Development Co., Ltd., Newcastle-upon-Tyne, England). *Aeronautical Journal,* vol. 78, Sept. 1974, p. 414-423. 25 refs.

The main parameters governing the selection of heat pipes for applications are described. Characteristics of the container and wick materials and of the working fluid are considered. Heat pipes have broad applications in spacecraft for separation of heat source and sink, for temperature flattening, for heat-flux transformation, and for temperature control. The variable conductance heat pipe, which is currently the ultimate development for spacecraft temperature control, is discussed in detail. Specific uses in spacecraft include temperature equalization, cooling and temperature control of electronic and other components, and applications in nuclear power sources. A.T.S.

A75-15201 # **Solar cells - Operation, development and applications.** D. Bonnet. *Battelle Information (Frankfurt),* Aug. 1974, p. 2-9. 22 refs.

In view of the general energy situation, the utilization of solar energy is arousing more and more interest. One means of harnessing such energy is the solar cell, which is suitable for the generation of electric energy both in space and on earth. This article describes the history and physical basis of research on solar cells. It traces the main lines of development, and outlines existing and potential applications. (Author)

A75-15795 **The use of hydrogen as an energy carrier.** C. Marchetti (EURATOM and Comitato Nazionale per l'Energia Nucleare, Centro per le Ricerche Comuni, Ispra, Italy). In: Superconducting machines and devices: Large systems applications; Advanced Study Institute, Entrèves, Italy, September 5-14, 1973, Lectures. New York, Plenum Press, 1974, p. 549-562. 20 refs.

Hydrogen has been considered as an energy vector because it is easily transportable, it is storable, very flexible in use and most important pollution free. Hydrogen can be produced by thermochemical water splitting through two or more intermediate steps because of the high temperature (3000 C) necessary to disassociate the water molecule. Theoretical efficiencies are calculated and economics are discussed. A flowsheet of a plant is included. N.D.

A75-16378 **Transparent heat-mirror films of TiO2/Ag/TiO2 for solar energy collection and radiation insulation.** J. C. C. Fan, F. J. Bachner, G. H. Foley, and P. M. Zavracky (MIT, Lexington, Mass.). *Applied Physics Letters,* vol. 25, Dec. 15, 1974, p. 693-695. 14 refs. USAF-sponsored research.

Transparent heat-mirror films of TiO2/Ag/TiO2 on glass with a visible transmission of 84% (at 0.5 micron) and an infrared reflectivity of 98 to 99% (at 10 microns) have been fabricated by RF sputtering. Initial tests indicate that the films are thermally stable in air at 200 C and inert to water attack. Because of their excellent optical properties and apparent stability, these transparent heat-mirror films offer great promise for use in solar-thermal power conversion and as transparent thermal insulators. (Author)

A75-16525 **New applications for optical components - High energy focusing.** *Optical Spectra,* vol. 8, Dec. 1974, p. 26-30.

The optical system used in the 20-beam Shiva system at the Lawrence Livermore Laboratory for research on laser fusion is described. The requirements on power, intensity, and beam profile are considered. Major component design problems include material survivability and the nonlinear index of refraction encountered with high-intensity light. The dielectrics, Faraday rotators, and calorimeters are given special mention. Future improvements affecting the laser glasses, wavelengths, and thin film coating technology are indicated. A.T.S.

A75-16834 # **Solar thermal absorption heat pump breakeven coefficient of performance.** M. Balasubramaniam, G. L. Schrenk, A. Lowi, and J. C. Denton (Pennsylvania, University, Philadelphia, Pa.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/Ener-2.* 9 p. 6 refs. Members, $1.00; nonmembers, $3.00.

This paper compares the performance of direct solar heating with heating obtained with solar energy amplified through an absorption heat pump. It is shown that if the performance of the two systems is to be at least equal under similar operating conditions, the absorption heat pump must have a minimum heating coefficient of performance (COP)H, which is defined as the breakeven (COP)H. It is further indicated that with presently available equipment (flat plate solar collectors and absorption heat pumps), it is more advantageous to heat the conditioned space directly, bypassing the heat pump circuit. For solar thermal absorption heat pumps to be practical, it is necessary to improve the performance of both the collector and the heat pump substantially over what is currently obtained. (Author)

A75-16835 # **Comparative performance characteristics of cylindrical parabolic and flat plate solar energy collectors.** J. W. Tester, R. M. Mayer (Oak Ridge National Laboratories, Oak Ridge, Tenn.), and A. P. Fraas (Oak Ridge National Laboratories, Knoxville, Tenn.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/Ener-3.* 13 p. 11 refs. Members, $1.00; nonmembers, $3.00.

The performance of a flat plate and a cylindrical parabolic focusing solar energy collector were measured concurrently and compared to collector temperatures ranging from 135 to 185 F under Oak Ridge, Tennessee, weather conditions with a view toward their use in a residential total energy system. The flat plate collection system was of conventional design while the focusing collector was a low concentration factor, fixed orientation device that employed a finned tube receiver. The importance of seasonal and diurnal variations in the sun's alignment was critical to performance of the focusing collector and was considered in detail. Performance models were developed to predict monthly operation under Oak Ridge weather conditions. The economics of utilizing either system for domestic space heating and air conditioning were investigated briefly with the resulting data, but further data for collector temperatures up to at least 250 F are needed for a definite comparison. (Author)

A75-16836 # **Methods for low cost manufacture of silicon solar arrays.** M. Wolf (Pennsylvania, University, Philadelphia, Pa.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/Ener-4.* 14 p. 13 refs. Members, $1.00; nonmembers, $3.00. NSF Grant No. GI-29729.

This paper presents a discussion on the photovoltaic approach of converting solar energy to electricity via the thermal route. Solar cells fabricated from elemental, single crystal silicon have provided the highest confirmed conversion efficiency and have established long operating life. With these advantages, silicon solar arrays can provide a viable long-term option for the future mix of energy sources. (Author)

A75-16837 # **Use of low grade solid fuels in gas turbines.** D. A. Furlong and G. L. Wade (Combustion Power Co., Inc., Menlo Park, Calif.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/Ener-5.* 10 p. Members, $1.00; nonmembers, $3.00. Research supported by the U.S. Environmental Protection Agency and U.S. Department of the Interior.

A direct combustion concept for using solid fuels, known as the CPU-400, is being developed at Combustion Power Company, under contract to the Environmental Protection Agency and the Office of Coal Research. The CPU-400 utilizes a fluidized bed combustor in a gas turbine cycle to convert the heating value of solid fuel into electricity. This paper describes the process development unit and results of experiments on the fluidized bed combustor and supporting equipment. Properties of the solid fuels used are presented and combustor performance is discussed. The effectiveness of the inertial separators used to remove particulates from the hot gases prior to turbine inlet is also discussed. Preliminary turbine performance is presented along with the results from a set of on-line exhaust gas sampling instruments. (Author)

A75-16838 # **Progress in development of auxiliary MHD power plant components at Avco Everett Research Laboratory, Inc.** F. A. Hals, F. E. Becker, R. E. Gannon, H. F. Steinle, D. B. Stickler, and B. Kivel (Avco Everett Research Laboratory, Inc., Everett, Mass.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/Ener-6.* 24 p. 20 refs. Members, $1.00; nonmembers, $3.00. Research supported by the U.S. Department of the Interior, Electric Power Research Institute, Baltimore Gas and Electric Co., Boston Edison Co., Consolidated Edison Company of New York, NEGEA Service Corp., New England Power Co., Northeast Utilities Service Co., and Avco Corp.

The development of auxiliary power plant components and items are of utmost importance for applications of the MHD concept to commercial power generation. This paper reviews the progress in the current development work at AERL of high temperature air preheaters, alternate combustion methods of coal and of techniques for emission control of nitrogen oxides in the effluent gas from an MHD power plant. The purpose of this auxiliary component development work is to provide criteria and engineering data for the practical design and operation of coal burning MHD power systems. (Author)

A75-16839 # **Recent MHD generator testing at Avco Everett Research Laboratory, Inc.** R. Rosa, S. Petty, G. Enos, R. Kessler, and J. Klepeis (Avco Everett Research Laboratory, Inc., Everett, Mass.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/Ener-7.* 15 p. Members, $1.00; nonmembers, $3.00. Research supported by the U.S. Department of the Interior, Electric Power Research Institute, Baltimore Gas and Electric Co., Boston Edison Co., Consolidated Edison Company of New York, NEGEA Service Corp., New England Power Co., Northeast Utilities Service Co., and Avco Corp.

In a previous paper of Rosa et al. (1973), the several MHD generator test facilities presently in operation at the Avco Everett Research Laboratory (AERL) were described and the test results obtained up to that time were summarized. More recent results, obtained since that time, are presented here. Since the facilities were fully described previously, only the significant changes are described here. (Author)

A75-16840 # **Potential for large-scale energy storage in electric utility systems.** F. R. Kalhammer and P. S. Zygielbaum (Electric Power Research Institute, Palo Alto, Calif.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/Ener-9.* 13 p. 40 refs. Members, $1.00; nonmembers, $3.00.

Projections of the nation's future energy requirements and power generation mix, along with the emergence of new concepts for energy conversion and storage, necessitate concerted efforts to develop advanced techniques of storing energy. Significant societal benefits appear possible if today's practice of storing energy almost solely in the form of chemical fuels can be widely supplemented by other forms of energy storage. Potential benefits of large-scale energy storage by advanced methods are discussed broadly in terms of electric utility system economics, resource conservation and environmental impacts. Potentially significant applications outside the utility industry are highlighted. The prospects for realizing these potential benefits are intimately related to the success of current efforts to develop advanced, large-scale energy storage systems which are technically and economically feasible. The developmental status of major candidate systems are reviewed, and the key research requirements are outlined. The expected advantages and disadvantages of practical alternatives are compared briefly. (Author)

A75-16841 # **A comparison of methods for electric power generation from geothermal hot water deposits.** A. L. Austin and A. W. Lundberg (California, University, Livermore, Calif.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/Ener-10.* 13 p. 13 refs. Members, $1.00; nonmembers, $3.00.

A comparison is made of three energy conversion concepts: the Flashed Steam System, the Binary Cycle System, and the Total Flow System. These systems are analyzed for typical wellhead characteristics found in hot-water geothermal resources. The Total Flow concept passes the steam and water mixture directly through convergent-divergent nozzles and an impulse turbine. The Total Flow concept has the potential for 60 percent greater efficiency than either of the other systems. (Author)

A75-16842 # **Two-stage methane production from solid wastes.** J. D. Keenan (Pennsylvania, University, Philadelphia, Pa.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/Ener-11.* 13 p. 24 refs. Members, $1.00; nonmembers, $3.00. NSF Grants No. GI-29729; No. GI-34991.

This paper discusses the development of methods for the economic production of methane gas by the anaerobic digestion of organic matter. The process is widely used for the stabilization of sewage solids. The conversion of waste materials to fuel gas via anaerobic digestion represents a potential solution not only to the energy problem, but simultaneously to the solid wastes problem. The purpose of the research reported in this paper was to study the potential of two-stage digestion for the generation of fuel gas from particulate organic fuel materials. (Author)

A75-16857 # **Solar selective surfaces made of semiconducting powders.** R. W. Warren (Westinghouse Research Laboratories, Pittsburgh, Pa.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/HT-13.* 9 p. 13 refs. Members, $1.00; nonmembers, $3.00.

Because of the energy crisis there has been renewed interest in developing ways of using solar energy for useful purposes. One of the simplest of these employs solar energy as a heat source. A major problem in this application is finding a structure and materials which will absorb the solar energy with high efficiency and low cost. In this paper a novel design is presented which uses powdered silicon for this purpose. Measurements of the optical properties of powdered silicon in the visible and infrared regions are reported. Novel ways of using thin beds of these powders to collect solar energy are discussed as well as their advantages and disadvantages relative to more conventional collectors. (Author)

A75-16860 # **Natural convection in enclosed spaces - A review of application to solar energy collection.** H. Buchberg, I. Catton, and D. K. Edwards (California, University, Los Angeles, Calif.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/HT-12.* 14 p. 42 refs. Members, $1.00; nonmembers, $3.00.

A75-16861 # **Solar radiation heat transfer to high temperature heat carriers.** E. Bilgen (Montreal, Université, Montreal, Canada). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/HT-14.* 10 p. 17 refs. Members, $1.00; nonmembers, $3.00. Research supported by the National Research Council of Canada.

The fundamental aspect of propagation of heat flux due to solar radiation to a high-temperature heat carrier through a metallic wall of a collector is studied, and an exact solution of the problem is obtained. Theoretical results are compared to experimental measurements made with a focusing-type collector. The surface temperature of a flat-plate collector is also predicted on the basis of the exact method of analysis. The overall heat-transfer coefficient to a high-temperature heat carrier is also determined. (Author)

A75-16862 # **A hot liquid energy storage system utilizing natural circulation.** W. F. Phillips and R. A. Pate (Utah State University, Logan, Utah). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/HT-16.* 9 p. Members, $1.00; nonmembers, $3.00.

The results are presented from a combined experimental and theoretical study on a hot liquid energy storage system, which utilizes natural convection to circulate the liquid between the storage tank and the heat exchanger. The results are presented in the form of dimensionless charts which can easily be used to select the tank and heat exchanger dimensions for the design of a system to meet given specifications. Good agreement was obtained between the theoretical model and experimental data. Although the present work was performed with solar heating systems in mind, the design charts are presented in a sufficiently general form so that they could be used to design a storage system for other applications as well. (Author)

A75-16863 # **Performance of heat pumps using cold-side energy storage and unconventional heat sources.** R. A. Lawrence (Ohio University, Athens, Ohio). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/HT-17.* 12 p. 9 refs. Members, $1.00; nonmembers, $3.00.

The results of parametric studies to determine the effectiveness of various techniques for reducing the capital and operating costs of electric heat pumps for application in the colder regions of the United States are presented. Methods considered are extraction and storage of heat from the atmosphere during warm winter days, the use of solar energy from nonconcentration collectors, water-reservoir heat sources and underground water heat sources. The first of these methods proves to be ineffective for the climates considered. The latter three methods can provide significant energy savings. The use of underground water, where feasible, appears to offer the greatest potential for energy savings and cost reduction. (Author)

A75-16864 # **Solar energy storage within the absorption cycle.** J. Baughn and A. Jackman (California, University, Davis, Calif.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/HT-18.* 9 p. 15 refs. Members, $1.00; nonmembers, $3.00.

Solar energy storage may be achieved within the absorption cycle using the considerable energy required to separate a refrigerant from an absorbent solution. The stored energy can be recovered by the highly exothermic absorption of the refrigerant in a weak absorbent solution. Storage of the refrigerant, weak absorbent solution, and the strong absorbent solution is required. While this is more difficult than some solar energy storage systems, it has the important advantage that the stored fluids can be used for either space heating and hot water (the exothermic absorption reaction) or for air conditioning and refrigeration (evaporation of the refrigerant). The requirements for building heating and cooling needs are investigated, and this method is compared with alternatives such as hot water, hot rock and fusible salt storage. (Author)

A75-16865 # **Sizing of solar energy storage systems using local weather records.** G. L. Moore (Missouri, University, Columbia, Mo.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/HT-20.* 6 p. Members, $1.00; nonmembers, $3.00.

The design of a heat storage system for a solar heated structure is a regional problem. The daily weather variations for a specific location can be quite different from the variations at another location only miles away. This paper points out a design method using local weather records of daily insulation percentages and degree-days for the winter months. With this method, the effects of adding one or two days of extra heat storage capacity to a solar heating system can be evaluated in terms of extra structural heat load carried by the stored heat. Undersizing or oversizing a heat storage system for a given location is possible unless due regard is paid to the local duration and frequency of cloud cover during the stormy, coldest winter months. This information can be extracted directly from the local weather records. (Author)

A75-16867 # **Dynamic response of solar heat storage systems.** W. J. Yang (Michigan, University, Ann Arbor, Mich.) and C. P. Lee. *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/HT-22.* 18 p. 5 refs. Members, $1.00; nonmembers, $3.00.

An analysis is performed to determine the transient heat transfer between a heat-storage material and a circulating fluid in solar heat storage systems due to the inlet temperature variations of the circulating fluid. Both the specific-heat and heat-of-fusion types of heat storage are treated. Liquids (such as water) and porous media (such as rocks) are used as the heat-storage materials in the specific-heat type, while salt hydrates of moderate fusion temperature (typically sodium sulfates decahydrate) are employed for heat storage in the heat-of-fusion type. Three fluids, water, air and ammonia are considered the circulating fluids. The circulating fluid exchanges heat directly with the porous medium in a heat storage bin, but indirectly with the heat-storage liquid or salt hydrate through thin tubes inside a container. Analytical results for both the transient and the frequency response are obtained through the use of the Laplace transformation technique. (Author)

A75-16869 # **Performance of a laser mirror heat pipe.** D. L. Jacobson (Arizona State University, Tempe, Ariz.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/HT-61.* 13 p. 8 refs. Members, $1.00; nonmembers, $3.00. Contract No. F30602-72-C-0418. AF Project 3012-14.

The design and testing of a cylindrical copper-water heat pipe for application to an optically flat end for laser beam reflection is described. The heat pipe is 2 in. in diameter and 3 in. in length. The wick consists of sintered copper screen-covered grooves. The evaporator end of the device was heated by electrical resistance wires or by a carbon arc solar simulator. Heat was removed at the condenser end by a circumferential water calorimeter. The device was instrumented internally and externally with Cu-Cn thermocouples. Reflecting surface distortions were measured from the highly polished heat pipe end by a focal length change method. The heat pipe demonstrated the ability to significantly reduce surface deflections and therefore laser beam distortion. (Author)

A75-16879 # **Power from ocean waves.** M. D. Martin (Arizona, University, Tucson, Ariz.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/Pwr-5.* 8 p. 5 refs. Members, $1.00; nonmembers, $3.00.

A first-order calculation of the power per unit area which might be extracted from ocean waves indicates that a power density of the order of 50 w/sq ft might be achieved. This level is roughly an order of magnitude greater than that expected of solar power generated by other commonly proposed means. The utility of the scheme and its economic feasibility depend upon finding successful solutions to several design problems. (Author)

A75-16880 # **Economics of a hydrogen storage peaking power plant.** T. S. Jayadevaiah and S. C. Chiu (Wisconsin, University, Milwaukee, Wis.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/Pwr-6.* 6 p. 8 refs. Members, $1.00; nonmembers, $3.00.

Hydrogen storage for peaking plants is reconsidered in the context of increasing fuel costs, concern for environmental effects, and new techniques available for hydrogen storage. A rough cost analysis and comparison is made between hydrogen storage and conventional oil engine peaking plant for a 10-MW subsystem. From these preliminary calculations, hydrogen storage peaking plant using technology available now becomes competitive if the fuel costs rise above $1.20 per million Btv, which already may be the case today. (Author)

A75-16881 # **Optimising pumped storage with tidal power in an estuary.** T. L. Shaw and I. J. Westwood (Bristol, University, Bristol, England). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/Pwr-7.* 7 p. 6 refs. Members, $1.00; nonmembers, $3.00.

This paper forms a sequel to earlier studies in which the principles behind this type of power project were given mainly qualitative attention. The authors are now able to present quantitative data on the detailed performance of a scheme shown to generate at constant output through 12 hours by day from a pumped storage input of nearly 8 hours by night plus harnessing of the tides. It is shown that the pump-turbine installations would operate at equal total power level in each mode. (Author)

A75-16882 # **Gasification of solid wastes in fixed beds.** A. C. W. Eggen and R. Kraatz (K. T. Lear Associates, Inc., Manchester, Conn.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/Pwr-10.* 10 p. 7 refs. Members, $1.00; nonmembers, $3.00.

The benefits of fixed bed gasification for energy recovery are outlined. Basic mechanisms are developed, and the variations produced by feedstock, gasification oxidizer, as well as slagging versus non-slagging operation, are discussed. Process and hardware design considerations are given. Potential problem areas, such as channeling and particulate carry-out, are described. Scaling and its limitations are outlined. Gas utilization and system integration are discussed for approaches ranging from simple steam generators to more sophisticated gas turbine and fuel cell combinations. (Author)

A75-16883 # **Coal gasification by Atomics International's Rockgas process.** C. A. Trilling (Rockwell International Corp., Atomics International Div., Canoga Park, Calif.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/Pwr-11.* 10 p. Members, $1.00; nonmembers, $3.00.

The Rockgas process for the gasification of coal uses the partial oxidation of coal in a molten sodium carbonate medium to produce a low-Btu fuel gas for consumption at the site of the gasification plant. The sulfur and ash of the coal are retained in the melt, a sidestream of which is circulated continuously through a regeneration system for regeneration of the carbonate, removal of the ash, and recovery of elemental sulfur. The fuel gas produced has an effective heating value of about 150 Btu/scf. Following removal of entrained particulates, it can be used as a clean non-polluting fuel gas for either industrial heat or utility power generation applications. (Author)

A75-16884 # **The analysis of the performance of a pancake absorber-heat exchanger for a solar concentrator.** W. S. Duff (Colorado State University, Fort Collins, Colo.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/Sol-1.* 5 p. Members, $1.00; nonmembers, $3.00. NSF Grant No. GI-37815.

The performance of a pancake absorber-helical heat exchanger for use with a solar concentrating collector will be analyzed in this paper. The principal difference between this type of absorber-heat exchanger and most other absorber-heat exchangers of concentrating solar collectors is that there is an increasing intensity of radiation along the length of the heat exchanger tube. The performance of the pancake absorber-heat exchanger will be presented under various design conditions. A comparison will then be made with a performance analysis of this absorber-heat exchanger under the simplifying assumption that the heat exchanger tube is uniformly radiated. This comparison shows that there are some important differences between the performance predictions of the two analyses. (Author)

A75-16885 # **A case study - Utilization of solar energy in residential dwellings.** E. A. Farber and C. A. Morrison (Florida, University, Gainesville, Fla.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/Sol-2.* 8 p. Members, $1.00; nonmembers, $3.00.

This paper discusses techniques presently in use and in the design stage which utilize solar energy to various extents so as to

make residential dwellings virtually energy independent. Data are also presented to establish the availability of solar energy on the surface area of a typical residence. Diagrams relate the amount of available solar insolation to the latitude, location and time of the year. Data kept over the past several years at the University of Florida's research residence, Gainesville, Florida, provides the data base used for this case study. These data will be used in the future for comparison with the data being collected now that the residence has been converted to solar energy. Estimates of savings which may be realized by using solar energy are discussed in this paper. Schematic diagrams and photographs are presented which depict layouts of equipment assemblies currently available and in use at the Solar Energy Research Residence. (Author)

A75-16886 # **An analytical and experimental investigation of a laboratory solar pond model.** N. Chepurniy and S. B. Savage (McGill University, Montreal, Canada). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/Sol-3.* 12 p. 27 refs. Members, $1.00; nonmembers, $3.00. Research supported by the Brace Research Institute and National Research Council of Canada.

Solar ponds have been suggested as an effective means to collect and store incoming solar radiation for power production. This paper presents a mathematical model of the solar pond to predict the time-dependent temperature distributions in the pond. The effects of the pond depth, intensity and wavelength distribution of the incident radiation, and the effect of the concentration gradient on the pond temperature buildup are investigated. Sample calculations using a high order implicit finite difference scheme are given for a laboratory solar pond model subjected to a constant incident heat lamp radiation. Laboratory experiments are described and the experimental time-dependent temperature profiles are compared with the theoretical predictions. (Author)

A75-16888 # **Performance of the thermal trap solar collector.** R. L. San Martin (New Mexico State University, Las Cruces, N. Mex.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/Sol-5.* 6 p. 11 refs. Members, $1.00; nonmembers, $3.00.

The thermal trap flat plate solar collector is unique to New Mexico State University where in 1964 work was initiated on this type of collector. The thermal trap collector employs a transparent solid (methyl methacrylate) adjacent to the fluid cooled collector plate. It is found that by the use of this transparent solid which has a high transmittance at short wavelengths (up to 1.1 microns) combined with a low transmittance at longer wavelengths (greater than 1.1 microns) and a small thermal conductivity, and effective and efficient solar collector can be developed. Experimental collector tests were performed for a variety of operational conditions over a six-month period. The collector efficiency was experimentally determined and an analysis of the heat losses was accomplished. (Author)

A75-16889 # **Selection and evaluation of the University of Florida's solar powered absorption air conditioning system.** E. A. Farber, C. A. Morrison, and H. A. Ingley (Florida, University, Gainesville, Fla.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/Sol-6.* 10 p. 22 refs. Members, $1.00; nonmembers, $3.00.

This paper reviews through discussion and computer analysis a data base used for the evaluation of low temperature, 93 C (200 F) or less, solar energy refrigeration and air-conditioning systems. In the 'state-of-the-art' discussion of air conditioning methods, the advantages and disadvantages of such systems as vapor jet cooling, rankine cycle cooling, evaporative cooling, and absorption refrigeration are reviewed. Refrigerants as well as absorbents are discussed and the characteristics of several combinations pointed out. The most promising fluid combination cylces were analyzed with computer programs. Some of the resulting data are presented in graphical form for the various possible modes of operation considered. (Author)

A75-16890 # **Assessment of Rankine cycle for potential application to solar-powered cooling of buildings.** H. M. Curran, M. Lokmanhekin, T. Alereza, and M. Miller (Hittman Associates, Inc., Columbia, Md.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/Sol-7.* 15 p. 29 refs. Members, $1.00; nonmembers, $3.00. NSF Grant No. C-858.

In this study an assessment is made of the potential application of Rankine cycles to drive vapor compression refrigeration cycles for the cooling of buildings. A reference system configuration is developed using minimum capital cost as a criterion. The essential components are a solar collector, a Rankine cycle, and a vapor compression refrigeration cycle. Other components are a high-temperature thermal storage unit, a low-temperature storage unit, and an auxiliary source of thermal energy. Ideal efficiencies are presented for Rankine cycles with various working fluids, as functions of expander inlet temperature and condensing temperature. Actual efficiencies of some Rankine cycles developed by various manufacturers are used to establish probable performance limits relative to expander inlet and condensing temperatures. The performance characteristics of the Rankine cycle are interfaced with the cooling load and solar energy input to establish the relative component capacities. (Author)

A75-16891 # **Dynamic simulation for performance analysis of solar heated and cooled buildings.** C. B. Winn and G. R. Johnson (Colorado State University; Solar Environmental Engineering Co., Fort Collins, Colo.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Nov. 17-22, 1974, Paper 74-WA/Sol-8.* 9 p. Members, $1.00; nonmembers, $3.00. NSF Grant No. C-854.

A dynamic simulation model for use in the performance analysis of specific designs of solar heated and cooled buildings has been developed and tested. To use the design program, the user has merely to specify the components (that is, each subsystem; for example, collectors, storage units, splitting and mixing valves, house heating and cooling loads, auxiliary heating, auxiliary cooling, heat exchangers, etc.) and the manner in which they are connected and all initial conditions. The executive program then writes the program for the specific system to be analyzed. Each subsystem is described by a set of time-dependent differential equations or possibly algebraic equations. System state variables include temperature and mass flow rate. (Author)

A75-16925 **An engine project engineer's view of advanced secondary power systems.** W. L. McIntire and S. M. Hudson (General Motors Corp., Detroit Diesel Allison Div., Detroit, Mich.). *Society of Automotive Engineers, National Aerospace Engineering and Manufacturing Meeting, San Diego, Calif., Oct. 1-3, 1974, Paper 740884.* 11 p. Members, $1.75; nonmembers, $2.75.

Increasing secondary powerloads, advanced technology components, varied installations, and increased emphasis on cost and performance provide the requirements against which the engine project engineer must seek a balance during the conceptual, design, and development phases of an engine program. This paper reviews the requirements for advanced engine secondary power systems and some of the trends which are developing for future propulsion systems. (Author)

A75-17000 **The energy perspective.** G. F. C. Rogers. *Chartered Mechanical Engineer,* vol. 21, Oct. 1974, p. 61-65.

The maximum estimates of world fossil fuel reserves are presented, giving attention to current rates of consumption. It is pointed out that the oil reserves would be exhausted around the year 2020. The utilization of water power and vegetation is considered along with questions regarding geothermal power, possibilities presented by solar radiation, and problems connected with the use of nuclear fission as an energy source. The prospects to obtain energy from nuclear fusion are examined and attention is given to approaches to save fuel by increasing the efficiency with which the energy resources are used. G.R.

A75-17024 **Energy problems - Solar energy and manure gas (Les problèmes de l'énergie - Energie solaire et gaz de fumier).** M. Isman (Institut National Agronomique de Paris-Grignon, Paris, France). *Sciences et Techniques,* Nov. 15, 1974, p. 17-22. In French.

The fermentation of natural or artificial manures and plant byproducts produces a combustible gas composed essentially of methane and carbon dioxide. Techniques for producing this gas under artificial fermentation conditions are explained. The gas production can be controlled to yield fuel which is more efficient than that produced under natural conditions. The gas produced can be used to fuel engines, such as on farm equipment, and for other purposes. This has been done successfully in France and Algeria for more than thirty years. Under economical conditions, one ton of chaff can yield 200-250 cubic meters of combustible gas. Thus, France, for example, could produce enough manure gas from farm wastes to supply all needs of agricultural machinery now fueled by petroleum products. Producing fuel in this way can yield cost, pollution, and storage advantages. A.T.S.

A75-17067 **Utilization of tubular thermoelectric modules in solar generators.** M. A. Markman, L. M. Simanovskii, and V. T. Kamenskii (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Istochnikov Toka, Kishinev, Moldavian SSR). *(Geliotekhnika,* no. 1, 1974, p. 23-27.) *Applied Solar Energy,* vol. 10, no. 1-2, 1974, p. 16-18. Translation.

An experiment was performed to determine the efficiency of a solar thermoelectric generator utilizing a tubular thermoelectric module and a parabolic-cylindrical solar-energy concentrator. The efficiency of such a generator is found to be about 3 %, comparable to existing types. Its advantages derive from the use of simple and inexpensive concentrators and standard tubular thermoelectric converters. A.T.S.

A75-17068 **Determination of the temperature field in a tubular thermoelectric module.** M. A. Markman, L. M. Simanovskii, I. R. Iurkevich, and V. T. Kamenskii (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Istochnikov Toka, Kishinev, Moldavian SSR). *(Geliotekhnika,* no. 1, 1974, p. 28-30.) *Applied Solar Energy,* vol. 10, no. 1-2, 1974, p. 19-21. Translation.

A method has been developed for investigating the temperature field in the inner conductor of a tubular thermoelectric module. Observations show the thermal resistance of the module elements to be both stable and independent of time and of thermal cycling. Measurements of module parameters in open-circuit experiments and under conditions of maximum output power are used to determine the temperature drop across the electrically insulating elements and contact junctions of the module. With this method it is possible to obtain information on the quality of assembly, stability, and temperature drop across the electrically insulating elements of the module. T.S.

A75-17069 **Design of a tubular heat collector for a solar power installation with a parabolocylindric concentrator.** G. Ia. Umarov, T. Z. Abidov, and V. S. Trukhov (Akademiia Nauk Uzbekskoi SSR, Fiziko-Tekhnicheskii Institut, Tashkent, Uzbek SSR). *(Geliotekhnika,* no. 1, 1974, p. 44-47.) *Applied Solar Energy,* vol. 10, no. 1-2, 1974, p. 33-35. Translation.

A method was developed for determining the basic thermal parameters of a smooth-walled tubular heat exchanger for use as the heat collector in a solar power generator with a parabolic-cylindrical concentrator. The calculations show that the collector efficiency and the temperature-head losses increase with increasing concentration factor and decrease with increasing collector working temperature. The equations derived can be used for optimizing solar generators with respect to concentrator and energy-converter parameters. A.T.S.

A75-17076 **Prospects for using dynamic thermocompression converter in solar power plants.** G. Ia. Umarov, V. S. Trukhov, and I. A. Tursunbaev (Akademiia Nauk Uzbekskoi SSR, Fiziko-Tekhnicheskii Institut, Tashkent, Uzbek SSR). *(Geliotekhnika,* no. 2, 1974, p. 10-14.) *Applied Solar Energy,* vol. 10, no. 1-2, 1974, p. 53-56. Translation.

It is shown analytically that at power levels on the order of 1 kW, a heat to pneumatic energy converting thermocompressor which employs a modified Stirling cycle is superior to other types of dynamic converter proposed for solar power plants. The advantages which accrue from the use of a pneumatic drive between the dynamic converter and the actuating mechanism include elimination of an intermediate generator/electric motor link, lack of constraints on the mutual position of the dynamic converter and actuating mechanism, and optimal operation of the solar power plant under various operating conditions. The modification differs significantly from the classical Stirling cycle, both in the structure and in the thermodynamics of the cycle itself. Heat is converted to the potential energy of a compressed working fluid. The mechanical efficiency is higher than that of the Stirling engine, because of smaller friction losses due to the absence of a connecting rod/crank mechanism. V.P.

A75-17077 **Some generalizations of sample water-supply calculations for solar-powered pumping plants.** R. B. Salieva (Tashkentskii Elektrotekhnicheskii Institut, Tashkent, Uzbek SSR). *(Geliotekhnika,* no. 2, 1974, p. 28-34.) *Applied Solar Energy,* vol. 10, no. 1-2, 1974, p. 67-70. 7 refs. Translation.

A75-17081 **Experience in setting up solar-energy survey for Azerbaidzhan.** V. I. Es'man, E. A. Movsumov, and P. F. Rzaev (Akademiia Nauk Azerbaidzhanskoi SSR, Institut Fiziki, Baku, Azerbaidzhan SSR). *(Geliotekhnika,* no. 2, 1974, p. 51-58.) *Applied Solar Energy,* vol. 10, no. 1-2, 1974, p. 83-88. 5 refs. Translation.

A75-17083 **Effectiveness of using semiconductor heat pumps under the conditions of the Turkmen SSR.** D. I. Ibragimov and A. I. Filatov (Gosudarstvennyi Nauchno-Issledovatel'skii Energeticheskii Institut, Moscow, USSR). *(Geliotekhnika,* no. 2, 1974, p. 64-70.) *Applied Solar Energy,* vol. 10, no. 1-2, 1974, p. 93-97. Translation.

The efficiency of semiconductor heat pump (SHP) utilization is calculated. A district located within a centralized electric-service area of the Turkmen SSR is investigated. Specific per-capita heat-consumption norms are used to determine the annual needs of the district for heat. The total adjusted expenditures for different schemes of supplying heat to the Turkmen SSR are obtained as a function of fuel cost. Observation indicates the most effective heat supply scheme to involve the utilization of SHP for heating, ventilation, air conditioning, and hot-H2O supply. T.S.

A75-17084 **Convergence and speed of calculations for thermoelectric heat pump.** A. G. Makhlin (Gosudarstvennyi Nauchno-Issledovatel'skii Energeticheskii Institut, Moscow, USSR). *(Geliotekhnika,* no. 2, 1974, p. 71-75.) *Applied Solar Energy,* vol. 10, no. 1-2, 1974, p. 98-101. 6 refs. Translation.

A theorem is proposed and proved stating a condition for the calculation of a thermoelectric device to converge to a unique solution. This condition relates by means of an inequality the coefficients of heat transfer, heat-transferring surface area, and thermal commutation resistance. Convergence and rapidity of computation are discussed on the basis of the initial values these coefficients may have. P.T.H.

A75-17503 * # **Wind energy developments in the 20th century.** D. J. Vargo (NASA, Lewis Research Center, Cleveland, Ohio). *Annual Regulatory Information Systems Conference, 4th, St. Louis, Mo., Sept. 10-12, 1974, Paper.* 28 p. 20 refs.

Wind turbine systems for generating electrical power have been tested in many countries. Representative examples of turbines which have produced from 100 to 1250 kW are described. The advantages of wind energy consist of its being a nondepleting, nonpolluting, and

free fuel source. Its disadvantages relate to the variability of wind and the high installation cost per kilowatt of capacity of wind turbines when compared to other methods of electric-power generation. High fuel costs and potential resource scarcity have led to a five-year joint NASA-NSF program to study wind energy. The program will study wind energy conversion and storage systems with respect to cost effectiveness, and will attempt to estimate national wind-energy potential and develop techniques for generator site selection. The studies concern a small-systems (50-250 kW) project, a megawatt-systems (500-3000 kW) project, supporting research and technology, and energy storage. Preliminary economic analyses indicate that wind-energy conversion can be competitive in high-average-wind areas. A.T.S.

A75-17504 * # **Concepts for central solar electric power generation.** J. K. Kintigh (Black and Veatch Consulting Engineers, Kansas City, Mo.). *Frontiers of Power Technology Conference, Oklahoma State University, Stillwater, Okla., Oct. 9, 10, 1974, Paper.* 38 p. Contract No. NAS3-18014.

The investigation reported was conducted to select the best conceptual design of a power plant for the dynamic conversion of solar heat to electricity. Conversion of thermal energy to electricity was to be an accomplished with conventional turbomachinery. Questions of site selection are discussed along with solar energy collection systems, aspects of candidate system definition, and reference systems. G.R.

A75-18080 **Fusion power - Prospects and impact.** J. N. Davidson (Georgia Institute of Technology, Atlanta, Ga.). In: National Electronics Conference, 30th, Chicago, Ill., October 16-18, 1974, Proceedings. Volume 29. Oak Brook, Ill., National Engineering Consortium, Inc., 1974, p. 113-118. 15 refs.

The present work discusses the status of controlled fusion technology, the major technical problems remaining to be solved, and the probable impact of a fusion energy system. The basic concepts behind the obtaining of energy released in the fusion of two light nuclei are reviewed, and the ideas of open (bottle) confinement and closed (torus) confinement of a plasma are sketched. Resistance heating, adiabatic compression, injection of high-energy particles, and electromagnetic irradiation (laser beam irradiation, for example) are briefly discussed as current techniques for heating a plasma to the temperature necessary for fusion to take place. A major problem remaining is the design of a first wall around the reaction which will be exposed to a flux of about 100 trillion neutrons per sq cm per sec. It appears likely that a fusion power plant will produce between 2,000 and 10,000 megawatts of electrical power per installation. P.T.H.

A75-18269 # **Extended energy management methods for flight performance optimization.** A. J. Calise (Dynamics Research Corp., Wilmington, Mass.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 13th, Pasadena, Calif., Jan. 20-22, 1975, Paper 75-30.* 8 p. 15 refs.

This paper develops a singular perturbation approach to extend existing energy management (EM) methods. A procedure is outlined for modeling altitude and flight path angle dynamics which are ignored in EM solutions. It is shown that feedback solutions can be obtained, even for EM problem formulations which currently result in a two-point boundary value problem. In particular, feedback controls for three-dimensional trajectory optimization problems have been derived using the extended energy management approach. The procedure outlined in this paper is general and applicable to solving a wide class of optimal control problems. It avoids the 'matching' problem that currently exists in applying singular perturbation theory to nonlinear problems. Asymptotically stable boundary layer solutions are a natural result of the approach. (Author)

A75-18798 # **Effect of heat transfer from the lateral surfaces of semiconductor thermocouples on the energy characteristics of a thermoelectric generator (O vliianii teplootdachi s bokovykh poverkhnostei poluprovodnikovykh termoelementov na energeticheskie kharakteristiki termoelektricheskogo preobrazovatelia).** G. A. Kokliuev and E. P. Oganov. *Akademiia Nauk SSSR, Izvestiia, Energetika i Transport,* Nov.-Dec. 1974, p. 121-124. 5 refs. In Russian.

A75-19050 **Compact solar energy concentrator.** R. W. Hosken. *Electro-Optical Systems Design,* vol. 7, Jan. 1975, p. 32-35.

A mirror design is presented that is far lighter and easier to handle than present solar collectors, and that although flat, acts like a parabolic reflector. It is a variation of the Fresnel lens: the surface of a flat circular plate is contoured to reflect all rays to a focal point. Proper design of the surface contours permits moving the secondary mirror closer to the primary mirror, resulting in more overall compactness than is found in paraboloid systems. Potential difficulties include the cost and producibility of casting or machining a contoured planar surface and obscuration by the inner ring lip of light reflected from outer rings. S.J.M.

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STAR ENTRIES

N75-10039# Oak Ridge National Lab., Tenn.
TOTAL ENERGY USE FOR COMMERCIAL AVIATION IN THE US
E. Hirst Apr. 1974 15 p refs
(Contract W-7405-eng-26; Grant NSF AG-398)
(ORNL-NSF-EP-68) Avail: NTIS HC $3.25

The total energy impacts of commercial aviation in the United States are shown. Direct fuel use by commercial airplahds (1080 trillion Btu in 1971) amounts to 6% of direct fuel use for all domestic transportation, 1.6% of the total national energy budget. Indirect energy requirements are one-third as great as the direct fuel use. Thus, total energy demand for domestic commercial aviation in 1971 was 1450 trillion Btu, 2% of national energy use. Direct fuel savings due to adoption of airline conservation measures can be increased by one-third to account for the indirect energy savings. Some conservation measures, such as a reduction in short-haul flights, are likely to have larger energy savings, because short-haul flights involve higher maintenance costs, greater airport use, and higher passenger service costs on a passenger-mile basis than do longer flights. Other measures, such as reducing cruise speeds, are likely to have relatively small indirect energy savings. In all cases, the direct fuel savings can be increased by 20%. NSA

N75-10259# Committee on Commerce (U. S. Senate).
LIMIT LEAD IN GASOLINE
Washington GPO 1974 110 p refs Hearing before Subcomm. on Environment of Comm. on Commerce, 93d Congr., 1st Sess., 29 Nov. 1973
(GPO-29-660) Avail: Subcomm. on Environment

A Congressional investigation was conducted to determine the validity of the requests from the Environmental Protective agency to limit the amount of lead which could be added to gasoline for motor vehicle use. The economic factors, pollution problem; and product availability are discussed. Testimony is provided by selected witnesses concerning the harmful physical effects of lead in gasoline. Charts are provided to show the production capacity of unleaded fuels and the anticipated demand for the product. Author

N75-10347*# Grumman Aerospace Corp., Bethpage, N.Y.
HEAT PIPE MANUFACTURING STUDY Final Report
F. Edelstein Aug. 1974 223 p refs
(Contract NAS5-23156)
(NASA-CR-139140; CEM-10R) Avail: NTIS HC $7.25 CSCL 20M

Heat pipe manufacturing methods are examined with the goal of establishing cost effective procedures that will ultimately result in cheaper more reliable heat pipes. Those methods which are commonly used by all heat pipe manufacturers have been considered, including: (1) envelope and wick cleaning, (2) end closure and welding, (3) mechanical verification, (4) evacuation and charging, (5) working fluid purity, and (6) charge tube pinch off. The study is limited to moderate temperature aluminum and stainless steel heat pipes with ammonia, Freon-21 and methanol working fluids. Review and evaluation of available manufacturers techniques and procedures together with the results of specific manufacturing oriented tests have yielded a set of recommended cost-effective specifications which can be used by all manufacturers. Author

N75-10578+ Atomic Energy Commission, Washington, D.C. Technical Information Center.
COAL PROCESSING: GASIFICATION, LIQUEFACTION, DESULFURIZATION: A BIBLIOGRAPHY, 1930 - 1974
Oct. 1974 765 p refs
(TID-3349) Avail: NTIS HC $17.25

The bibliography provides a comprehensive listing of topical materials concerning the several coal processing techniques, including carbonization, desulfurization and purification, hydrogenation, gasification, liquefaction, pyrolysis and cracking, and solvent extraction. Properties of processed coal, coal by-products, and problems in waste management are also covered by the listing. A.A.D.

N75-10580# Committee on Science and Astronautics (U. S. House).
RESEARCH, DEVELOPMENT, AND THE ENERGY CRISIS
Washington GPO 1974 210 p ref Hearing before Subcomm. on Energy of Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., No. 22, 20 Nov. 1973
(GPO-27-032) Avail: Subcomm. on Energy

Congressional hearings are presented on a bill to provide for early commercial demonstration of technology for solar heating and combined solar heating and cooling by NASA in cooperation with the National Bureau of Standards, the National Science Foundation, the Secretary of Housing and Urban Development, and other Federal agencies. Preliminary results of an ongoing study of energy usage in public and commercial buildings are also discussed. The effects of building location, design, and operation alternatives are considered, together with initial estimates of the conservation potential in the sector. J.A.M.

N75-10581# Committee on Interstate and Foreign Commerce (U. S. House).
INPEPENDENT TRUCKERS AND THE ENERGY CRISIS
Washington GPO 1974 111 p refs Hearings on H.J. Res. 893 before Comm. on Interstate and Foreign Commerce and Subcomm. on Transportation and Aeron., 93d Congr., 2d Sess., 30 Jan. - 6 Feb. 1974
(GPO-31-412) Avail: Subcomm. on Transportation and Aeron.

The Interstate Commerce Commission and the Department of Transportation appeared before the House Subcommittee on Transportation and Aeronautics to make available data on what their respective agencies are doing in regard to the independent truckers and the trucking industry as a whole. The effects of the energy crisis on the independent truckers is examined, as well as possible solutions to their problems. J.A.M.

N75-10584*# Auburn Univ., Ala. School of Engineering.
MEGASTAR: THE MEANING OF ENERGY GROWTH: AN ASSESSMENT OF SYSTEMS, TECHNOLOGIES, AND REQUIREMENTS Executive Summary
Sep. 1974 42 p refs
(Grant NGT-01-003-044)
(NASA-CR-120355) Avail: NTIS HC $3.75 CSCL 10A

A methodology for the display and analysis of postulated energy futures for the United States is presented. A systems approach that includes the methodology of technology assessment is used to examine three energy scenarios--the Westinghouse Nuclear Electric Economy, the Ford Technical Fix Base Case and a MEGASTAR generated Alternate to the Ford Technical Fix Base Case. The three scenarios represent different paths of energy consumption for the present to the year 2000. Associated with these paths are various mixes of fuels, conversion, distribution, conservation and end-use technologies. MEGASTAR presents the estimated times and unit requirements to supply the fuels, conversion and distribution systems for the postulated end uses for the three scenarios and then estimates the aggregate manpower, materials, and capital requirements needed to develop the energy system described by the particular scenario. The total requirements and the energy subsystems for each scenario are assessed for their primary impacts in the areas of society, the environment, technology and the economy. Author

N75-10585*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLAR ENERGY ABSORBER Patent Application
Lott W. Brantley, Jr., inventor (to NASA) Filed 29 Oct. 1974 15 p
(NASA-Case-MFS-22743-1; US-Patent-Appl-SN-518684) Avail: NTIS HC $3.25 CSCL 10A

A solar energy absorber, including a tubular absorber surface through which a fluid passes for transferring thermal energy, layer is vacuum or air for minimizing thermal energy losses through convection. A clear liquid passes between two intermediate layers of glass for transferring, by means of conduction, the thermal energy absorbed by either the initial passage of the visible spectrum of electromagnetic rays or by infrared radiation radiated from an absorber positioned below. Author

N75-10586*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLAR ENERGY TRAP Patent Application
Lott W. Brantley, Jr., inventor (to NASA) Filed 29 Oct. 1974 16 p
(NASA-Case-MFS-22744-1; US-Patent-Appl-SN-518544) Avail: NTIS HC $3.25 CSCL 10A

An apparatus is provided for trapping solar energy emitted from the sun for heating a fluid that could be subsequently used in turbines and the like. The apparatus includes an elongated vertical light pipe having an open end through which the visible spectrum of electromagnetic radiation from the sun passes to strike a tubular absorber carried adjacent the other end. The light pipe has a coated interior surface of a low absorptivity and a high reflectivity at the visible wave lengths and a high absorptivity/emissivity ratio at infrared wave lengths. The tubular absorber has a coating on the surface for absorbing visible wave lengths so as to heat the fluid passing through. Infrared wave lengths are radiated from the tubular absorber back into the light pipe for heating fluid passing through a tubular coil wound thereon. NASA

N75-10587*# Kanner (Leo) Associates, Redwood City, Calif.
THE ECONOMICS OF USING WIND POWER FOR ELECTRICITY SUPPLY IN THE NETHERLANDS AND FOR WATER SUPPLY ON CURACAO
H. Vermeulen Washington NASA Oct. 1974 64 p ref Transl. into ENGLISH from the Netherlands reports/TW-555 and GCV-R-128
(Contract NASw-2481)
(NASA-TT-F-15982; TW-555; GCV-R-128) Avail: NTIS HC $4.25 CSCL 10A

It is shown to be economically feasible to harness the wind for electricity supply in the Netherlands in terms of power and production costs. Different wind power plants are discussed in detail. An abridged account of a Danish proposal to harness wind power, and calculation of the efficiency Danish aeromotor are included. Comparisons are made with the power need situation in Curacao, and it is determined that a similar wind power conversion capability recommended for the Netherlands is feasible for the West Indies as well. Author

N75-10588# Committee on Interior and Insular Affairs (U. S. Senate).
ECONOMIC IMPACT OF THE OIL SHALE INDUSTRY IN WESTERN COLORADO
Washington GPO 1974 226 p refs Hearing before Subcomm. on Public Lands of Comm. on Interior and Insular Affairs, 93d Congr., 2d Sess., 19 Jan. 1974
(GPO-28-608) Avail: Subcomm. on Public Lands

The economic impact of leasing public lands for development of the oil shale industry in western Colorado was discussed before the Senate Subcommittee on Public Lands. E.H.W.

N75-10591# Mound Lab., Miamisburg, Ohio.
ADVANCED HEAT SOURCE CONCEPTS
J. E. Selle 10 Apr. 1974 8 p ref
(Contract AT-33-1-GEN-53)
(MLM-2134) Avail: NTIS HC $3.25

Recent trends in heat source programs indicate the feasibility of a modular approach to heat source design. In this approach, modules, comprised of a number of individually encapsulated units or capsulettes, are stacked together to form one heat source. Each capsulette can independently survive impact and post-impact containment. Such heat sources are useful for electrical power generation in space. Author (NSA)

N75-10592# Oak Ridge National Lab., Tenn.
NSF-RANN ENERGY ABSTRACTS: A MONTHLY ABSTRACT JOURNAL OF ENERGY RESEARCH
M. P. Guthrie Jan. 1974 45 p refs
(Contract W-7405-eng-26)
(ORNL-EIS-74-52-Vol-2-No-1) Avail: NTIS HC $3.75

The bibliography contains ninety-three research citations from technical journal articles, popular or semi-technical magazine articles, topical reports, symposium papers and proceedings, monographs, and books published within the past two years. Citations are grouped by subject category headings of energy, energy sources, unconventional energy sources and power generation, electric power, electric power generation, electric power transmission and distribution, energy storage, and energy demand and consumption. NSA

N75-10593# California Univ., Livermore. Lawrence Livermore Lab.
US ENERGY FLOW CHARTS FOR 1950, 1960, 1970, 1980, 1985, AND 1990
A. L. Austin and S. D. Winter 16 Nov. 1973 18 p refs
(Contract W-7405-eng-48)
(UCRL-51487) Avail: NTIS HC $3.25

Energy flow charts for the U.S., showing the origin and disposition of energy for the years 1950,1960,1970,1980,1985, and 1990, are presented along with a piscussion of their development and the implications of the data they represent. An appendix describes the construction of one chart in detail, serving as an example of the method. Author (NSA)

N75-10594# California Univ., Livermore. Lawrence Livermore Lab.
RATIONALE FOR SETTING PRIORITIES FOR NEW ENERGY TECHNOLOGY RESEARCH AND DEVELOPMENT
B. Rubin, S. Winter, W. Ramsey, and G. Werth 4 Jan. 1974 60 p refs
(Contract W-7405-Eng-48)
(UCRL-51511) Avail: NTIS HC $4.25

A strategy for employing new technologies to meet United States energy shortages by 1985, including a set of ground rules for choosing among different technologies, is presented. Twenty-five technology areas are indicated, each of which meets the ground rules and is potentially capable of providing at least 0.5 x 10 to the 15th power Btu/yr by 1985. Source energy prices and 1985 energy production quantities are estimated. Total R and D costs are estimated to be $5.7 billion; total production plant capital costs would be about $73 billion. Relative values of different technologies are compared on the basis of city-gate energy prices. Development of these technologies would approximately double the commercially-available fossil fuel reserves, assuming an energy price increase (in 1973 dollars) of about 30% over 1973 prices. Nonfossil reserves also would be greatly increased. Addition of the energy supplies produced by these new technologies to the supplies derived through conventional means could lead to self-sufficiency in energy by the mid-1980's. Author (NSA)

N75-10595# Atomic Energy Commission, Washington, D.C.
ENERGY TRANSPORTATION, DISTRIBUTION, AND STORAGE Subpanel Report 4 used in preparing the AEC Chairman's Report to the President
1973 158 p refs
(WASH-1281-4) Avail: NTIS HC $6.25

Five year R and D program objectives in transportation and distribution are: (1) continue development of increased-capacity

ac and dc overhead power transmission systems by doubling the present capacity by 1985, and achieving a multiplication of 4 to 10 times by the year 2000; (2) to continue the development of reliable and low-cost underground transmission systems capable of matching future overhead systems in both power capacity and voltage; (3) to develop advanced methods and equipment for systems security and control that wcl improve reliability and efficiency of generation, transmission, and distribution; and (4) to analyze electrical energy transportation systems development in order to identify the more desirable growth options, and to pursue fundamental investigations that have potential for long-term (beyond 2000 AD) applicativn. Five-year objectives in the area of energy storage are given. Author (NSA)

N75-10597# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEVELOPMENT OF SOLAR ENGINEERING IN THE USSR
U. A. Arifov 29 Jul. 1974 15 p Transl. into ENGLISH from Geliotekh. (USSR), no. 6, 1972 p 3-8
(AD-784708; FTD-HT-23-792-74) Avail: NTIS CSCL 10/1
The research in problems of solar engineering in the U.S.S.R. is briefly surveyed. F.O.S.

N75-10598# Army Foreign Science and Technology Center, Charlottesville, Va. Transl. into ENGLISH from Mekh. Elek. (USSR), no. 7, 1971 p 43-44
STANDARDIZED WIND ELECTRIC POWER UNIT
V. Fedotov and V. P. Kharitonov 9 May 1974 6 p refs
(AD-783764; FSTC-HT-23-1824-73) Avail: NTIS CSCL 10/2
The standardized UVEU- (1-4) . 6 wind electric power unit is discussed. The unit is suitable for operation at small sites which are distant from power networks and do not have a high power demand. Output and engineering characteristics of the unit are given. GRA

N75-10599# Bureau of Mines, Laramie, Wyo. Energy Research Center.
PRELIMINARY EVALUATION OF UNDERGROUND COAL GASIFICATION AT HANNA, WYOMING
G. G. Campbell, C. F. Brandenburg, and R. M. Boyd Oct. 1974 17 p
(BM-TPR-82) Avail: NTIS HC $3.25
A field test of underground coal gasification was conducted to investigate the technological feasibility of gasifying a subbituminous coal; preliminary results of the experiment are described. The coal was ignited in the central well of a 16-well pattern. Both forward and reverse combustion techniques were attempted to prepare a path of sufficient permeability to permit the high air injection rates necessary for gasification. Gasification between linked wellbores was sustained for periods as long as 3 months. Hydrogen-rich gas havig a heating value of 100 to 150 Btu/scf was produced. Author

N75-10600# Michigan Univ., Ann Arbor.
EVALUATION OF COAL CONVERSION PROCESSES TO PROVIDE CLEAN FUELS, PART 1 Final Report, Nov. 1973 - Feb. 1974
Donald L. Katz, Dale E. Briggs, Edward R. Lady, John E. Powers, and M. Rasin Tek Feb. 1974 78 p refs Sponsored by Electric Power Research Inst., Palo Alto, Calif.
(PB-234202/0; EPRI-206-0-0-1) Avail: NTIS HC $4.00 CSCL 21D
The ongoing research and development programs are reported on coal conversion to clean fuels and coal utilization in environmentally acceptable ways for electric power generation. Part 1 contains the choices and recommendations for research support by EPRI. Those processes which seem to have the best prerequisites for providing clean fuels from coal at the earliest dates are delineated. The bases for the reasoning behind the choices are given. Coal beneficiation, gasification, liquefaction and fluidized bed combustion are compared and evaluated with regard to their potential integration into the electric power industry. GRA

N75-10601# Little (Arthur D.), Inc., Cambridge, Mass.
IMPACT OF MOTOR GASOLINE LEAD ADDITIVE REGULATIONS ON PETROLEUM REFINERIES AND ENERGY RESOURCES, 1974-1980, PHASE 1 Final Report
May 1974 131 p
(Contract EPA-68-02-1332)
(PB-234185/7; EPA-450/3-74-032a) Avail: NTIS HC $4.75 CSCL 13B
The report presents results of a study to assess the impact on operations of petroleum refineries and on energy resources of two regulations promulgated by the Environmental Protection Agency to control the level of lead additive in motor gasoline. The first of these regulations requires the availability of low-octane, lead-free gasoline for vehicles which will be equipped with lead sensitive catalytic converters designed to meet 1975 automotive emission standards. For health reasons, the second regulation requires a gradual phase-down of the lead content of the total gasoline pool (including higher octane gasoline to satisfy the remaining high-compression ratio engines). The study considers separately the impact of each regulation. Effects on overall refinery yields, refinery operation flexibility to maximize production of gasoline and/or heating oils, and on energy resources requirements have been considered. Other parametric studies evaluate suppositions of a need for a higher octane lead free gasoline and a higher demand for lead free gasoline than now forecast. GRA

N75-10603# FMC Corp., Princeton, N.J. Chemical Research and Development Center.
CHAR OIL ENERGY DEVELOPMENT Monthly Reports, Apr. 1968 - Oct. 1969
Jul. 1974 305 p refs
(Contract DI-14-01-0001-498)
(PB-233263/3; MR-19; MR-20; MR-21; MR-22; MR-23; MR-24; MR-25; MR-26; MR-27; MR-28; MR-29; MR-30; MR-31; MR-32; MR-33; MR-34; MR-35; MR-36; MR-37) Avail: NTIS HC $18.25 CSCL 07A
These monthly reports (Apr 68-Oct 69) trace the progress of the development of the COED (charoil-energy-development) process--from bench scale to pilot plant operations at Princeton, New Jersey--by the FMC Corporation under contract (14-01-0001-498) to the Office of Coal Research. Under development since 1962, the COED process converts coal to low-sulfur synthetic crude oil, gas, and char by the fluidized-bed pyrolysis of coal, followed by the hydrotreating of the coal oil to synthetic crude oil. The char can be gasified to give a clean fuel gas for power generation, thus reopening the potential of using high sulfur coals for power generation. Successful operation of a 100 pound-per-hour process development unit led to the design, construction, and operation of a pilot plant at Princeton. The pilot plant can process 36 tons of coal per day and hydrotreat 30 barrels of coal-derived oil daily. GRA

N75-10604# Michigan Univ., Ann Arbor.
EVALUATION OF COAL CONVERSION PROCESSES TO PROVIDE CLEAN FUELS, PART 2 Final Report, Nov. 1973 - Feb. 1974
Donald L. Katz, Dale E. Briggs, Edward R. Lady, John E. Powers, and M. Rasin Tek Feb. 1972 410 p refs Sponsored by Electric Power Research Inst., Palo Alto, Calif.
(PB-234203/8; EPRI-206-0-0-2) Avail: NTIS HC $8.50 CSCL 21D
A review is made of six general methods of coal utilization with elimination of the sulfur prior to or during combustion in an electric power generating plant: fluidized bed combustion, coal beneficiation, pyrolysis, coal gasification, coal dissolution and liquefaction, in-situ combustion. The processes in each category were reviewed, analyzed and evaluated. Critical process steps, where additional research must be done before the processes can be considered at the commercial stage of development, were identified. The advantages and disadvantages of 37 processes were identified. Also included are discussions of combined cycle systems, economics, retrofit capabilities, thermodynamics and coal slurry pipelines. These topics give perspective to the general subject of coal use. (Modified author abstract) GRA

N75-10605# Stanford Research Inst., Menlo Park, Calif.
EFFECTIVE UTILIZATION OF SOLAR ENERGY TO PRODUCE CLEAN FUEL Final Report
John A. Alich, Jr. and Robert E. Inman Jun. 1974 164 p refs
(Grant NSF GI-38723)
(PB-233956/2; NSF-RA/N-74-036) Avail: NTIS HC $5.00 CSCL 21D

The suitability of plant material as an energy feedstock was evaluated. Items covered include: types of vegetation best suited for a solar conversion facility, type and availability of land, logistics and economics of growing the desired crop, energy budget for plant material production and harvesting, and a technoeconomic comparison of firing the crops directly for electric power generation with converting them to clean fuel gas (methane or low-Btu gas) either at the farm site or at selected markets. Research needs in key technical and economic areas are pointed out.
Author (GRA)

N75-10608# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
NOVEL MATERIALS FOR POWER SYSTEMS. PART 3: SELECTIVE EMITTERS FOR ENERGY CONVERSION Annual Technical Report, 1 Jun. 1973 - 31 May 1974
R. J. Schwartz, D. DeWitt, K. Hoilman, L. Tiedeman, and S. Gaalema 15 Jul. 1974 46 p refs
(Grant DAHC15-73-G-0011; ARPA Order 2338)
(AD-784449) Avail: NTIS CSCL 10/2

The purpose of the research was to determine those materials which would be most promising for use as selective emitters, to fabricate initial samples for testing, to build an optical system capable of measuring the spectral efficiency rapidly, and accurately, and to make initial measurements on the spectral efficiency of promising samples. All of these goals have been met. It has been determined that the rare earth oxides and mixtures of rare earth oxides are quite promising as selective emitters for energy conversion. Initial samples of erbium oxide and mixtures of erbium oxide and ytterbium oxide have been fabricated. An optical system for measuring spectral efficiency has been built and preliminary tests run for measuring the spectral efficiency of these materials. The spectral efficiency measurement apparatus incorporates an automatic data acquisition system which allows the rapid processing of large numbers of samples.
GRA

N75-10609# Advanced Kinetics, Inc., Costa Mesa, Calif.
CHEMICAL TO ELECTROMAGNETIC ENERGY CONVERSION TECHNIQUES Final Report, May 1972 - Mar. 1974
Ralph W. Waniek Jun. 1974 159 p refs
(Contract F30602-72-C-0401; AF Proj. 4506)
(AD-783901; RADC-TR-74-154) Avail: NTIS CSCL 10/2

The objective of the work was to develop techniques for conversion of the very high density energy stored chemically to pulses of electrical energy. Reliable low cost single shot convertors have been demonstrated by investigators in explosive flux compression technology. The techniques investigated are for use in high power lightweight transmitter experiments in support of TP05. Multiple shot magnetic flux compression concepts were analyzed, experimentally verified, and categorized as to potential device use. The concepts investigated have the capability for multiple pulse operation and all involved the rapid deceleration of either explosively driven shock fronts or explosively driven metallic projectiles in a magnetic field. The effects of physical parameters of the decelerated medium and the magnetic field were experimentally verified and parameter tradeoffs were developed.
GRA

N75-10764# Committee on Science and Astronautics (U. S. House).
ADVANCED NUCLEAR RESEARCH
William G. Wells, Thomas N. Tate, and Patricia Schwartz Washington GPO Oct. 1974 27 p Rept. Prepared by Subcomm. on Aeron. and Space Technol. presented to Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., 9 Oct. 1974
(GPO-41-253) Avail: Subcomm. on Aeron. and Space Technol.

Reviewed are results of nuclear power and propulsion research and their potential benefits for associated technological areas in power generation and power supplies. The high efficiency of nuclear process heat techniques for coal conversion processes, and the application of plasma core reactor research to disposing of radioactive waste products are emphasized.
G.G.

N75-10836# Army Foreign Science and Technology Center, Charlottesville, Va.
DEVICES BASED ON THERMOELECTRICAL PHENOMENA
A. F. Gorodetskii, A. F. Kravchenko, and E. M. Samoilov 12 Apr. 1974 24 p refs Transl. into ENGLISH from the monograph "Osnovy Fiz. Poluprovod. i Poluprovod. Prib" USSR, 1966 p 315-326
(AD-783821; FSTC-HT-23-45-74) Avail: NTIS CSCL 20/12

The energy fundamentals of thermoelectric generators are presented, for the direct conversion of thermal energy into electrical at high efficiency and to produce cold in refrigeration units. The conditions under which the efficiency of an actual thermoelectric generator will be at a maximum are described. Thermostatting radioelectric devices are also discussed.
GRA

N75-10850# Committee on Labor and Public Welfare (U. S. Senate).
EFFECTS OF ENERGY CRISIS ON EDUCATION, 1974
Washington GPO 1974 296 p refs Hearing before Subcomm. on Education of Comm. on Labor and Public Welfare, 93d Congr., 2d Sess., 7 Jan. 1974
(GPO-27-765) Avail: Subcomm. on Education

The increased costs of fuel, both for physical plant heating and for bus transportation, were discussed before Congress in terms of public school budgets and expenditures. Special allocations of oil to elementary and secondary schools are considered, along with the discontinuance of school busing for desegregation purposes. Actions taken by HEW, in cooperation with the Federal Energy Office, to respond to the energy shortage as it affects the educational community are outlined.
A.A.D.

N75-10857# Committee on Ways and Means (U. S. Senate).
ELIMINATION OF DUTY ON METHANOL IMPORTED FOR CERTAIN USES
Ullman Washington GPO 1974 5 p Rept. to accompany H.R. 11251 presented by Comm. on Ways and Means, 93d Congr., 2d Sess., 23 Apr. 1974
(H-Rept-93-998; GPO-99-081) Avail: US Capitol, House Document Room

A Congressional hearing was conducted on the proposal to remove duty payments on methanol imported for certain uses. The purpose of the bill is to provide duty-free status for methyl alcohol (methanol) when imported for use in producing synthetic natural gas or for direct use as a fuel. The effect of the bill on revenues is examined. The bill was unanimously ordered favorably by the committee.
Author

N75-10859# Committee on Appropriations (U. S. House).
PUBLIC WORKS FOR WATER AND POWER DEVELOPMENT AND ATOMIC ENERGY COMMISSION APPROPRIATION BILL, 1975. PART 6: TENNESSEE VALLEY AUTHORITY
Washington GPO 1974 288 p Hearings before Subcomm. on Public Works of Comm. on Appropriations, 93d Congr., 2d Sess., 10 Apr. 1974
(GPO-32-403) Avail: Subcomm. on Public Works

A Congressional hearing was conducted to determine the fiscal year 1975 appropriations for: (1) public works for water, (2) power development, and (3) the atomic energy commission. The various projects to be conducted by the agencies concerned are explained to justify the allocation of the requested funds. Charts are presented to show prior year funding for the various projects. Testimony by selected witnesses is submitted to show the accomplishments and plans of the organizations.
Author

N75-10860# Committee on Interior and Insular Affairs (U. S. Senate).
NATIONAL CRUDE OIL REFINERY DEVELOPMENT ACT, PART 2
Washington GPO 1974 177 p refs Hearings on S. 2743 before Comm. on Interior and Insular Affairs, 93d Congr., 2d Sess., 29-30 May 1974
(GPO-35-578) Avail: Comm. on Interior and Insular Affairs
The need for increased refining capacity among independent domestic refiners was described to Congress in a hearing which attempted to obtain background information supportive of the issues involved in the proposed National Crude Oil Refinery Development Act. Other questions dealt with include: (1) the need for a continuation of the mandatory allocation program beyond its expiration date; (2) the effect of the elimination of oil import fees on independent refiners; and (3) the need for making a portion of the crude oil imported through the use of supertankers and deepwater ports available to those without reasonable access to supertankers. A.A.D.

N75-10861# Committee on Interior and Insular Affairs (U. S. Senate).
THE NATIONAL COAL CONVERSION ACT AND THE NATIONAL CRUDE OIL REFINERY DEVELOPMENT ACT
Washington GPO 1974 249 p refs Hearing on S. 2652 and S. 2743 before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 10 Dec. 1973
(GPO-28-964) Avail: Comm. on Interior and Insular Affairs
Aspects of two bills, one to authorize the President to require certain power plants and industrial facilities to convert to the use of domestic coal as their primary fuel source, and the other to authorize a loan guarantee program designed to stimulate increased petroleum refining capacity, were debated before Congress. Environmental concerns were included during the discussion, and details were given on flue gas desulfurization technology, a method of controlling sulphur oxide emissions from coal and oil burning electric power plants. A.A.D.

N75-10983# Joint Publications Research Service, Arlington, Va.
HOW SPACECRAFT ARE FUELED
N. Novikov 22 Nov. 1974 23 p Transl. into ENGLISH from Nauka Zhizn (Moscow), no. 2, 1972 p 25-32
(JPRS-63514) Avail: NTIS HC $3.25
The sequence of operations and the manner of performing the basic operations in fueling rockets and spacecraft are described. Author

N75-11110 National Bureau of Standards, Boulder, Colo. Cryogenic Data Center.
HYDROGEN FUTURE FUEL: A LITERATURE SURVEY ISSUED QUARTERLY, ISSUE NO. 6
Nov. 1974 31 p refs
Avail: Issuing Activity
A bibliography is presented of papers concerning energy and hydrogen fuel. Approximately 500 references are listed. F.O.S.

N75-11226# Arizona State Univ., Tempe. Dept. of Mechanical Engineering.
AN INTERCELL HEAT PIPE FOR FUEL CELL AND BATTERY COOLING Final Report, Jun. 1972 - Jul. 1973
Dean L. Jacobson Dec. 1973 42 p refs
(Contract F30602-72-C-0418; AF Proj. 3145)
(AD-782888; AFAPL-TR-74-5) Avail: NTIS CSCL 10/2
A planar (rectangular cross section) heat pipe was designed to transfer 2000 watts at 115C plus or minus 12C. The evaporator area was fixed at 30.48cm by 12.7cm per side so that the design heat flux was 3.45 watts/sq cm. The heat pipe was tested with electrical heaters to simulate waste heat from two adjacent high power density fuel cell or battery modules. The device was constructed from two milled copper plates which were electron beam welded to produce the completed structure. The finished heat pipe thickness was 1.27cm. A single layer of 100 mesh copper screen covered rectangular milled capillary grooves. Triply distilled, deionized water was chosen as the working fluid. (Modified author abstract) GRA

N75-11410# Joint Publications Research Service, Arlington, Va.
FURTHER DEVELOPMENT OF SCIENTIFIC RESEARCH IN THE FIELD OF GEOLOGY AND OF THE SURVEY AND EXPLORATION OF PETROLEUM AND GAS
V. V. Semenovich 12 Nov. 1974 16 p Transl. into ENGLISH from Sov. Geol. (Moscow), no. 7, 1974 p 3-12
(JPRS-63414) Avail: NTIS HC $3.25
A review is provided of principal directions of scientific research in the field of geology, exploration and prospecting for petroleum and gas that constitute priority significance for selecting the basic directions for exploratory-survey operations and for increasing their methodological level and economic efficiency. Author

N75-11413*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXPLORATION FOR FOSSIL AND NUCLEAR FUELS FROM ORBITAL ALTITUDES
Nicholas M. Short Nov. 1974 59 p
(NASA-TM-X-70781; X-923-74-322) Avail: NTIS HC $4.25 CSCL 08G
Results from the ERTS program pertinent to exploration for oil, gas, and uranium are discussed. A review of achievements in relevant geological studies from ERTS, and a survey of accomplishments oriented towards exploration for energy sources are presented along with an evaluation of the prospects and limitations of the space platform approach to fuel exploration, and an examination of continuing programs designed to prove out the use of ERTS and other space system in exploring for fuel resources. Author

N75-11455# Committee on Interior and Insular Affairs (U. S. House).
OIL SHALE DEVELOPMENT, PART 2
Washington GPO 1974 130 p Hearings before Subcomm. on Mines and Mining of Comm. on Interior and Insular Affairs, 93d Congr., 2d Sess., 25-26 Feb. 1974
(GPO-30-368) Avail: Subcomm. on Mines and Mining
Information was provided to Congress concerning plans for exploration and production of oil from shale, including such factors as lease arrangements, domestic abundance of oil shale, projected development costs, and efficiency of currently available extraction processes. The probable contribution of oil shale development to plans for U. S. energy self-sufficiency was also assessed. A.A.D.

N75-11457# Bureau of Natural Gas, Washington, D.C. Office of Economics.
OFFSHORE INVESTIGATION: PRODUCIBLE SHUT-IN LEASES, JANUARY 1974, PHASE 1
Mar. 1974 60 p
Avail: NTIS HC $4.25
Information was gathered concerning federal oil and gas leases in the offshore Louisiana and Texas areas classified by the U. S. Geological Survey as "producible shut-in." Results indicate that a total of 168 leases are classified as producible shut-in. The estimated potential hydrocarbon production of these leases is discussed along with reasons for the numerous extensions of shut-in lease terms. Author

N75-11458# Bureau of Natural Gas, Washington, D.C.
OFFSHORE INVESTIGATION: PRODUCIBLE SHUT-IN LEASES AS OF JANUARY 1974, PHASE 2
Jul. 1974 30 p Original contains color illustrations
Avail: NTIS HC $3.75
Estimates were made of the proved and probable gas reserves underlying the producible shut-in leases of the Louisiana and

Texas Outer Continental Shelf. Data from the files of the U.S. Geological Survey and the Federal Power Commission were used. Results are summarized in tabular form. Author

N75-11459*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR SEA POWER PLANTS (SSPP): A CRITICAL REVIEW AND SURVEY
Alvin M. Strauss (Cincinnati Univ.) Sep. 1974 76 p refs Proposed for presentation at Intern. Solar Energy Soc. Intern. Conf., Los Angeles, Jul. 1975 Submitted for publication
(NASA-TM-X-70783; X-704-74-277) Avail: NTIS HC $4.75 CSCL 10A

An overview of technical and economic matters relating to the eventual success or failure of the SSPP concept is presented, with emphasis on the pollution and energy problems which the SSPP would serve to eliminate. Factors discussed include cost, mariculture possibilities, siting, legal limitations, design materials, mooring and anchoring, and the human element involved. Several alternative power systems are considered for incorporation into SSPP design, such as Nitinol power, Claude cycle, and closed cycle engine systems. A.A.D.

N75-11462# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
DEGASIFICATION OF THE MARY LEE COALBED NEAR OAK GROVE, JEFFERSON COUNTY, ALABAMA, BY VERTICAL BOREHOLE IN ADVANCE OF MINING
C. H. Elder and Maurice Deul 1974 25 p refs
(BM-RI-7968) Avail: NTIS HC $3.25

A 5-hole pattern was drilled from the surface at a site near Oak Grove, Jefferson County, Ala., to degasify the gassy Mary Lee coalbed in advance of mining. Gas and water production was monitored for 1 year, 4 months to allow gas flow to stabilize fully. A thickened water stimulation treatment was designed and applied in one hole of the pattern to evaluate this degasification technique for the Mary Lee coalbed. A gas production rate of 70,000 ft 3/day after stimulation treatment indicates that the use of vertical boreholes coupled with hydraulic fracturing in advance of mining the Mary Lee coalbed would provide for more rapid degasification and could provide a possible source of natural gas. Author

N75-11463# Committee on Science and Astronautics (U. S. House).
BIOCONVERSION
Washington GPO 1974 430 p refs Hearing before Subcomm. on Energy of Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., No. 40, 13 Jun. 1974
(GPO-37-403) Avail: Subcomm. on Energy

The conversion of solar energy and solid waste energy into useable fuels by processes collectively known as bioconversion was discussed in a Congressional hearing whose purpose was to examine alternative methods of producing energy that are efficient and cost effective. The techniques and apparatus needed for bioconversion operations are explained, and a system for methane recovery and fertilizer production from garbage and sewage is offered as an example. The marketability of fuels derived from solid waste, as well as the economic factors associated with solar energy conversion and use were also assessed. A.A.D.

N75-11464# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
IN SITU COMBUSTION OF COAL FOR ENERGY Technical Progress Report
Robert F. Chaiken Nov. 1974 15 p refs
(BM-TPR-84) Avail: NTIS HC $3.25

A concept of efficient thermal energy generation through the in situ combustion of coal and the on site conversion of that energy to electricity is discussed and shown to offer distinct advantages in the utilization of U. S. coal reserves. Analysis of data from previous underground coal gasification projects suggests that coal can be efficiently burned underground and that the burning process should be maintainable for time periods sufficient to power a commercial electricity generation plant. Analyses describing some of the requirements of a 100 megawatt (thermal) in situ combustor are also presented, and several design possibilities are suggested. Author

N75-11465# Princeton Univ., N.J. Dept. of Chemical Engineering.
UTILIZATION OF PLASMA EXHAUST ENERGY FOR FUEL PRODUCTION
J. D. Fish and R. C. Axtmann 1973 24 p refs Sponsored by AEC
(COO-3028-7) Avail: NTIS HC $3.25

The plasma exhausts from fusion reactors represent a source of high-grade energy which might be utilized to produce chemical fuels via endothermic reactions. This article examines electrolytic, radiolytic and photolytic processes in terms of the energy required to produce a mole of hydrogen gas from the dissociation of water. The results indicate that while electrolysis is not clearly superior from the standpoint of energetics, practical consideration would probably preclude the use of the other schemes. Author (NSA)

N75-11466# California Univ., Livermore. Lawrence Livermore Lab.
REVIEW OF DIRECT ENERGY CONVERSION OF ION BEAMS: EXPERIMENTAL RESULTS AND REACTOR APPLICATIONS
R. W. Moir 2 Apr. 1974 18 p refs Presented at Meeting on Technol. of Controlled Nucl. Fusion, San Diego, Calif., 16-18 Apr. 1974 Sponsored by AEC
(UCRL-75600; Conf-740402-23) Avail: NTIS HC $3.25

In order to produce neutral beams for fusion reactors efficiently, the energy carried by the unneutralized portion of the ion beam may have to be recovered in a direct converter. Several concepts applicable to beam direct conversion are discussed. The concept that has received the most attention uses planar sets of grids. One experimental test with a hydrogen ion beam at 2 keV and 0.1 W/sq cm gave an efficiency of 95%. Another experiment at 20 keV and 200 W/sq cm was limited by gas-pressure effects to about 70% efficiency. The loss mechanisms and such design constraints as power density, space charge, and secondary electron emission are discussed. Author (NSA)

N75-11467# California Univ., Livermore. Lawrence Livermore Lab.
SHALLOW SOLAR POND ENERGY CONVERSION SYSTEM: AN ANALYSIS OF A CONCEPTUAL 10-MWe PLANT
A. F. Clark, J. A. Day, W. C. Dickinson, and L. F. Wouters 25 Jan. 1974 31 p refs Revised
(Contract W-7405-eng-48)
(UCRL-51533-Rev-1) Avail: NTIS HC $3.75

A shallow solar pond system appears to be the most cost effective way to produce large scale electric power from solar energy. Water is used both for heat collection and heat storage. Inexpensive layers of weatherable transparent plastic over the water supress heat loss to the environment. The hot water is stored in an insulated reservoir at night and during bad weather. The stored hot water heats a thermodynamic fluid, such as Freon 11, which drives a turbine and an electric generator. A shallow solar pond system can be built using materials, fabrication techniques, and geometrics that are presently used on a large scale in U. S. industry. A 10 MWe plant built in the Southwest would require a total area of about 2.5 sq km and could provide power for a community or a manufacturing process. The estimated busbar cost of electricity (in 1973 dollars) for a shallow solar pond system, which could become on line in as short a time as 5 to 7 years, is 27 mills/kWh. It is projected that this cost could be reduced by almost half with the development of improved and cheaper plastics and more efficient turbines. Author (NSA)

N75-11468# Los Alamos Scientific Lab., N.Mex.
APPLICATION OF TECHNOLOGY FROM THE ROVER PROGRAM AND RELATED DEVELOPMENTS
R. E. Schreiber Apr. 1974 11 p
(Contract W-7405-eng-36)
(LA-5558) Avail: NTIS HC $3.25

The history of the Rover and UHTREX programs is reviewed with particular emphasis on the development of technology which could be applied to present energy needs. The existing capabilities are briefly described and two specific applications, process heat production and self-contained power and propulsion plants, are presented as examples of substantial promise for immediate work. Author (NSA)

N75-11469# Oak Ridge National Lab., Tenn.
NSF-RANN ENERGY ABSTRACTS. A MONTHLY ABSTRACT JOURNAL OF ENERGY RESEARCH, VOLUME 2, NO. 4
M. P. Guthrie, ed. Apr. 1974 42 p
(Contract W-7405-eng-26; Grant NSF AG-398)
(ORNL-EIS-74-52-Vol-2-4) Avail: NTIS HC $3.75

Citations with abstracts are given for 94 publications covering energy sources, electric power, and energy production. Articles on economics, supply-demand, environmental effects, policy, management, and research are included. NSA

N75-11470# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorentwicklung.
TECHNOLOGICAL AND COMMERCIAL POSSIBILITIES WHICH RESULT BY USING A HIGH TEMPERATURE REACTOR FOR THE FUTURE SUPPLY OF MINERAL OIL IN THE FRG
H. G. Eickhoff Nov. 1973 88 p refs In GERMAN; ENGLISH summary
(JUL-1017-RG) Avail: AEC Depository Libraries HC $7.50

An analysis of the total fossil energy resources in the world and a comparison with future requirements shows very clearly that nuclear reactors have to be applied to save the available reserves of oil. Technological efforts and commercial possibilities of high temperature nuclear process heat in the FRG are shown till the year 2000. The increasing environmental burden (especially the SO2-emission) caused by burning fossil fuel was considered in particular. This is followed by an examination of the processes which enable the production of synthetic liquid hydrocarbons if the reserves of oil are exhausted. To make a statement about the costs which arise by coupling nuclear process heat to endothermal processes, quantity balances and energy balances have been set up. The possible process configurations of the coupling assembly HTR-conversion process are shown in the flow sheets. It was possible to show that the introduction of the new technologies in oil processing requires the availability of cheap hydrogen. NSA

N75-11606 Joint Publications Research Service, Arlington, Va.
PROSPECTS FOR UTILIZATION OF UNDERWATER HOUSES AND CHAMBERS IN DEVELOPMENT OF MARINE OIL DEPOSITS
I. P. Kuliyev and Yu. P. Vladimirov *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 90-93 Transl. into ENGLISH of the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 83-86

The development of offshore petroleum and gas deposits in the U.S.S.R. and abroad were examined in terms of the actual prospects of utilizing underwater habitat/laboratories for research in industrial hydraulic engineering techniques for construction of offshore platforms. Author

N75-11730# Brookhaven National Lab., Upton, N.Y.
APPLICATIONS OF FUSION POWER TECHNOLOGY TO THE CHEMICAL INDUSTRY
M. Beller, J. R. Powell, and M. Steinberg 2 Jun. 1974 40 p refs Presented at the 77th Natl. Meeting on the Am. Inst. of Chem. Engr., Pittsburgh, 2 Jun. 1974 Sponsored by AEC
(BNL-18815; Conf-740609-2) Avail: NTIS HC $3.75

Energy forms available from controlled thermonuclear reactors (CTR) are reviewed, and methods of application to chemical processes are discussed. Specific chemical processes which can utilize CTR energy are described, and the potential for this utilization is assessed. Author (NSA)

N75-11745# California Univ., Livermore. Lawrence Livermore Lab.
OUTLOOK FOR FUSION ENERGY SOURCES: REMAINING TECHNOLOGICAL HURDLES
R. F. Post 20 Mar. 1974 26 p Presented at 140th Meeting of the Am. Assoc. for the Advan. of Sci., San Francisco, 25 Feb. 1974 Sponsored by AEC
(UCRL-75418; Conf-740213-6) Avail: NTIS HC $3.75

Controlled fusion research is now in its third decade. Through this effort most of the critical scientific issues for the main approach to fusion-magnetic confinement-have been resolved. Remaining critical scientific questions are mainly quantitative in nature, and have to do with residual instabilities of the confined fusion plasma. Laser fusion, much newer on the scene, also has critical quantitative issues to resolve, issues that will be addressed in the next few years. Author (NSA)

N75-12064*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
POWER PROCESSOR DESIGN CONSIDERATIONS FOR A SOLAR ELECTRIC PROPULSION SPACECRAFT
E. N. Costogue and J. A. Gardner 30 Jun. 1974 67 p refs (Contract NAS7-100)
(NASA-CR-140842; JPL-TM-33-705) Avail: NTIS HC $4.25 CSCL 21C

Propulsion power processor design options are described. The propulsion power processor generated the regulated dc voltages and currents from a solar array source of a solar electric propelled spacecraft. The power processor consisted of 12 power supplies that provide the regulated voltages and currents necessary to power a 30-cm mercury ion thruster. The design options for processing unregulated solar array power and for generating the regulated power required by each supply are studied. The technical approaches utilized in the developed design and the technological limitation of the identified design options are discussed. Alternate approaches for delivering power to a number of mercury ion thrusters and methods of optimizing are described. It was concluded that this power processor design should be considered for application in solar electric propulsion missions of the future. Author

N75-12252# Los Alamos Scientific Lab., N.Mex.
PROCESS ENVIRONMENT EFFECTS ON HEAT PIPES FOR FLUID-BED GASIFICATION OF COAL
D. C. Strimbeck, D. C. Sherren, and E. S. Keddy 1974 20 p refs Presented at the 9th Intersoc. Energy Conversion Eng. Conf., San Francisco, 26-30 Aug. 1974 Sponsored by AEC
(LA-UR-74-984; Conf-740805-1) Avail: NTIS HC $3.25

The Bureau of Mines is evaluating sodium-type heat pipes for the isothermal transport of heat at 2,000 F from a fluid-bed coal-air combustor to a fluid-bed coal-steam gasifier. Tests were conducted to determine the physical and chemical effects of combustion-gasification atmospheres on Inconel 601 pipe. A prototype pipe exposed to such an environment for 522 hours functioned acceptably and remains operable. Tests with this pipe and five pipes of the same design are continuing. Results of initial tests of the six pipes are presented and the pipes and gasification concept are described. Author (NSA)

N75-12428# Federal Energy Administration, Washington, D.C.
PROJECT INDEPENDENCE
Nov. 1974 788 p refs
Avail: SOD HC $8.35

An evaluation of the U.S. energy problem is presented which assesses the 'base case' situation through 1985 and evaluates the impacts and implications of a wide range of major energy policy alternatives, including the strategic options available to the U.S. of increasing domestic energy supply, conserving and managing energy demand, and establishing standby emergency programs. The strategies are evaluated in terms of their impact on the following variables: (1) development of alternative energy sources: (2) vulnerability to import disruptions; (3) economic growth, inflation, and unemployment; (4) environmental effects;

and (5) regional and social impacts. The study provides the analytical and factual basis for focusing debate on the inherent choices and tradeoffs, and for selecting a national energy policy. Author

N75-12430# *Committee on Science and Astronautics (U. S. House).*
SOLAR SEA THERMAL ENERGY
Washington GPO 1974 138 p refs Hearing before Subcomm. on Energy of Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., No. 41, 23 May 1974
(GPO-37-476) Avail: Subcomm. on Energy

The hearings concerning the utilization of the ocean thermal differences as a source of energy are reported. Solar sea power produced by heat engines operating in the tropical oceans, power economics in the 1980's, and the environmental impact are discussed. F.O.S.

N75-12431# Committee on Science and Astronautics (U. S. House).
ENERGY AND ENVIRONMENTAL STANDARDS
Washington GPO 1974 960 p refs Hearings before Subcomm. on Energy of Comm. on Sci. and Astronaut., 93d Congr., 1st and 2d Sess., No. 45, 25, 27 Sep.; 4, 18 Oct. 1973
(GPO-37-171) Avail: SOD HC $7.45

The problem of environmental standards and their effects on the production and utilization of energy as related to air quality are discussed. Specific standards for sulfur and nitrogen oxide emissions are considered in regard to human health, economic damage inflicted by pollutants, and the competing needs for energy. G.G.

N75-12432# Guyol (Nathaniel B.), San Rafael, Calif.
THE APPROACHING ENERGY CRISIS: A CALL FOR ACTION
Nathaniel B. Guyol 1974 13 p
Avail: NTIS HC $3.25

The energy crisis is not a crisis but a two phase threat to our energy supplies. In the first phase, it is a threat of physical shortages and very high prices on certain petroleum products in the months immediately ahead. In the second phase it is a threat of physical shortages and very high prices on both oil and natural gas in the years ahead. Import requirements could be reduced by: (1) opening up the Elk Hills Naval Reserve; (2) ordering a one-third reduction in military use of oil; (3) reducing aviation fuel requirements by consolidating flights and schedules on competing airlines; (4) reconverting certain oil burning power plants to coal fuel. Together, these four measures alone could cut a million barrels per day from our import requirements in a period of only a few months. Author

N75-12435# American Gas Association, Inc., Arlington, Va.
A SURVEY OF LNG TECHNOLOGICAL NEEDS IN THE USA: 1974 TO BEYOND 2000
L. A. Sarkes and D. B. Mann (NBS, Boulder, Colo.) 1974 22 p refs Presented at the 4th Intern. Conf. on Liquefied Nat. Gas, Algiers, 24-27 Jun. 1974
Avail: NTIS HC $3.25

A comprehensive analysis of research needs of liquefied natural gas (LNG) was conducted. LNG research priorities for five years are considered vital to overcome the potential suppression of growth in the LNG industry that could result from lack of available technology. A survey of National Bureau of Standards LNG research and how these relate to the future technological growth of the LNG industry are discussed. Author

N75-12436# Western Gear Corp., Lynwood, Calif.
ENERGY PLANTATIONS: SHOULD WE GROW TREES FOR POWER PLANT FUEL?
R. S. Evans Jul. 1974 17 p refs
(VP-X-129) Avail: NTIS HC $3.25

The proposal that trees, a renewable resource, might be cut as fuel for electric power plants is examined. It is found that the idea has doubtful promise for most regions of North America except the Pacific Northwest. Generally, annual production of wood and bark is relatively low and cutting of very large forest areas would be required to fuel a power plant of reasonable size. In the Pacific Northwest, wood and bark production in dense red alder stands is exceptionally high and the land area requirements for an energy plantation do not seem excessive. This could have practical implications for Vancouver Island, where further hydro electric development is impractical and steam-electric plants may be required. Author

N75-12438# Council on Environmental Quality, Washington, D.C.
ENERGY AND THE ENVIRONMENT: ELECTRIC POWER
Aug. 1973 63 p refs
Avail: SOD HC $1.00

The trends in U.S. demand for energy, and the energy supply systems intended to serve that demand are assessed, especially in regards to the adverse impacts on the environment resulting from energy production and consumption. The electric power industry is the focus of the discussion which analyzes the costs and effectiveness of various controls for currently operating fossil fuel and nuclear systems, as well as the emerging technologies which have the potential for reducing some of the attendant damages to public and ecological health. Projections of environmental consequence were formulated by combining electric energy demand forecasts with data on environmental impacts; such projections provide a baseline against which future energy policy proposals may be measured. A.A.D.

N75-12439# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Systemtechnik und Reaktorphysik.
ENERGY AND THE ENVIRONMENT IN BADEN-WUERTTEMBERG
D. Faude, A. Bayer, G. Halbritter, G. Spannagel, H. Stehfest, and D. Wintzer Apr. 1974 183 p refs In GERMAN.
(KFK-1966-UF) Avail: AEC Depository Libraries HC $12.25

The environmental impacts of energy production and consumption are investigated. Special emphasis is placed upon the energy conversion sector, i.e., power stations and refineries and upon the regional problems of the Upper Rhein area: Thermal and chemical emissions, and their regional distribution, are determined from a regional analysis of the energy statistics of Baden-Wurttemberg. The problem of the effects of environmental pollution is addressed by two examples: effects of ionizing radiation and epidemiological analyses of air pollution (SO2). For the regional area of the Upper Rhein the following problems are investigated in greater detail: thermal capacity of the Rhein River under various meteorological conditions; effects of wet cooling towers with natural draft; expected radiation doses from nuclear facilities; and air pollution, i.e., a map of the regional SO2-concentrations calculated from data on emissions and meteorological conditions. Author (NSA)

N75-12440# Brookhaven National Lab., Upton, N.Y.
METAL HYDRIDES AS HYDROGEN STORAGE MEDIA A Summary With Appendix
J. J. Reilly, R. H. Wiswall, K. C. Hoffman, and C. H. Waide May 1974 23 p refs Presented at 7th Alternative Automotive Power Systems Div. Contractors Coordination Meeting, Ann Arbor, Mich., 15 May 1974 Sponsored by AEC
(BNL-18887; Conf-740543-1) Avail: NTIS HC $3.25

A summary of work on metal hydrides as hydrogen storage media is given. An appendix contains information on hydride heats of formation, energy density of automotive power sources, criteria for evaluation of a candidate metal hydride, and metal hydride screening experiments. NSA

N75-12441# Brookhaven National Lab., Upton, N.Y.
IRON TITANIUM HYDRIDE AS A SOURCE OF HYDROGEN FUEL FOR STATIONARY AND AUTOMOTIVE APPLICATIONS
J. J. Reilly, K. C. Hoffman, G. Strickland, and R. H. Wiswall

1974 31 p refs Presented at 26th Power Sources Symp., Atlantic City, N. J., 29 Apr. 1974 Sponsored by AEC
(BNL-18651; Conf-740407-4) Avail: NTIS HC $3.75

Hydrogen is a potential fuel for various types of power sources, such as fuel cells, internal combustion engines, gas turbines, etc. However, a major problem is the difficulty encountered in its storage and bulk transport. A possible solution to the problem lies in the use of a metal hydride as a hydrogen storage medium. The material most near to practical application is iron titanium hydride ($FeTiH_{1.95}$). This material can be synthesized through the direct union of hydrogen with the intermetallic compound, FeTi, in a two-step reaction. A stationary hydrogen storage reservoir has been built and is undergoing performance tests. The reservoir will be used in an experimental peak shaving unit being built by Public Service Electric and Gas Co. of New Jersey to examine the feasibility of storing electrical energy through the production, storage and reconversion of hydrogen. Iron titanium hydride is also of interest as a source of hydrogen fuel for automotive use. The energy density of $FeTiH_{1.95}$, on the basis of available hydrogen, is 268 whr/lb; a value that compares favorably with even the most advanced battery systems suggested for automotive use. Author (NSA)

N75-12442# Oak Ridge National Lab., Tenn.
RESIDENTIAL ENERGY CONSERVATION
J. C. Moyers 1973 10 p Sponsored by AEC
(TID-26534) Avail: NTIS HC $3.25

One-third of the total electrical sales in the U. S. went to residential users in 1970. Refrigeration, water heating, space heating, and air conditioning are used most extensively in that order. An all-electric home energy consumption breakdown was made. The performance of heat pumps was computed for Atlanta, Philadelphia, and Minneapolis. The efficiency of window air conditioners was studied. The overall economic data are computed involving properly installed insulation. NSA

N75-12443# Brookhaven National Lab., Upton, N.Y.
SURVEY OF APPLICATIONS OF FUSION POWER TECHNOLOGY TO THE CHEMICAL AND MATERIAL PROCESSING INDUSTRY
M. Steinberg, M. Beller, and J. R. Powell May 1974 103 p refs Sponsored by AEC
(BNL-18866) Avail: NTIS HC $5.25

An initial survey of the application of controlled thermonuclear fusion power technology to the chemical and material processing industry was made. The general principles concerning the forms of energy, the energy conversion efficiency terms, and the process design criteria, were categorized, defined, and evaluated. A survey of potential, conventional, and advanced chemical processes is presented and capacity projections are made to the year 2000. Author (NSA)

N75-12445# Atomic Energy Commission, Washington, D.C.
DCTR POWER SUPPLY AND ENERGY STORAGE REVIEW MEETING
D. S. Beard 1974 297 p Conf. held at Germantown, Md., 5-7 Mar. 1974
(WASH-1310; Conf-740335) Avail: NTIS HC $8.75

The present and future needs in the power supply and energy storage area are discussed. Various approaches and alternatives are presented to meet these needs. Existing capabilities and projected needs, possible approaches, inductive systems, MHD systems, switching, and capacitive systems are examined. NSA

N75-12447# Los Alamos Scientific Lab., N.Mex.
ENERGY STORAGE FOR THE ELECTRIC POWER INDUSTRY
W. E. Keller 1973 10 p refs Presented at Conf. on Advanced Energy Systems, Denver, 20 Jun. 1974 Sponsored by AEC
(LA-UR-74-918; Conf-740641-1) Avail: NTIS HC $3.25

The following energy storage systems for leveling the energy demands from power companies are briefly discussed: (1) pumped hydrostorage (2) compressed air storage,(3) secondary batteries, (4) liquid hydrogen storage, and (5) flywheels. Superconducting magnetic energy storage systems are also discussed. NSA

N75-12448# Army War Coll., Carlisle Barracks, Pa.
OIL FOR THE FREE WORLD IN THE 1970'S Student Essay
Eugene W. Massengale 4 Sep. 1973 21 p refs
(AD-779352) Avail: NTIS CSCL 05/3

One of the central problems facing the Western industrial powers during the seventies is whether the oil producing states of the Middle East will expand production and continue exporting. The problem is complicated by the Arab-Israeli dispute, and the intrusion of Soviet Russia into the area. The paper examines: (1) the extent of the potential shortage, and the degree to which the United States, Western Europe, and Japan will become dependent on the Middle East as a source of oil; (2) the long term reliability of the Middle East as a source of oil to the West in general, and the United States in particular; (3) the influence and aims of the Soviet Union in the region; and (4) the alternatives available to the United States. (Modified author abstract) GRA

N75-12449# RAND Corp., Santa Monica, Calif.
ENERGY CONSUMPTION BY INDUSTRIES IN SUPPORT OF NATIONAL DEFENSE: AN ENERGY DEMAND MODEL
C. C. Mow Aug. 1974 70 p refs
(Contract DAHC15-73-C-0181; ARPA Order 189-1)
(AD-784964; R-1448-ARPA) Avail: NTIS CSCL 10/1

Energy used by the manufacturing and transportation sectors of the U.S. economy in support of DoD activities is studied. Estimates are given of energy usage by various industries in support of DoD activities for 1965 and 1967 through 1970. The methodology applied in the report is sufficiently general to lend itself to estimating future industrial energy requirements for various DoD force postures and to analyzing various energy policies in a more energy-austere environment than at present. GRA

N75-12695# Technical Research Centre of Finland, Helsinki.
[TECHNOLOGY AND COMMUNITY DEVELOPMENT MATERIALS PROCESSING, AND ELECTRICAL AND NUCLEAR TECHNOLOGY]
1973 84 p refs Original contains color illustrations
Avail: NTIS HC $4.75

Activities of the Technical Research Center of Finland are discussed. Community development, materials and processing, and electrical and nuclear technologies are reported. It is shown that the information service assists the activity units of the Center and this information is available to other research organizations. M.C.F.

N75-12723# Atomic Energy Commission, Washington, D.C.
NUCLEAR POWER GROWTH, 1974 - 2000
Feb. 1974 78 p
(WASH-1139-74) Avail: NTIS HC $4.75

Domestic and foreign trends in the growth of nuclear power are evaluated. The future capability of foreign nations to supply uranium enrichment service to reactor operators, the timing and application of plutonium recycle technology, and the timing and rate of introduction of the fast-breeder reactor are discussed. A total of seven separate cases was prepared. These cases provide a reasonable range of estimates of the growth of nuclear power and the concomitant range of requirements for separative work, uranium and related materials and services. Forecasts for the next decade are based on an analysis and evaluation of nuclear plants already operating, those under construction, and those planned. Forecasts beyond this period are based on extrapolations of near-term growth trends together with differing assumptions about future trends in energy consumption and electricity generating capacity. Author (NSA)

N75-12797# Atomic Energy Commission, Washington, D.C. Div. of Controlled Thermonuclear Research.

FUSION POWER BY MAGNETIC CONFINEMENT
Feb. 1974 104 p refs
(WASH-1290) Avail: NTIS HC $5.25

The overall fusion program to develop a working fusion reactor using low-density closed systems, high-density systems, and open systems is outlined. The present and near-term emphasis among these programs is and will be about 60% tokamaks, 20% high density, and 20% mirrors. The areas of reaearch to be considered for furture work are outlined. Items concerning funding and the overall program are discussed. NSA

N75-12807# Tennessee Univ. Space Inst., Tullahoma.
MHD ENERGY CONVERSION Final Report, 1 Sep. 1968 - 31 Aug. 1974
John B. Dicks Aug. 1974 28 p refs
(Contract F44620-69-C-0031; AF Proj. 6813; AF Proj. 9752)
(AD-785419; AFOSR-74-1503TR) Avail: NTIS CSCL 20/9

Theoretical and experimental investigations were made on a number of phenomena in magnetohydrodynamics that are pertinent in the combustion gas driven MHD generators. Different types of generators of diagonal conducting wall designs were studied and a number of different fuels and seed were used in these investigations. Both liquid and solid fuels were used in the experiments. Optical measurements were made to measure the relative temperature and absolute velocity of the plasma. Three-dimensional current distributions were measured along with analysis. (Modified author abstract) GRA

N75-12814# Los Alamos Scientific Lab., N.Mex.
SUPERCONDUCTING MAGNETIC ENERGY STORAGE
H. L. Laquer 1974 22 p refs Presented at the 5th Intern. Cryogenic Eng. Conf., Kyoto, Japan, 7-10 May 1974
(Contract W-7405-eng-36)
(LA-UR-74-737; Conf-740509-7; ICEC-5) Avail: NTIS HC $3.25

Four distinct areas are discussed in which superconducting magnetic energy storage can be applied. Differences in energy transfer times place different requirements on the storage oil, on the switch or transfer element and on the energy losses in the superconductor. Designs and experiments in one of these areas with 2 to 300 kJ units, and analysis and plans for an installation that is to provide 250 MJ of plasma compression energy for the theta-pinch controlled thermonuclear fusion test reactor are discussed. Those elements of inductive storage that need further development before a theta-pinch fusion reactor can become economically competitive are mentioned. Size and costs of the energy storage components of these systems are compared with similar and with larger inductive storage systems that are to interact reversibly with electric utility networks.
Author (NSA)

N75-12857# Hudson Inst., Inc., Croton-on-Hudson, N.Y.
ENERGY AND SECURITY: IMPLICATIONS FOR AMERICAN POLICY Final Report
Uzi B. Arad, Michael Hudson, David Robison, Robert H. Shatz, and Barry J. Smernoff 24 Jul. 1974 179 p refs
(Contract DAHC15-73-0246)
(AD-785084; HI-1884/2-RR) Avail: NTIS CSCL 15/3

Interactions between energy policy and national security are discussed. Topic areas covered include: Energy policy options available to the U.S.; energy security problems of U.S. allies; monetary and trade implications of existing and near-term energy flows around the world; energy conservation to meet challenges of tight supplies and high prices; geopolitics of petroleum supplies; and recommendations for research on energy and security issues. GRA

N75-12885*# National Aeronautics and Space Administration, Washington, D.C.
OUR PRODIGAL SUN
1974 16 p
(NASA-EP-118) Avail: NTIS MF $2.25; SOD HC $0.35 CSCL 03B

Characteristics of the sun are reported indicating it as a source of energy. Data from several space missions are discussed, and the solar activity cycle is presented. The corona, flares, prominences, spots, and wind of the sun are also discussed.
M.C.F.

N75-13007* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE PLATFORM POWER CONSERVING SYSTEM Patent
Charles W. Kurvin, inventor (to NASA) (Radiation, Inc., Melbourne, Fla.) Issued 26 Nov. 1974 9 p Filed 31 Aug. 1973 Supersedes N73-32769 (11 - 23, p 2849) Sponsored by NASA
(NASA-Case-GSC-11182-1; US-Patent-3,851,250; US-Patent-Appl-SN-393527; US-Patent-Class-325-4) Avail: US Patent Office CSCL 22B

A system is described where an unattended receiver and transmitter equipped data collection platform is interrogated by a substantially polar orbiting satellite. The method and apparatus involve physically representing the orbit of the satellite and the spin of the planetary body with timers, and using these representations to turn on the platform's receiver only when the satellite should be in radio range of the platform, whereby battery power at the platform is conserved.
Official Gazette of the U.S. Patent Office

N75-13164# Los Alamos Scientific Lab., N.Mex.
METHODS OF ENERGY TRANSFER FROM A MAGNETIC ENERGY STORAGE SYSTEM USING A TRANSFER CAPACITOR AND A SUPERCONDUCTING SWITCH
D. M. Weldon and J. D. G. Lindsay May 1974 19 p refs
(Contract W-7405-eng-36)
(LA-5631-MS) Avail: NTIS HC $3.25

Three circuits for magnetic energy storage using a transfer capacitor and a superconducting switch are analyzed, and a set of equations are derived which can be used for parameter studies of these circuits. Author (NSA)

N75-13378 Florida Univ., Gainesville.
ENERGY REQUIRED TO DEVELOP POWER IN THE UNITED STATES Ph.D. Thesis
Pong Nen Lem 1973 213 p
Avail: Univ. Microfilms Order No. 74-19165

Overview models were developed to aid in examining some of the critical issues of the energy systems in the United States. These simplified models provide a general perspective by considering concepts such as energy quality, feedback in energy systems, and net power. Data on energy resources, economic considerations, and environmental interactions were organized according to the issues in a manner useful in more detailed models, and were used in the examples developed. Several models were simulated on an analog computer, showing the development of complexity in the overview models using data for the United States. The extent to which nuclear power is subsidized is calculated using an energy basis for the measurement. The true cost is not yet assessed due to uncertainties in radioactive waste storage and major accidents. Dissert. Abstr.

N75-13379# Committee on Science and Astronautics (U. S. House).
SOLAR PHOTOVOLTAIC ENERGY
Washington GPO 1974 180 p refs Hearings before Subcomm. on Energy of Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., No. 43, 6 and 11 Jun. 1974
(GPO-39-576) Avail: Subcomm. on Energy

The direct conversion of solar energy into electricity by photovoltaic devices was explained to Congress as part of a continuing series of hearings on ways to utilize the sun's energy. The capabilities of solar photovoltaic cells are discussed, along with certain identified problem areas, energy storage capacity, and estimated costs. Some of the broad applications of photovoltaic energy conversion for both domestic and industrial purposes are suggested. The various options for the development, production, implementation, and operation of photovoltaic systems

that produce electricity and hydrogen fuel gas from solar energy are considered, and the estimated future costs of producing electricity using such systems are compared with those of conventional systems that use fossil and nuclear fuels. A.A.D.

N75-13380*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WIND ENERGY DEVELOPMENTS IN THE 20TH CENTURY
Donald J. Vargo 1974 29 p refs Presented at 4th Ann. Regulatory Inform. Systems Conf., St. Louis, 10-12 Sep. 1974
(NASA-TM-X-71634; E-8172) Avail: NTIS HC $3.75 CSCL 10A

Wind turbine systems of the past are reviewed and wind energy is reexamined as a future source of power. Various phases and objectives of the Wind Energy Program are discussed. Conclusions indicate that wind generated energy must be considered economically competitive with other power production methods. J.M.S.

N75-13381*# Auburn Univ., Ala. School of Engineering.
MEGASTAR: THE MEANING OF GROWTH. AN ASSESSMENT OF SYSTEMS, TECHNOLOGIES, AND REQUIREMENTS Final Report
Sep. 1974 594 p refs
(Grant NGT-01-003-004)
(NASA-CR-120338) Avail: NTIS HC $13.25 CSCL 10A

A methodology for the display and analysis of postulated energy futures for the United States is presented. A systems approach methodology including the methodology of technology assessment is used to examine three energy scenarios--the Westinghouse Nuclear Electric Economy, the Ford Technical Fix Base Case and a MEGASTAR generated Alternate to the Ford Technical Fix Base Case. The three scenarios represent different paths of energy consumption from the present to the year 2000. Associated with these paths are various mixes of fuels, conversion, distribution, conservation and end-use technologies. MEGASTAR presents the estimated times and unit requirements to supply the fuels, conversion and distribution systems for the postulated end uses for the three scenarios and then estimates the aggregate manpower, materials, and capital requirements needed to develop the energy system described by the particular scenario. Author

N75-13382*# Kanner (Leo) Associates, Redwood City, Calif.
UTILIZATION OF SOLAR ENERGY
I. Oshida Washington NASA Dec. 1974 23 p refs Transl. into ENGLISH from Kagaku (Japan), v. 43, no. 11, Nov. 1973 p 658-663
(Contract NASw-2481)
(NASA-TT-F-16090) Avail: NTIS HC $3.25 CSCL 10A

Comments are presented on an international conference concerned with solar energy utilization. The difficulties of harnessing solar energy are outlined in terms of three basic properties: (1) high dilution, (2) intermittent nature, and (3) high entropy. The current state and future prospects of utilization of solar energy in various forms are discussed. Author

N75-13383*# Kanner (Leo) Associates, Redwood City, Calif.
SOLAR POWER GENERATING SYSTEMS AS SOURCES OF NON-POLLUTING ENERGY (POWER GENERATION IN SPACE AND POWER GENERATION ON THE GROUND)
Tatsuo Tani and Takashi Horigome Washington NASA Dec. 1974 14 p refs Transl. into ENGLISH from J. Inst. Elec. Eng. Jap. (Japan), v. 92, no. 12, Dec. 1972 p 31-24
(Contract NASw-2481)
(NASA-TT-F-16091) Avail: NTIS HC $3.25 CSCL 10A

Various systems of solar power generation in space and on the ground which have been made public thus far are considered. In connection with the proposed American system for building solar power stations in space, the composition of the solar power stations and the microwave power transmission system, the efficiency of the microwave power transmission system, the method of delivering the power stations into orbit in space, and other related matters are discussed. Two systems for solar thermal power stations on the ground are outlined. The first is the system proposed by a group at the University of Arizona, and the second is one using an MHD generator. Research and development ought to be commenced immediately concerning solar thermal power generating systems on the ground. Author

N75-13384*# Kanner (Leo) Associates, Redwood City, Calif.
WIND POWER PROJECTS OF THE FRENCH ELECTRICAL AUTHORITY
R. Bonnefille Washington NASA Dec. 1974 61 p refs Transl. into ENGLISH of "Les Realisations d Electricite de France Concernant l Energie Eolienne", Rept. F40/74, no. 4. Electricite de France, Direction des Etudes et Recherches, Service Generateurs et Echangeurs de Chaleur Thermiques et Nucleaires, Apr. 1974 p 1-45
(Contract NASw-2481)
(NASA-TT-F-16057) Avail: NTIS HC $4.25 CSCL 10B

Systematic measurement of the wind power distribution in France has shown that the design of wind generators involves two basic problems: the irregularity of the energy supply and the mechanical strength of the assembly. Since these problems have largely been solved for generators less than 10 kW, the main body of this discussion deals with practical tests on one

N75-13385*# Kanner (Leo) Associates, Redwood City, Calif.
EXPLOITING WIND POWER FOR THE PRODUCTION OF ELECTRICITY
M. Johansson Washington NASA Dec. 1974 55 p refs Transl. into ENGLISH from the Danish report TR-152
(Contract NASw-2481)
(NASA-TT-F-16058; TR-152) Avail: NTIS HC $4.25 CSCL 10A

The economic, energy-economic, and environmental issues involved in any prospective exploitation of wind power intended to cover a minor part (10%) of Denmark's consumption of electricity are discussed. The chief basis for the calculations involved is the 200 kW experimental windmill built at Gedser in 1956-57, which ceased to produce electricity in 1967. However, in exploring the ramifications of making Denmark partially dependent on wind energy power, estimates are made on the basis of projected larger series of mills of the Gedser type. Wind mill projects abroad, such as at Vattenfall, NSF and NASA, are also discussed, as is Denmark's dependence on power from Sweden and Germany. Author

N75-13386*# Scientific Translation Service, Santa Barbara, Calif.
A SYSTEM UTILIZING SOLAR ENERGY
Washington NASA Dec. 1974 8 p Transl. into ENGLISH from Densoken Nyusu (Japan), no. 284, Sep. 1973 p 1-3
(Contract NASw-2483)
(NASA-TT-F-16089) Avail: NTIS HC $3.25 CSCL 10A

The possibilities of using solar energy as a future energy source are discussed. A system utilizing solar energy is described and discussed. The factors necessary for a solar energy system are listed. Author

N75-13387# Committee on Science and Astronautics (U. S. House).
WIND ENERGY
Washington GPO 1974 393 p refs Hearing before Subcomm. on Energy of Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., No. 49, 21 May 1974
(GPO-37-390) Avail: Subcomm. on Energy

Wind energy as a resource base was investigated in a *Congressional hearing whose purpose was to ascertain the amount* of power available from wind, the maximum amount recoverable, and the relationship between the maximum amount recoverable and the present capacity of U.S. electric power generating systems. Basic information on the economic factors associated with the generation of energy from wind in commercial quantities is provided. Such concerns as implementation costs, environmental impacts, land use and water requirements, visual and noise effects, social acceptability, and institutional constraints are also discussed, and several demonstration projects are proposed. A.A.D.

N75-13388# RAND Corp., Santa Monica, Calif.
ELECTRICITY CONSERVATION MEASURES IN THE COMMERCIAL SECTOR: THE LOS ANGELES EXPERIENCE
J. P. Acton, M. H. Graubard, and D. J. Weinschrott Sep. 1974 74 p
(Contract FEA-14-01-0001-1715)
(R-1592-FEA) Avail: NTIS HC $4.25

The results are studied of a Los Angeles city ordinance effecting a cutback in electricity consumption. Preliminary statistical analysis indicated a quick reduction in electricity use by consumers in all sectors (commercial, industrial, and residential), with particularly significant drops in commercial consumption. Several commercial establishments were investigated to account for their rapid adjustment, and it was found that: (1) lighting changes accounted for most of the reduced usage, (2) the 20 percent cutback specified by the ordinance did not generally cause severe dislocations, and (3) time and costs involved in implementation were considered relatively small. The adaptation of the residential sector to the constraints is also discussed. Comments on the applicability of the Los Angeles experience to other areas are presented. N.E.R.

N75-13389# Sandia Labs., Livermore, Calif.
PROSPECTS FOR SOLAR ENERGY UTILIZATION
T. D. Brumleve Jun. 1974 11 p Presented at the Calif. Soc. of Profess. Eng., Stateline, Nevada, 13-15 Jun. 1974
(Contract AT(29-1)-789)
(SAND-74-8604; Conf-740639-1) Avail: NTIS HC $3.25

A brief overview of the present status and the prospects for various potential applications of solar energy is presented. A few general observations regarding the nature and utilization of solar energy are offered. Main emphasis is on the direct use of solar radiation in heat engines. NSA

N75-13390# Sandia Labs., Albuquerque, N.Mex.
SOLAR INCIDENCE FACTOR AND OTHER GEOMETRIC CONSIDERATIONS OF SOLAR ENERGY COLLECTION
W. P. Schimmel, Jr. Jul. 1974 22 p
(Contract AT(29-1)-789)
(SAND-74-26) Avail: NTIS HC $3.25

A vector analysis was made of the 5-degree-of-freedom system occurring in a flat plate or focused collector system. The results of this analysis were extended to include the case of an intermediate flat plate reflector. Because the expressions obtained are very general in nature, it is possible to work from local weather bureau data (with an appropriate scale factor to take into account the ratio of specular to total insolation) for a comparison of various proposed collector systems. Armed with these results, systems analysts can begin to optimize candidate systems and evaluate the effect of system constraints, and devote more time to the physics of solar absorption and other system considerations. Author (NSA)

N75-13392# Sandia Labs., Albuquerque, N.Mex.
SOLAR ENERGY: SANDIA'S PHOTOVOLTAIC RESEARCH PROGRAM
G. A. Samara and D. G. Schueler May 1974 14 p refs
(Contract AT(29-1)-789)
(SLA-74-281) Avail: NTIS HC $3.25

A brief description is given of Sandia Laboratories on-going and planned activities in photovoltaic solar energy conversion. The scope of the program, its overall objectives and expected accomplishments are outlined. Author (NSA)

N75-13393# Teledyne Isotopes, Timonium, Md. Energy Systems Div.
ECONOMIC RADIOISOTOPE THERMOELECTRIC GENERATOR PROGRAM: PROGRAM PLAN
Nov. 1973 149 p refs
(Contract SNSO-3)
(IESD-3112-3) Avail: NTIS HC $5.75

This program plan describes the effort required to develop, test, and manufacture the 400 W(e) economic radioisotope thermoelectric generator (ERTG) for space applications. The initial program is described in IESD-3112-1. NSA

N75-13396# National Academy of Engineering, Washington, D.C.
EVALUATION OF COAL-GASIFICATION TECHNOLOGY. PART 1: PIPELINE-W QUALITY GAS Interim Report
Apr. 1973 92 p refs
(Contract DI-14-32-0001-1216)
(PB-234036/2; OCR-74-INT-1) Avail: NTIS HC $2.25; SOD HC $0.70 as SD2414-00057 CSCL 07A

The discussion of coal gasification for production of pipeline gas includes information on the natural gas shortage, and projected needs, cost estimates (capitalized and operating), and specific problems of eight gasification processes. GRA

N75-13397# Monsanto Research Corp., Dayton, Ohio.
EFFECT OF GAS TURBINE EFFICIENCY AND FUEL COST ON COST OF PRODUCING ELECTRIC POWER Final Report
William H. Hedley May 1974 32 p refs
(Contract EPA-68-02-1320)
(PB-234159/2; MRC-DA-434; EPA-650/2-74-041) Avail: NTIS HC $3.75 CSCL 10A

It is shown that combining gas and steam turbines (COGAS systems) can increase overall power generation efficiency at costs of 6 to 10 mills per kWh as a function of fuel costs of 40 to 100 cents per million Btu. Such a capability will improve gas turbine efficiency by 29 percent to 37 percent over the next 9 years, and in turn will result in combined cycle efficiencies of 42 percent to 54 percent. GRA

N75-13398# Monsanto Research Corp., Dayton, Ohio.
EFFICIENCIES IN POWER GENERATION Final Report, Nov. 1973 - Feb. 1974
T. R. Blackwood and W. H. Hedley Mar. 1974 48 p refs
(Contract EPA-68-02-1320)
(PB-234160/0; MRC-DA-404; EPA-650/2-74-021) Avail: NTIS HC $3.75 CSCL 10A

Twenty-three different ways of using or converting energy. A tabular comparison of the thermodynamic limiting present and future (1990) efficiencies are provided. A brief discussion was given on efficiency limiting factors, possible general routes for process improvement, and relevant on-going research and development. The report concludes that more study is required in several of the following areas: atmospheric fluidbed combustion, automotive, bottoming cycle, chemical coal cleaning systems, chemically active fluid-bed combustion, coal cleaning plants, coal liquefaction, combined cycle (gas and steam), conventional boilers, conventional boilers plus flue gas cleaning, conversion of coal to methanol, diesel, Feher cycle, fuel cells, gas turbine, and various other related areas. Author (GRA)

N75-13399# Bureau of Mines, Laramie, Wyo. Energy Research Center.
RETORTING INDEXES FOR OIL-SHALE PYROLYSES FROM ETHYLENE-ETHANE RATIOS OF PRODUCT GASES
I. A. Jacobson, Jr., A. W. Decora, and G. L. Cook Jun. 1974 27 p refs
(PB-234050/3; BM-RI-7921) Avail: NTIS HC $3.75 CSCL 07A

In a closely controlled laboratory retorting system for oil shale, a relationship was developed between the temperature in the retort and the weight ratio of ethylene to ethane in the gases produced. Reciprocal temperature was shown to be directly proportional to the log (Ethylene)/(Ethane). From this relationship a number, called retorting index, was developed. It has the dimension of temperature, but its magnitude depends on both temperature and residence time for the reactants in the heated zone in the oil shale retort. The slopes of the lines relating reciprocal temperature and the logarithm of the ethylene-ethane ratios are nearly constant for each of the retorting processes for which data have been presented. GRA

N75-13400# British Steel Corp., Sheffield (England). Information Services.
THE GASIFICATION OF COAL: A BIBLIOGRAPHY
D. G. Brinn Jun. 1974 15 p

(PB-234294/7; SM/BIB/409/1) Avail: NTIS HC $3.25

The bibliography consists of some 60 annotated references from the literature mainly within the period 1970-1973. The processes considered are: Winkler; Winkler-Flesch; Lurgi; Bi-Gas; Koppers Totzek; Hygas; CO2 Acceptor; Atgas; Kellogg; Synthane; Westinghouse; Cogas; Stone and Webster; and Hydrane. GRA

N75-13401# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.

CLEAN POWER GENERATION FROM COAL Final Report, 30 Jun. 1972 - 23 Jan. 1973

May 1974 337 p refs

(Contract DI-14-32-0001-1223)

(PB-234188/1; OCR-84) Avail: NTIS; SOD HC $3.30 CSCL 10B

The tasks which were contained within the research which was directed towards the attainment of clean power generation from coal are the following: (1) identification of most promising power plant concepts using coal; (2) fuel cell battery development; (3) turbine development; (4) particulate removal from high temperature, high pressure gases; and (5) development of a low cost solid electrolyte hydrogen production process. Progress on the determination of 1990 environmental conditions of power plants and electric utility steam coal prices in the period 1970 to 1985 is discussed, along with regional forecasts of electric utility industry generation requirements to 1985 and forecasts of electric utility industry generation requirements to 1990. A subroutine is described for induced or natural draft cooling tower performance; cooling tower cost, and So2 stack gas scrubbing equipment. GRA

N75-13641# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

A REVIEW OF THE STATUS OF MHD POWER GENERATION TECHNOLOGY INCLUDING SUGGESTIONS FOR A CANADIAN MHD RESEARCH PROGRAM

P. C. Stangeby Nov. 1974 154 p refs

(UTIAS-39) Avail: NTIS HC $6.25

The fundamentals of MHD power generation technology are reviewed, and the economic aspects of MHD are considered. Special MHD applications are analyzed, including: (1) H2-02-Cs MHD peaking, and (2) tar sand processing by rapid devolatilization with or without MHD. Recommendations for a Canadian R and D program are outlined, along with estimated costs. Author

N75-13644# Atomic Energy Commission, Washington, D.C.

STATUS AND OBJECTIVE OF TOKAMAK SYSTEMS FOR FUSION RESEARCH

1974 111 p refs

(WASH-1295) Avail: NTIS HC $5.25

The following topics related to Tokamak research are discussed: (1) configurational stability and optimization, (2) plasma transport and scaling laws, (3) heating, and (4) boundary effects. NSA

N75-13690*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

TRANSPORTATION VEHICLE ENERGY INTENSITIES. A JOINT DOT/NASA REFERENCE PAPER

Alfred C. Mascy and Robert L. Paullin (DOT, Washington) Jun. 1974 29 p

(NASA-TM-X-62404; DOT-TST-13-74-1) Avail: NTIS HC $3.75 CSCL 13F

A compilation of data on the energy consumption of air and ground vehicles is presented. The ratio BTU/ASM, British Thermal Units/Available Seat Mile, is used to express vehicle energy intensiveness, and related to the energy consumed directly in producing seat-mile or ton-mile productivity. Data is presented on passenger and freight vehicles which are in current use or which are about to enter service, and advanced vehicles which may be operational in the 1980's and beyond. For the advanced vehicles, an estimate is given of the date of initial operational service, and the performance characteristics. Other key considerations in interpreting energy intensiveness for a given mode are discussed, such as: load factors, operations, overhead energy consumption, and energy investments in new structure and equipment. Author

N75-13882*# Scientific Translation Service, Santa Barbara, Calif.

MISSION AND ORGANIZATION OF THE DFVLR: TWO YEARS OF INTEGRATED SOCIETY OF GERMAN AERONAUTICAL AND SPACE FLIGHT RESEARCH

Volker Aschoff Washington NASA Dec. 1974 34 p Transl. into ENGLISH from Ueber die Aufgabe und die Organisation der DFVLR: Zwei Jahre Einheitsgesellschaft der Deutschen Luft- und Raumfahrtforschung, (Porz), Sep. 1971 p 114-146

(Contract NASw-2483)

(NASA-TT-F-16086) Avail: NTIS HC $3.75

A historical review on organizational developments of the German aeronautical societies is followed by a description of management methods for modern aerospace research facilities. The development history of the German Society for Aerospace Research is outlined and its scientific and geographic organizations are described. The various institutes of the society are assigned individual research on flow mechanics; flight mechanics and control materials and construction; propulsion and energy electronics and aerospace physics, simulation, and medicine. Author

N75-14002# Nederlands Scheeps-Studiecentrum TNO, Delft. Technische Afdeling.

ON THE POTENTIALITIES OF POLYPHENYLENE OXIDE (PPO) AS A WET-INSULATION MATERIAL FOR CARGO TANKS OF LNG-CARRIERS

G. Opschoor Jul. 1974 13 p refs

(Rept-194-M; TDCK-65202) Avail: NTIS HC $3.25

The possibility of applying PPO-foam for the wet insulation of liquified gas (LNG) tanks is discussed. Internal and external insulation systems are described, and properties of PPO-foam are treated. The mechanism of wet insulation is explained. Safety considerations require that a wet-insulation system consist of at least two layers, separated by a vapor barrier. Temperature distribution and thermal stresses in the materials were calculated for two wet-insulation models. It is concluded that PPO-foam is suitable for application as a wet-insulation material which can reduce the manufacturing costs of insulated LNG-tanks. Author (ESRO)

N75-14094# Maryland Univ., College Park.

HEAT PIPE SYMPOSIUM/WORKSHOP

D. K. Anand Nov. 1973 43 p refs Symp. held at College Park, Md., 5-6 Nov. 1973

(Grant NSF GK-38697)

(PB-236008/9) Avail: NTIS HC $3.75 CSCL 13A

The report describes results of a workshop meeting on research and technological development associated with heat pipe devices. Participants included representatives from industry, universities and government. The meeting was devoted to an assessment of the state-of-the-art of this field and the identification of needs and opportunities that can be effectively pursued through research. Topics discussed include fundamentals, wick properties and performance, fabrication, cryogenic heat pipes, gravity-assist pipes for high temperature applications, solar applications, space applications, variable conductance heat pipes, European developments, and identification of areas requiring additional research. GRA

N75-14134*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ANALYTICAL DESCRIPTION OF THE MODERN STEAM AUTOMOBILE

Jerry A. Peoples Nov. 1974 135 p refs

(NASA-TM-X-72199; M-TU-74-7) Avail: NTIS HC $5.75 CSCL 13F

The sensitivity of operating conditions upon performance of the modern steam automobile is discussed. The word modern has been used in the title to indicate that emphasis is upon

miles per gallon rather than theoretical thermal efficiency. This has been accomplished by combining classical power analysis with the ideal Pressure-Volume diagram. Several parameters are derived which characterize performance capability of the modern steam car. The report illustrates that performance is dictated by the characteristics of the working medium, and the supply temperature. Performance is nearly independent of pressures above 800 psia. Analysis techniques were developed specifically for reciprocating steam engines suitable for automotive application. Specific performance charts have been constructed on the basis of water as a working medium. The conclusions and data interpretation are therefore limited within this scope. Author

N75-14135*# Kentron Hawaii Ltd., Houston, Tex.
PROCEDURE FOR PREPARATION FOR SHIPMENT OF NATURAL GAS STORAGE VESSEL
A. M. Amawd Oct. 1974 15 p ref
(Contract NAS9-13413)
(NASA-CR-141455; JSC-09233) Avail: NTIS HC $3.25 CSCL 13L

A method for preparing a natural gas storage vessel for shipment is presented. The gas is stored at 3,000 pounds per square inch. The safety precautions to be observed are emphasized. The equipment and process for purging the tank and sampling the exit gas flow are described. A diagram of the pressure vessel and the equipment is provided. Author

N75-14264# Mitre Corp., Washington, D.C.
JAPANESE/UNITED STATES SYMPOSIUM ON SOLAR ENERGY SYSTEMS. VOLUME 1: SUMMARY OF PROCEEDINGS
Jun. 1974 53 p *Held in Washington, D. C., 3-5 Jun. 1974*
Sponsored by RANN
(Grant NSF GI-44066)
(MTR-6284-Vol-1) Avail: NTIS HC $4.25

Technical papers reviewing the present status and future plans for the development of solar energy systems in Japan and the United States are presented. In addition, data are given on the following: (1) solar-thermal systems for heating and cooling of buildings, heating of water, process heat, solar furnaces, and generation of electricity, (2) ocean based systems for generation of electricity, (3) photovoltaic systems for direct generation of electricity, (4) thermoelectric and thermionic systems for the direct generation of electricity, (5) wind energy conversion systems for the generation of electricity or the pumping of water, air, or other fluids, (6) organic material systems for the production of energy crops on land or in the oceans, and bioconversion processes for manufacturing heat, electricity, etc. and (7) chemical dissociation systems for the production of hydrogen and oxygen gases and electricity. Author

N75-14265# *Committee on Science and Astronautics* (U. S. House).
CONSERVATION AND EFFICIENT USE OF ENERGY
Olin E. Teague Washington GPO 1974 281 p refs Rept. of the Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., 18 Dec. 1974
(H-Rept-93-1634; GPO-38-968) Avail: SOD HC $2.60

The potential for energy conservation in the United States of America is assesed and the actions taken by the Federal agencies to achieve this goal are reviewed. Many economic, social, and technical issues relevant to the critical energy problem are elaborated. G.G.

N75-14268# Sandia Labs., Albuquerque, N.Mex.
AXIAL TEMPERATURE DIFFERENTIAL ANALYSIS OF LINEAR FOCUSED COLLECTORS FOR SOLAR POWER
D. O. Lee and W. P. Schimmel, Jr. 1974 7 p refs Presented at the 9th Intersoc. Energy Conversion Eng. Conf., San Francisco, 26 Aug. 1974 Sponsored by AEC
(SLA-74-5078; Conf-740805-3) Avail: NTIS HC $3.25

Solar energy collection over a moderate temperature range was studied, with Therminol 66 used as the collector fluid. Convective and radiative transport between the reciever and envelope, and from the envelope to the environment are modeled. Results are presented for (1) varying values of specular solar input for Albuquerque, New Mexico, on a statistical June 21, (2) fluid flow rate, (3) initial fluid temperature for both silvered and unsilvered envelopes, and (4) both evacuated and unevacuated envelopes. The best extraction of energy and the best temperature rise in the fluid is found to occur in the turbulent flow regime of the collector fluid. The maximum for any given flow rate with a given inlet temperature is shown to occur just after transition from laminar to turbulent flow. Author (NSA)

N75-14269# Teledyne Isotopes, Timonium, Md. Energy Systems Div.
ECONOMIC RADIOISOTOPE THERMOELECTRIC GENERATOR STUDY PROGRAM Final Technical Report
Oct. 1973 216 p
(Contract SNSO-3)
(IESD-3112-1) Avail: NTIS HC $7.25

Radioisotope thermoelectric generator concepts are evaluated and a reference design is selected which would provide a safe, reliable, economic 400 W(e) power supply for use in future space communication satellites. Nine basic concepts and 18 additional trade-off configurations were evaluated during the study program. The reference design ERTG is a generator with 400 W(e) EOM(5.5y) output, 15 standard heat source blocks, an improved all selenide thermopile, and two heat pipe augmented fins for waste heat rejection. The generator uses cm-244 as fuel but will accept pu-238. NSA

N75-14270# *Teledyne Isotopes, Timonium, Md. Energy Systems Div.*
ECONOMIC RADIOISOTOPE THERMOELECTRIC GENERATOR STUDY PROGRAM: APPENDICES. Final Technical Report
Oct. 1973 350 p *refs*
(Contract SNSO-3)
(IESD-3112-2) Avail: NTIS HC $9.50

This report consists of 14 appendices to the economic radioisotope thermoelectric generator (ERTG) study program described in IESD-3112-1. The appendices are entitled: Concept Summary Sheets; Low Temperature Heat Pipe Technology; Selenide T/E Technology and Test Data; Improved TAGS/2N T/E Technology; Bimetallic Seal Technology; Cold End Hardware Technology; Thermal Insulation Technology; Thermal Control Technology; Nuclear Safety Criteria; Heat Source Selection and Compatibility; Heat Source Response Analysis; Search and Recovery; Shield Analysis-Methods and Models; and Heat Pipe Attachment Techniques. NSA

N75-14271# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
THE MODULAR SOLAR ENERGY SATELLITE: INVESTIGATION ON LARGE SOLAR CELL SURFACES IN SPACE FOR THE PURPOSE OF EARTH POWER SUPPLY [DER MODULARE SONNEN-ENERGIE-SATELLITE. UNTERSUCHUNGEN AN GROSSEN SOLARZELLENFLAECHEN IM WELTRAUM ZUM ZWECK DER ENERGIEVERSORGUNG DER ERDE]
Jan Ruth May 1974 87 p refs In GERMAN; ENGLISH summary
(ILR-17-1974) Avail: NTIS HC $4.75

Increased feasibility of solar energy satellite is obtained by a modular honeycomb-like structure of solar collectors. Suggestions are given with regard to satellite control problems. Electrical propulsion was adopted to take care of orbit perturbations. ESRO

N75-14273# National Academy of Engineering, Washington, D.C.
EVALUATION OF COAL-GASSIFICATION TECHNOLOGY. PART 2: LOW AND INTERMEDIATE BTU FUEL GASES

Interim Report, Jan. - Dec. 1973
Mar. 1974 103 p refs
(Contract DI-14-32-0001-1216)
(PB-234042/0; OCR-74-INT-2) Avail: NTIS; SOD HC $1.10 as I63.10:74/INT2 CSCL 07A

Production of low and medium BTU from coal is discussed. Various gasification, desulfurization, and purification procedures are presented, as well as cost estimates, and alternative means of clean fuel production. GRA

N75-14274# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
EVALUATION OF AN ION EXCHANGE MEMBRANE FUEL CELL FOR SPACE POWER Final Report, Oct. 1969 - Jan. 1974
Irvin F. Luke May 1974 22 p
(AF Proj. 3145)
(AD-786888; AFAPL-TR-74-27) Avail: NTIS CSCL 10/2

An experimental electrolysis cell using an ion exchange membrane (solid polymer electrolyte) achieved 29,120 hours of endurance testing prior to failure. The cell was tested under a repetitive cycle of 23-hours electrolysis operation and one-hour open circuit. The cell was operated in the electrolysis mode at a constant current density of 128 amperes per square foot (asf) with the average cell temperature maintained at 170F. Disassembly inspection of the cell after the endurance test revealed very little degradation in the electrodes and screens, but considerable decomposition of the water transport wicks. Small cracks in two areas of the membrane accounted for the ultimate failure of the cell. (Modified author abstract) GRA

N75-14276# Army Foreign Science and Technology Center, Charlottesville, Va.
GEOTHERMAL POWER STATION
29 Mar. 1974 7 p Transl. into ENGLISH from Tekhn. Molodezhi (Moscow), no. 1, 1973 p 4-5
(AD-785948; FSTC-HT-23-1674-73) Avail: NTIS CSCL 10/2

The article mentions a geothermal power plant in Kamchatka using 200-300 degrees steam as the power source, at an efficiency of about 10%. It further mentions an extensive geothermal field in Kamchatka, with a water temperature of 80-90C, in which the exhaust steam heats freon, which runs a secondary generator. Creation of an artificial magma chamber with a 100 megaton thermonuclear device is proposed, to supply a geothermal power plant by means of heat pipes. GRA

N75-14277# Colorado State Univ., Fort Collins. Environmental Resources Center.
PRIMARY DATA ON ECONOMIC ACTIVITY AND WATER USE IN PROTOTYPE OIL SHALE DEVELOPMENT AREAS OF COLORADO: AN INITIAL INQUIRY
S. Lee Gray Jun. 1974 12 p refs
(Contract DI-14-01-0001-4006)
(PB-236039/4; OWRR-A-024-COLO(1); W74-12356) Avail: NTIS HC $3.25 CSCL 13B

Potential impacts of oil shale development on the economies of certain Western Slope communities in Colorado are quite large. These impacts will likely exert a substantial pressure on the land and water resource lease of the area in addition to the effects upon community development, regional income, income distribution, and a changing mix of business activity. In order to approach future research on these issues this seed research effort was designed to: (1) promote interaction and interchange of ideas among researchers and members of the affected communities; (2) to identify important areas of research needs in the oil shale region; and (3) to initialize the collection of primary data depicting the economic structure of the oil shale communities. GRA

N75-14278# Stanford Research Inst., Menlo Park, Calif.
CONTINUED DEVELOPMENT OF ENERGY TRANSMISSION AND CONVERSION SYSTEMS Annual Report, Jul. 1973 - Jul. 1974
P. M. Newgard, J. R. Woodbury, and J. Eckerle Aug. 1974 104 p
(Contract N01-HT-2907)
(PB-236181/4; NIH/NHLI-N01-HT-4-2907-1) Avail: NTIS HC $5.25 CSCL 10A

The report covers research directed toward the development and application of a technique for transfer of electrical energy into the human body in sufficient quantities to operate an implanted artificial heart. Progress was made in reducing the size and weight of components, especially those to be positioned near the heart within the thorax, without loss in overall efficiency. Progress was also made in upgrading the external power system to represent, more nearly, a truly portable system with increased reliablity. New brushless dc motors were designed, constructed, and tested. These provide higher efficiency than previously used motors and include large air gaps to allow operation while fully submerged in lubricants. A new 15 to 1 ratio gear system was *developed. Test data are presented showing achieved gear* efficiencies of about 97 percent. Author (GRA)

N75-14279# Oklahoma Industrial Development and Park Planning, Oklahoma City.
APPLICATION STUDY OF A NUCLEAR COAL SOLUTION GASIFICATION PROCESS FOR OKLAHOMA COAL, *VOLUME 1*
Apr. 1974 339 p refs Prepared by Stone and Webster Eng. Corp. and Gulf General Atomic
(Contract DI-14-32-0001-1219)
(PB-236156/6; GA-A120-68; OCR-86-F) Avail: NTIS MF $2.25; SOD HC $7.50 as I63.10:86 CSCL 07A

This report is presented in two parts, both included in one publication. Volume I contains the results of the Nuclear Coal Solution Gasification Study, descriptions of the coal gasification process and the nuclear reactor heat source, and the conclusions and recommendations formulated on the basis of the study. Volume II consists of the process sketches and equipment lists for the process steps and off sites plus a listing of the literature sources used in the study. This study (1) analyzes the potential increase in marketability and utility of coal reserves in Oklahoma by converting part of them to a higher-quality product and (2) provides the State of Oklahoma with information that will permit the State to analyze the possible benefits from the construction and operation of a coal gasification plant in eastern Oklahoma. Author (GRA)

N75-14280# Martin Marietta Corp., Denver, Colo.
SOLAR POWER SYSTEM AND COMPONENT RESEARCH PROGRAM Semiannual Progress Report, 15 Jan. - 15 Jul. 1973
Floyd A. Blake and Jesse D. Walton 31 Jul. 1974 240 p refs
(Grant NSF GI-41305)
(PB-236159/0; MCR-74-185;
NSF/RANN/SE/GI-41305/PR/74/2; NSF/RA/N-74-0-81;
SAPR-1) Avail: NTIS HC $7.50 CSCL 10B

System analysis and component design for a 100-MWe solar energy conversion power system are discussed. Report covers user application analyses; meteorological analysis; economic analysis; boiler and superheater component research; and boiler design, bench model design, and test plan. Author (GRA)

N75-14281# Boston Univ., Mass. Dept. of Chemistry.
PHOTOCHEMICAL CONVERSION OF SOLAR ENERGY Semiannual Report, 1 Jan. - 30 Jun. 1974
Norman N. Lichtin 30 Jul. 1974 30 p refs
(Grant NSF GI-38103)
(PB-236266/3; NSF/RA/N-74-087) Avail: NTIS HC $3.75 CSCL 10A

Measurements were carried out to make possible correcting for photo-bleaching effects in the evaluation of quantum efficiencies for conversion of absorbed light into electrical power in an aqueous iron-thionine photogalvanic cell employing an illuminated and a dark electrode. The quantum efficiency of generation of charge carriers was measured. Thin layer totally-illuminated cells with one SnO2 and one Pt electrode were constructed and their performance evaluated with a range of iron-thionine cell solutions. Cyclic voltammetric study of electrode processes was initiated. A flash photolytic-kinetic spectrophoto-

metric investigation of the kinetics of disproportionation of semithionine in a wide range of aqueous organic solvents demonstrated clean second order kinetics in these solvents. The reaction of triplet thionine with Fe(II) in acidic aqueous solution was investigated. The stoichiometry and kinetics of oxidation of leucothionine by Fe(III) were studied in aqueous DMA solutions. (Modified author abstract) GRA

N75-14282# Boston Univ., Mass. Dept. of Chemistry.
PHOTOCHEMICAL CONVERSION OF SOLAR ENERGY Annual Progress Report, 1 Jun. - 31 Dec.
Norman N. Lichtin 22 Jan. 1974 48 p refs Prepared in cooperation with Esso Res. Eng. Co., Linden, N. J.
(Grant NSF GI-38103)
(PB-235474/4; NSF/RANN/SE/GI-38103/PR/73/4; NSF/RA/N-74-048) Avail: NTIS HC $3.75 CSCL 07E

Iron-thionine photogalvanic cells were studied. Cell configuration, electrode materials, solution composition, light intensity, mode of illumination of electrodes, and overvoltage effects were investigated as they relate to dependence of efficiency of conversion of light flux into electric power. Fundamental aspects of the photochemistry and thermal chemistry of the iron-thionine system are covered. Nonphotochemical experiments examine possible chemical side effects of reagents that might influence cell potential via coordination of iron, elementary reactions that occur in the illuminated cell, and various aspects of thionine chemistry. GRA

N75-14283# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
SOLAR THERMAL ELECTRIC POWER SYSTEMS Quarterly Progress Report, 1 Jan. - 30 Apr. 1974
Apr. 1974 177 p refs Prepared in cooperation with Westinghouse Electric Corp., Boulder, Colo.
(Grant NSF GI-37815)
(PB-235475/1; NSF/RANN/SE/GI-37815/PR/74/1; NSF/RA/N-74-045; QPR-1) Avail: NTIS HC $7.00 CSCL 10A

Results of research to identify cost effective solar thermal electric power systems are given. Parametric performance and cost models were developed for concentrating collector, heat transport, and heat storage subsystems. Dynamic programming methods to select optimal subsystems and the solar thermal power systems are discussed. Power systems larger than 3 MW capacity that can be used in electrical networks are considered. GRA

N75-14284# Carnegie-Mellon Univ., Pittsburgh, Pa.
SOLAR SEA POWER Quarterly Progress Report, 1 Feb. - 30 Apr. 1974
Clarence Zener, Robert R. Rothfus, Francis Clay McMichael, Charles Kriebel, and Abrahim Lavi 30 Apr. 1974 89 p refs
(Grant NSF GI-39114)
(PB-235469/4; NSF/RANN/SE/GI-39114/PR/74-3; NSF/RA/N-74-043; QPR-3) Avail: NTIS HC $4.75 CSCL 10B

The third quarterly report shows how appropriate grooving of the vertical evaporator tubes will greatly reduce their surface area. These three reports now constitute the conceptual basis for the design of a heat exchange system in which the total heat exchange area is only 7 sq ft/net kW output. An analysis of the mixing problem, including the finite radius of the input pipe, shows that the critical input calculated in the semi-annual report was indeed conservative. An ocean current is therefore not needed to avoid mixing for power outputs up to several hundred megawatts. The general problem of technological assessment, and outline the scope of future work is discussed. Author (GRA)

N75-14593# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
CLINCH RIVER BREEDER REACTOR: A COMBINED POWER AND FUEL SOURCE
W. M. Jacobi and Y. S. Tang 1974 19 p refs Presented at the 77th Natl. Meeting on the Am. Inst. of Chem. Engr., Pittsburgh Sponsored by AEC
(Conf-740609-4) Avail: NTIS HC $3.25

The features of LMFBR type reactors, the design status of the Clinch River Breeder Reactor, and the projected future improvements for commercial fast breeders are presented. Author (NSA)

N75-14832# Gulf General Atomic, San Diego, Calif.
RADIOISOTOPE SPACE POWER GENERATOR Annual Summary Report, 1 Jul. 1971 - 30 Jun. 1972
N. B. Elsner, F. D. Postula, G. C. Bradshaw, E. J. Steeger, R. L. Leedy, and C. W. Mautz 1 Mar. 1974 95 p refs
(Contract AT(04-3)-943)
(GA-A-12848) Avail: NTIS HC $4.75

The Isotec Technology FY1972 Annual Summary Report is an account of several different efforts: (1) continuing development in fabricating and characterizing TAGS, (2) segmenting of different combinations of materials, such as PbSnMnTe/BiSbTe and PbSnMnTe/TAGS, (3) isothermal testing in ultrahigh vacuum of SiGe and SiMo to determine their free vaporization rate and compatibility with different insulations, (4) studies of a means for measuring intermediate range thermal conductivities with small samples of material, and (5) transit activities, which consisted of TRANSIT launch support, fabrication of a display model of the generator, and thermoelectric testing. Author (NSA)

N75-15149*# Scientific Translation Service, Santa Barbara, Calif.
SOLAR ENERGY
Takashi Horigome and Tatsuo Tani Washington NASA Dec. 1974 18 p Transl. into ENGLISH from Saiensu (Japan), Mar. 1974 p 47-53
(Contract NASw-2483)
(NASA-TT-F-16092) Avail: NTIS HC $3.25 CSCL 10A

The use of solar energy, the techniques to be employed, and future prospects of solar energy as a widespread energy source are discussed. Diagrams of solar power systems are presented. Author

N75-15150# Joint Committe on Atomic Energy (U. S. Congress).
DEVELOPMENT, GROWTH, AND STATE OF THE NUCLEAR INDUSTRY
Washington GPO 1974 609 p refs Hearings before Joint Comm. on Atomic Energy, 93d Congr., 2d Sess., 5-6 Feb. 1974
(GPO-33-873) Avail: SOD HC $5.00

The hearings are reported concerning the production of power by nuclear energy. Topics discussed include: AEC-Industry relationship, Project Independence, advanced breeder concepts, contributions of the nuclear industry to alleviate reliance on foreign sources of fuel, sources of uranium, and nuclear fuel cycle. F.O.S.

N75-15153*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AN EVALUATION: THE POTENTIAL OF DISCARDED TIRES AS A SOURCE OF FUEL
L. W. Collins, W. R. Downs, E. K. Gibson, and G. W. Moore (Lockheed Electronics Co., Houston, Tex.) Dec. 1974 17 p refs
(NASA-TM-X-58143; JSC-09243) Avail: NTIS HC $3.25 CSCL 10A

The destructive distillation of rubber tire samples was studied by thermogravimetry, differential scanning calorimetry, combustion calorimetry, and mass spectroscopy. The decomposition reaction was found to be exothermic and produced a mass loss of 65 percent. The gas evolution curves that were obtained indicate that a variety of organic materials are evolved simultaneously during the decomposition of the rubber polymer. Author

N75-15154*# Kanner (Leo) Associates, Redwood City, Calif.
REPORT OF THE WIND POWER COMMITTEE
Washington NASA Jan. 1975 117 p Transl. into ENGLISH from Dan. Elvaer Foren. (Copenhagen), 1962
(Contract NASw-2481)
(NASA-TT-F-16062) Avail: NTIS HC $5.25 CSCL 01B

Wind-generated electricity was studied at an experimental mill and at wind measuring stations which consisted of a measuring cylinder mounted on a steel mast at elevations of 25 and 50 m. The mill is evaluated in terms of its cost and performance and is compared to other experimental mills in these terms. A system of economic models is presented which compares the costs for wind- and steam-generated electricity, with the conclusion that a wind power plant such as the one studied is unable to compete with a steam power plant. Wind power is held to be useful as a replacement for imported fuel and as a power reserve. Supplementary material on effect calculations and performance characteristics is also provided. Author

N75-15155# Committee on Interior and Insular Affairs (U. S. Senate).
THE PROSPECTS FOR GASOLINE AVAILABILITY: 1974
David Lindahl Washington GPO 1974 138 p refs Background paper presented to Comm. on Interior and Insular Affairs pursuant to S. Res. 45, 93d Congr., 2d Sess., 20 Jun. 1974 Prepared by the Library of Congr., Congressional Res. Service
(GPO-34-969) Avail: SOD HC $1.35 CSCL 21D

The projected availability of gasoline is reported for the use of the Senate's National Fuels and Energy Policy Study. An overview of the problems of supply and demand for gasoline in the U.S. is given. Factors and developments affecting gasoline supply and demand are examined. Gasoline availability is assessed and the impact of shortages is discussed. Two related documents are included: (1) a post-embargo supply-demand outlook; and (2) a brief report on the gasoline supply picture. J.M.S.

N75-15157*# United Air Lines, Inc., San Francisco, Calif.
FUEL CONSERVATION CAPABILITY AND EFFORT BY COMMERCIAL AIR CARRIERS
May 1974 19 p
(Contract NAS2-7208)
(NASA-CR-137624) Avail: NTIS HC $3.25 CSCL 10B

Computer capability weather input data, performance data, and ATC interface are discussed in terms of their role in preflight and inflight planning for commercial flights. The effect of preflight and inflight planning on fuel efficient operation was evaluated along with the impact of avionics. It was found that there is a potential fotr saving fuel through use of avionics, especially in the area of vertical guidance in all phases of flight. Other results of the study indicate: (1) preflight planning as it now stands is adequate with the exception that more accurate and up-to-date weather information is desirable; (2) better inflight information about existing weather conditions is needed; and (3) ATC can aid in fuel conservation. M.J.S.

N75-15158# Committee on Interior and Insular Affairs (U. S. Senate).
OVERSIGHT: MANDATORY PETROLEUM ALLOCATION PROGRAMS, PART 1
Washington GPO 1974 199 p Hearings before Comm. on Interior and Insular Affairs pursuant to S. Res. 45, 93d Congr., 2d Sess., 27 Feb. 1974
(GPO-30-060) Avail: Comm. on Interior and Insular Affairs

The impact and effectiveness of allocation programs are evaluated. The operation of the allocation system is examined with emphasis on the following areas: (1) adequacy of allocations to rapid growth areas; (2) impact of allocations on public transportation; (3) relationships between the allocation program and crude oil imports; and (4) effect of allocation regulations on gasoline retailers. Basic questions about energy are explored. J.M.S.

N75-15159# Committee on Interior and Insular Affairs (U. S. Senate).
OVERSIGHT: MANDATORY PETROLEUM ALLOCATION PROGRAMS, PART 2
Washington GPO 1974 387 p refs Hearings before Comm. on Interior and Insular Affairs Pursuant to S. Res. 45, 93d Congr., 2d Sess., 14-15 Feb. 1974
(GPO-31-519) Avail: Comm. on Interior and Insular Affairs

Testimony is presented on the affect of fuel shortages and higher fuel prices on the people of Ohio. The hearings are a part of an effort to assess the impact of the energy crisis on the American people. J.M.S.

N75-15160# Committee on Interior and Insular Affairs (U. S. Senate).
PROTOTYPE OIL SHALE LEASING PROGRAM
Washington GPO 1974 312 p refs Hearings before Subcomm. on Minerals, Materials and Fuels of Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 17 Dec. 1973 and 5 Mar. 1974
(GPO-28-686) Avail: Subcomm. on Minerals, Materials and Fuels

The leasing program for commercial-scale oil production on public lands in Colorado, Utah, and Wyoming was analyzed. It was designed to provide information for determining whether 600 million barrel oil shale reserves can be developed at acceptable economic and environmental costs. Topics discussed include the economic impacts on the three states, shale oil capital, operating and resource costs, projected energy supply and demand, the projected amount of oil shale reserves, present energy costs and supplies, and potential energy sources. Alternatives to the prototype leasing program were evaluated along with the leasing procedures. M.J.S.

N75-15161*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COST AND SIZE ESTIMATES FOR AN ELECTROCHEMICAL BULK ENERGY STORAGE CONCEPT
Marvin Warshay and Lyle O. Wright Washington Feb. 1975 13 p refs
(NASA-TM-X-3192; E-8138) Avail: NTIS HC $3.25 CSCL 10C

Preliminary capital cost and size estimates were made for a titanium trichloride, titanium tetrachloride, ferric chloride, ferrous chloride redox-flow-cell electric power system. On the basis of these preliminary estimates plus other important considerations, this electrochemical system emerged as having great promise as a bulk energy storage system for power load leveling. The size of this system is less than two per cent of that of a comparable pumped hydroelectric plant. The estimated capital cost of a 10 MW, 60- and 85-MWh redox-flow system compared well with that of competing systems. Author

N75-15166# California Univ., Livermore. Lawrence Livermore Lab.
REVISED COST ESTIMATE FOR THE LLL IN SITU COAL GASIFICATION CONCEPT
D. R. Stephens 20 May 1974 35 p refs
(Contract W-7405-eng-48)
(UCRL-51578) Avail: NTIS HC $3.75

Cost estimates for the LLL in situ coal gasification concept using chemical explosive fracturing are revised. Gas selling prices are calculated using the utility financing method recommended by the Federal Power Commission Task Force. Conservatively, surface plant capital investment and annual operating cost are estimated to be $221 million and $16.7 million, respectively, in 1974 dollars. Optimistically, the price is 21% per million Btu less than for the conservative case. These prices can be compared to surface processing estimates using the same procedures. There is a considerable potential cost advantage to in situ coal gasification using chemical explosive fracturing. Author (NSA)

N75-15168# Army Foreign Science and Technology Center, Charlottesville, Va.
WIND AND SOLAR POWER ENGINEERING
B. Konovalov 19 Apr. 1974 11 p Transl. into ENGLISH from Izv. (USSR), v. 273, 21 Nov. 1972 p 2
(AD-786844; FSTC-HT-23-0402-74) Avail: NTIS CSCL 10/1

The need for small wind and solar powered installations for use at small settlements and installations is briefly discussed.
GRA

N75-15169# Pittsburg and Midway Coal Mining Co., Kansas City, Mo.
DEVELOPMENT OF A PROCESS FOR PRODUCING AN ASHLESS, LOW-SULFUR FUEL FROM COAL. VOLUME 2: LABORATORY STUDIES. PART 1: AUTOCLAVE EXPERIMENTS Interim Report
Charles H. Wright, Russell E. Perrussel, and Gerald R. Pastor Oct. 1974 335 p refs
(Contract DI-14-01-0001-496)
(PB-236305/9; CR-53-INT-6; IR-6) Avail: NTIS MF $2.25; SOD HC $4.10 as 163,10:53/Int. 6 CSCL 07A

The autoclave experiments and related laboratory studies done in support of the development of the pilot plant for preparation of solvent refined coal are summarized. These studies were done to obtain data for use in planning the pilot plant construction and operations and to assist in evaluating the commercial and economic feasibility of the solvent refined coal process. A considerable part of the work was devoted to evaluating various coals, solvents, and reducing gases that might be considered for further study in the pilot plant. Author (GRA)

N75-15171# Bureau of Mines, Washington, D.C.
BUREAU OF MINES RESEARCH 1973. SUMMARY OF SIGNIFICANT RESULTS IN MINING, METALLURGY, AND ENERGY
Jul. 1974 114 p refs
(PB-234733/4; BM-SP-1-74) Avail: NTIS MF $2.25; SOD HC $1.25 CSCL 08I

Results of scientific and engineering investigations in developing technology for extracting, processing, and recycling minerals, metals, and fossil fuels are summarized. Various aspects of coal, oil shale, and petroleum research are covered, along with mineral processing; hydrometallurgy; pyrometallurgy; secondary resource recovery; metallic and nonmetallic materials; and mine safety. A directory of mining, metallurgy, energy, and mineral supply research centers is included with a list of recent publications. Author (GRA)

N75-15172# Bureau of Mines, Morgantown, W.Va. Energy Research Center.
BUREAU OF MINES ENERGY PROGRAM, 1973
John D. Spencer and Bill Linville Jul. 1974 82 p refs
(PB-234682/3; BM-IC-8651) Avail: NTIS HC $4.75 CSCL 21D

New and improved methods for the discovery and production of oil and gas and production of fluid fuels from coal continued to be the major thrust of the Bureau of Mines energy research program during 1973. Crude oil recovery from tar sands and oil shale also retained a high priority in this work. Complementing this program were numerous studies aimed at accomplishing the objective of increased energy output with greater safety and minimum harm to the natural environment. This report summarizes research objectives and results and itemizes formal publications of the Bureau of Mines on energy and related subjects. GRA

N75-15173# FMC Corp., Princeton, N.J. Chemical Research and Development Center.
CHAR OIL ENERGY DEVELOPMENT Interim Report, Jul. 1972 - Jun. 1973
L. J. Scotti, B. D. McMunn, M. I. Greene, R. C. Merrill, and F. H. Schoemann Apr. 1974 231 p
(Contract DI-14-32-0001-1212)
(PB-234018/0; OCR-73-INT-2) Avail: NTIS MF $2.25; SOD HC $2.35 as 163:10:73/INT2 CSCL 07A

Descriptors: Coal gasification, Bituminous coal, Manufactured gas, Crude Oil, Pyrolysis, Pilot plants, Hydrogenation, Electric power generation, Fluidized bed processing, Boiler fuels, Desulfurization, Liquefaction. Indentifiers: Coal liquefaction, Coed process, Chars. Operations of the COED (Char-Oil-Energy-Development) pilot plant at Princeton, N. J., from July 1972 to June 30, 1973, are discussed. Report covers pyrolysis, oil filtration, hydrotreating, materials of construction, and commercial design studies. GRA

N75-15174# Federal Power Commission, Washington, D.C. Bureau of Natural Gas.
OFFSHORE INVESTIGATION: PRODUCIBLE SHUT-IN LEASES AS OF JANUARY 1974 (SECOND PHASE)
Jul. 1974 28 p refs
(PB-234490/1) Avail: NTIS HC $3.75 CSCL 08I

Reserve estimates were made for each of the 168 leases classified by the U.S. Geological Survey (USGS) as producible shut-in as of January 22, 1974. Data available in the USGS files were used for estimating the gas reserves of 142 of the leases while reserve estimates for the remaining 26 leases were available in the records of the Federal Power Commission (FPC). The results of these reserve estimates are summarized.
Author (GRA)

N75-15176# Kentucky Univ., Lexington. Dept. of Chemical Engineering.
SYNTHETIC OIL FROM COAL Biannual Report, 1 Oct. 1973 - 31 Mar. 1974
Richard L. Kermode Jul. 1974 62 p refs Sponsored in part by NSF
(Proj. NSF/RANN)
(PB-234460/4; UKY-TR86-74-CME2) Avail: NTIS HC $4.25 CSCL 21D

A progress report is presented on the study of liquefaction of coal by hydrogenation. Projects studied include: variables associated with hydrogen production to identify those areas in which technical success is most likely to improve the overall economics of coal liquefaction, a solids separation study of flotation as a means of removing unconverted coal and ash from coal liquids, a low temperature carbonization process as a source for suitable refinery feedstock and char feedstock for a hydrogen plant, a systematic laboratory investigation to identify trace elements, and minerals detrimental to catalytic hydrogenation of coal. GRA

N75-15177# Mitre Corp., McLean, Va.
PROGRAM PLAN FOR ENVIRONMENTAL EFFECTS OF ENERGY Final Report, 15 May - 31 Jul. 1974
Robert P. Pikul and Robert Rabin Jul. 1974 309 p refs Sponsored by NSF
(PB-235115/3; MTR-6726) Avail: NTIS HC $9.25 CSCL 10A

The National Science Foundation's initial five year program plan for the environmental effects of energy is presented. A basic program for five energy sources (coal, oil and gas, oil shale, geothermal, and solar) is described. Preobligated projects, new environmental support studies, and program planning and evaluation needs are identified. Author (GRA)

N75-15178# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
INTERFUEL SUBSTITUTION IN THE CONSUMPTION OF ENERGY IN THE UNITED STATES. PART 1: RESIDENTIAL AND COMMERCIAL SECTOR Interim Report
Martin L. Baughman, Paul L. Joskow, and Frederick S. Zerhoot 25 May 1974 97 p refs
(Grant NSF GI-39151)
(PB-234536/1; MIT-EL-74-002) Avail: NTIS HC $4.75 CSCL 21D

A conceptual model used for fuel choice decisions is given and empirical results presented for appliance choices in the residential sector for four selected appliances and for the fuel split of aggregate energy consumption among three fuels. Determinants of total energy demand in the residential and commercial sectors are covered along with a simple flow adjustment model. Estimated relationships are used to make projections to 1980 for alternative price scenarios. GRA

N75-15179# California Inst. of Tech., Pasadena.
CALTECH SEMINAR SERIES ON ENERGY CONSUMPTION

IN PRIVATE TRANSPORTATION Final Report, 1 Jul. 1973 - 30 Jun. 1974
John R. Pierce 30 Jun. 1974 330 p refs
(Contract DOT-OS-30119)
(PB-235348/0; DOT-TST-75-7) Avail: NTIS HC $7.50 CSCL 21D

Data, concerned primarily with means of reducing the huge amount of valuable oil burned in private cars are reported. Topics discussed include means to produce vehicles that have: lower weight with adequate space and safety, efficient, low pollution engines, better suspension and lower-loss tires, reduced power loss in accessories at high speeds, reduced air drag, more efficient transmission, and efficient operation with a shorter warmup period. Other courses discussed that could have a useful effect on oil consumption in the near future are: computerized traffic control, carpools, vanpools, and computer buses, demand-responsive transit, and improved fixed-route transit. Hybrid cars, electric cars, personal rapid transit, telecommunications, and legislative changes in the field of taxation are covered. GRA

N75-15183# Illinois Univ., Urbana. Dept. of Civil Engineering.
BIOLOGICAL CONVERSION OF ORGANIC REFUSE TO METHANE Annual Progress Report, 1 Jul. 1973 - 30 Jun. 1974
John T. Pfeffer and Jon C. Liebman Jul. 1974 182 p refs
(Grant NSF GI-39191)
(PB-235468/6; UILU-ENG-74-2019;
NSF/RANN/SE/GI-39191/PR/74/2; NSF/RA/N-74-068)
Avail: NTIS HC $7.00 CSCL 10A

Urban solid wastes contain significant quantities of energy that can be reclaimed. Biological conversion of the organic refuse to methane by anaerobic fermentation is one mechanism by which this energy can be reclaimed. The results of an investigation of refuse fermentation at a thermophilic operating temperature of 60 C are reported. Results of dewatering of the fermentor residue by vacuum filtration and centrifugation are presented. A mathematical simulator of the fermentation process, vacuum filtration process, shredding and separation process, and residue disposal processes is constructed. Results from the simulator runs are given. GRA

N75-15184# California Inst. of Tech., Pasadena.
CALTECH SEMINAR SERIES ON ENERGY CONSUMPTION IN PRIVATE TRANSPORTATION: ADMINISTRATIVE SUMMARY Final Report, 1 Jul. 1973 - 30 Jun. 1974
Albert R. Hibbs 30 Jun. 1974 30 p refs
(Contract DOT-OS-30119)
(PB-235349/8; DOT-TST-75-6) Avail: NTIS HC $3.75 CSCL 21D

A brief summary of organizational and administrative actions covering the preparation for and conduct of the seminar series, together with a brief commentary on the whole operation and an analysis of results is presented. Author (GRA)

N75-15185# Arizona Univ., Tucson. Optical Sciences Center.
CHEMICAL VAPOR DEPOSITION RESEARCH FOR FABRICATION OF SOLAR ENERGY CONVERTORS Quarterly Progress Report, 1 Jan. - 31 Mar. 1974
B. O. Seraphin 30 Apr. 1974 47 p refs
(Grant NSF GI-36731)
(PB-235481/9; NSF/RANN/SE/GI-36731X/PR/74/1;
NSF/RA/N-74-004) Avail: NTIS HC $3.75 CSCL 13H

The project will support research on a new approach to a selective solar energy convertor that can be used to transform solar radiation into high temperature heat. The selective solar energy convertor is basically a two-layered construction in which the top layer is a semiconductor material, such as silicon, having high absorption for solar radiation and high transparency for blackbody radiation from the heated unit. The bottom layer is a metal film having high reflectance. Author (GRA)

N75-15186# Arizona Univ., Tucson. Optical Sciences Center.
RESEARCH APPLIED TO SOLAR-THERMAL POWER SYSTEMS: CHEMICAL VAPOR DEPOSITION RESEARCH FOR FABRICATION OF SOLAR ENERGY CONVERTORS Annual Progress Report, 1 Jan. - 31 Dec. 1973
B. O. Seraphin 31 Dec. 1973 95 p refs
(Grant NSF GI-36371)
(PB-234565/0; NSF/RA/N-74-004) Avail: NTIS HC $4.75 CSCL 10B

The project supports research on a new approach to a selective solar energy convertor that can be used to transform solar radiation into high temperature heat. This heat can be transferred and applied in a steam turbin-generator unit to produce electricity. The selective solar energy convertor is basically a two-layered construction in which the top layer is a semiconductor material, such as silicon, having high absorption for solar radiation and high transparency for blackbody radiation from the heated unit. The bottom layer is a metal film having high reflectance. Author (GRA)

N75-15187# Exxon Research and Engineering Co., Linden, N.J.

FEASIBILITY STUDY OF ALTERNATIVE FUELS FOR AUTOMOTIVE TRANSPORTATION. VOLUME 1: EXECUTIVE SUMMARY
F. H. Kant, R. P. Cahn, A. R. Cunningham, M. H. Farmer, and W. Herbst Jun. 1974 29 p
(Contract EPA-68-01-2112)
(PB-235581/6; EPA-460/3-74-009-a-Vol-1) Avail: NTIS HC $3.75 HC also available from NTIS $16.50/set of 3 reports as PB-235580-SET CSCL 13B

Highlights of a study dealing with alternative liquid fuels derived from domestic coal and oil shale are discussed. Economic technical, and performance criteria are considered for gasolines, distillates, and methanol for the time period 1975-2000. Estimated cost for producing the fuels is covered as well as safety, toxicity, reliability, compatibility with various engines, and convenience of use. Author

N75-15188# Exxon Research and Engineering Co., Linden, N.J.

FEASIBILITY STUDY OF ALTERNATIVE FUELS FOR AUTOMOTIVE TRANSPORTATION. VOLUME 2: TECHNICAL SECTION
F. H. Kant, R. P. Cahn, A. R. Cunningham, M. H. Farmer, and W. Herbst Jun. 1974 238 p refs
(Contract EPA-68-01-2112)
(PB-235582/4; EPA-460/3-74-009-b-Vol-2) Avail: NTIS HC $7.50 HC also available from NTIS $16.50/set of 3 reports as PB-235580-SET CSCL 13B

Feasible and practical alternatives are identified to automotive fuels derived from petroleum for the 1975-2000 time period. The alternative fuels are liquids derived from domestic coal and oil shale -- specifically, gasolines, distillates, and methanol. Fuels were screened on the basis of economic, technical, and performance criteria, with consideration given to the way in which each fuel could be brought into general use. Consideration was given to the environmental impact of producing and using the fuels. Feasible and practical alternative automotive fuels were identified and gasoline-type and distillate-type fuels from oil shale together with gasoline-type, distillate-type, and methanol fuels from coal were evaluated in detail. Safety, toxicity, reliability, compatibility with different engines, and covenience of use were considered. GRA

N75-15189# Exxon Research and Engineering Co., Linden, N. J.
FEASIBILITY STUDY OF ALTERNATIVE FUELS AND AUTOMOTIVE TRANSPORTATION. VOLUME 3: APPENDICES
F. H. Kant, R. P. Cahn, A. R. Cunningham, M. H. Farmer, and W. Herbst Jun. 1974 143 p refs
(Contract EPA-68-01-2112)
(PB-235583/2; EPA-460/3-74-009-c-Vol-3) Avail: NTIS HC $5.75 HC also available from NTIS $16.50/set of 3 reports as PB-235580-SET CSCL 13B

Supplementary material for some of the topics discussed in Volume 2 is presented. The titles are as follows: background considerations; transportation fuel demand; resource base information; possible approach of other countries to alternative

transportation fuels; build-up of synthetic fuels manufacturing capacity; significance of fuel properties; bases for capital recovery; refining of shale and coal syncrude; coal mining costs and investments; and cost of operating and automobile. GRA

N75-15190# TRW Systems Group, Redondo Beach, Calif.
SOLAR HEATING AND COOLING OF BUILDINGS, PHASE O. VOLUME 2: FINAL REPORT Final Report
31 May 1974 534 p refs
(Contract NSF C-853)
(PB-235423/1; TRW-25168.002; NSF/RA/N-74-002B) Avail: NTIS HC $12.50 HC also available from NTIS $20.00/set of 3 reports as PB-235421-SET CSCL 13A

Functional performance, and operational requirements for solar water heating, space heating, and cooling systems for a range of building types in various climatic regions of the U.S. are established. The report assesses market capture potential for solar heating/cooling applications and identifies cost-effective system/building/region combinations. Social and environmental impacts are considered along with projected first costs, present value, and equivalent costs (including operation and maintenance costs). GRA

N75-15191# General Electric Co., Philadelphia, Pa. Space Div.
SOLAR HEATING AND COOLING OF BUILDINGS, PHASE O: FEASIBILITY AND PLANNING STUDY. VOLUME 3, BOOK 1, APPENDIX A, TASK 1: DEVELOPMENT OF REQUIREMENTS. APPENDIX B, TASK 2: SYSTEMS DEFINITION Final Report
May 1974 354 p refs
(Contract NSFC-855)
(PB-235433/0; DOC-74SD4219-Vol-3-Bk-1;
NSF/RA/N-74-021C) Avail: NTIS HC $10.00 HC also available from NTIS $45.00/set of 5 reports as PB-235430-SET CSCL 13A

Appendices to the study of solar heating and cooling of buildings are presented. The development is reported of requirements and a collector solar flux computer program, a preliminary solar heating and cooling screening model, a peak design loads computation program, and building parameters used to develop heating and cooling loads. Systems definition, including descriptions of models for heat pumps, solar absorption cooling systems, solar Rankine systems, nocturnal cooling, solar collector simulation, skytherm heating and cooling systems, and collector performance are described. Also discussed are thermal energy storage, heat recovery HVAC systems, on-going research pertinent to solar heating and cooling of buildings, system performance data plots, and climatological optimization of solar collectors. GRA

N75-15192# Westinghouse Electric Corp., Baltimore, Md. Special Systems.
SOLAR HEATING AND COOLING OF BUILDINGS. PHASE O: FINAL REPORT, VOLUME 1 Final Report, Oct. 1973 - May 1974
May 1974 361 p refs
(Contract NSF C-854)
(PB-235427/2; W-DESC-SS-10275-1; NSF/RA/N-74-023B) Avail: NTIS HC $10.00 HC also available from NTIS $25.00/set of 4 reports as PB-235425-SET CSCL 13A

A comprehensive analysis was made of technical, economic, social, environmental and institutional factors affecting the feasibility of using solar energy for heating and cooling buildings. Solar heating and cooling systems can become competitive in most regions of the country in the 1985-1990 period. Heating-only systems can be competitive in the 1975-1980 period in limited regions of the country. Impressive progress has recently been made in solar collectors but further reduction in costs is necessary to capture a large market. Five regions of the country containing more than 75 percent of the population have been identified as the market for solar systems. The amount of fossil fuel that can be saved by use of solar energy will build up slowly and could reach 50 million barrels of oil per year by 1990. GRA

N75-15193# Westinghouse Electric Corp., Baltimore, Md. Special Systems.
SOLAR HEATING AND COOLING OF BUILDINGS. PHASE O: FINAL REPORT. VOLUME 2: APPENDICES A-N Final Report, Oct. 1973 - May 1974
May 1974 400 p refs
(Contract NSF C-854)
(PB-235428/0; W-DESC-SS-10275-2; NSF/RA/N-74-023C) Avail: NTIS HC $10.25 HC also available from NTIS $25.00/set of 4 reports as PB-235425-SET CSCL 13A

Appendices are presented to a study of the technical, economic, social, environmental, and institutional factors affecting the feasibility of using solar energy for heating and cooling of buildings. Titles of the appendices are: Building and usage selection; solar collector and solar heating/cooling; future fuel prices; Westinghouse building code; changes in standard building practice, insulation and materials, structures; thermal and noise comfort in buildings; residential and nonresidential building design; reliability and maintainability; safety and code aspects for solar systems; solar cooling by adsorption air-conditioners; informational material development; control requirements; a state-of-the-art review of solar heating and cooling systems and subsystems; and absorption air-conditioning. For Vol. 1, see N75-15192. GRA

N75-15194# Westinghouse Electric Corp., Baltimore, Md. Special Systems.
SOLAR HEATING AND COOLING OF BUILDINGS. PHASE O: FINAL REPORT. VOLUME 3: APPENDICES O-Y Final Report, Oct. 1973 - May 1974
May 1974 412 p refs
(Contract NSF C-854)
(PB-235429/8; W-DESC-SS-10275-3; NSF/RA/N-74-023D) Avail: NTIS HC $10.50 HC also available from NTIS $25.00/set of 4 reports as PB-235425-SET CSCL 13A

This volume contains 11 appendices to a study of the technical, economic, social, environmental, and institutional factors affecting the feasibility of using solar energy for heating and cooling of buildings. Appendices include: Computer evaluation program: structure and fuel price projections; questionnaires delineation of constraints, and acceptability of systems; tables of results: delineation of constraints, and acceptability of systems; economic analysis and data; specification for preliminary design; competitive strengths and disadvantages of solar versus conventional systems; key market and institutional barriers; and preliminary identification of government policy and incentive actions. GRA

N75-15195# Westinghouse Electric Corp., Baltimore, Md. Special Systems.
SOLAR HEATING AND COOLING OF BUILDINGS. PHASE O: FINAL REPORT. EXECUTIVE SUMMARY
May 1974 68 p
(Contract NSF C-84)
(PB-235426/4; W-DSC-SS-10275-4; NSF/RA/N-74-023A) Avail: NTIS HC $4.25 HC also available from NTIS $25.00/set of 4 reports as PB-235425-SET also available from NTIS $9.00/set of 3 executive summaries as PB-235420 CSCL 13A

Results of a comprehensive analysis of the technical, economic, social, environmental, and institutional factors affecting the feasibility of using solar energy for heating and cooling systems are summarized. Results indicate that solar heating and cooling could become economically competitive in most regions of the country in the 1985-1990 period. Author (GRA)

N75-15203# Bureau of Mines, Washington, D.C.
BUREAU OF MINES RESEARCH PROGRAMS ON RECYCLING AND DISPOSAL OF MINERAL, METAL, AND ENERGY-BASED WASTES
C. B. Kenahan, R. S. Kaplan, J. T. Dunham, and D. G. Linnehan
1973 60 p refs
(PB-227476/9; BM-IC-8595) Avail: NTIS HC $4.25 CSCL 08I

A summary of Bureau of Mines research on utilization and disposal of solid wastes is presented, accompanied by an extensive

bibliography of related publications. The Bureau's Solid Waste and Materials Recycling Program is directed toward four main areas of research, development, and demonstration: (1) extraction of mineral, metal, and energy values from urban refuse; (2) upgrading and recycling of automotive and related ferrous and nonferrous scrap; (3) utilization and stabilization of mine, mill, and smelter wastes; and (4) recovery and reuse of values from industrial waste products. GRA

N75-15462# California Univ., Livermore. Lawrence Livermore Lab.

DART: A SIMULATION CODE FOR A DIRECT ENERGY CONVERTER FOR FUSION REACTORS

B. C. Howard, W. L. Barr, and R. W. Moir 13 May 1974 93 p refs

(Contract W-7405-eng-48)

(UCRL-51557) Avail: NTIS HC $4.75

The DART code simulates the behavior of the charged particles which leak out of a mirror fusion reactor and are electrically recovered in a direct energy converter. The code was used to design a laboratory-scale direct energy converter. A full-scale reactor converter is now being designed. The simulation technique, which includes space charge and secondary particle effects, and the method for calculating the efficiency with which the ion energy is converted to electricity is described. Output examples and listings of DART and several directly related codes are given. Author (NSA)

N75-15500# Committee on Banking, Housing and Urban Affairs (U.S. Senate).

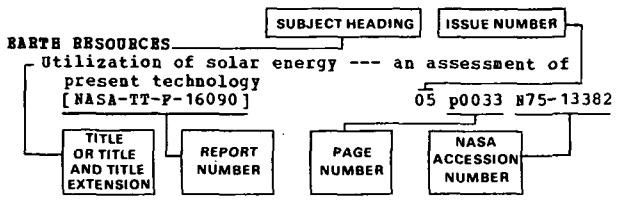
SMALL BUSINESS AND THE ENERGY CRISIS

Washington GPO 1974 263 p refs Hearings on S. 2760, S. 3096, and S. 3217 before Subcomm. on Small Business of Comm. on Banking, Housing and Urban Affairs, 93d Congr., 2d Sess., 30 Apr. - 1 May 1974

(GPO-33-574) Avail: Subcomm. on Small Business

The leisure and recreation (L-R) industry is described, and the possible impacts of energy shortages, conservation and allocation measures are assessed for small business. The use of leisure time by the individual, economic magnitude of the L-R industry, leisure related expenditures, and transportation modes for L-R trips are discussed. F.O.S.

Typical Subject Index Listing



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PERSONAL AUTHOR INDEX

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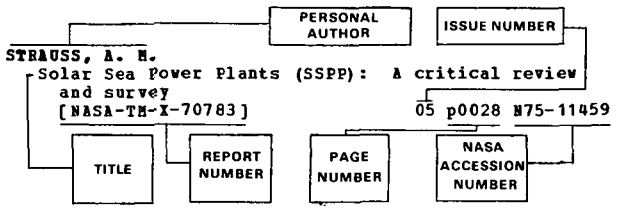

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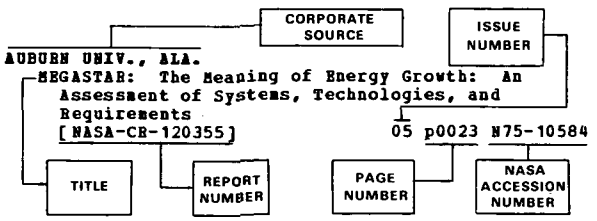

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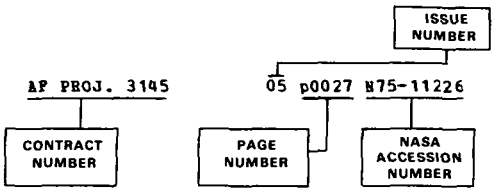

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REPORT/ACCESSION INDEX

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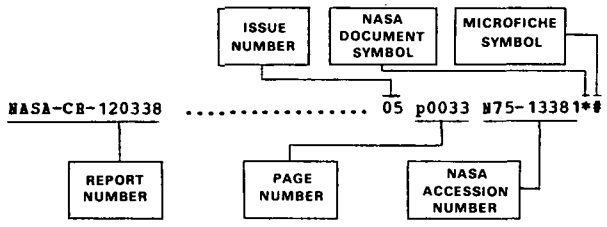

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