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Energy
A Continuing
Bibliography
with Indexes

NASA SP-7043(33)
April 1982

National Aeronautics and
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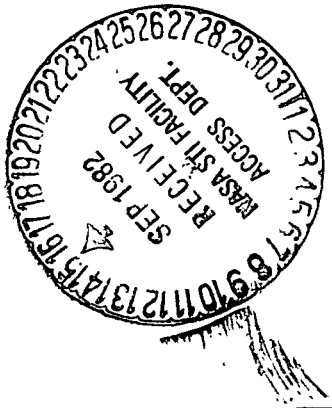

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ACCESSION NUMBER RANGES

Accession numbers cited in this Supplement fall within the following ranges.

STAR (N-10000 Series)	N82-10001 - N82-16039
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NASA SP-7043(33)

ENERGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

Issue 33

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between January 1 and March 31, 1982 in

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

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INTRODUCTION

This issue of *Energy: A Continuing Bibliography with Indexes* (NASA SP-7043(33)) lists 1211 reports, journal articles, and other documents announced between January 1, 1982 and March 31, 1982 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.

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 entries are arranged in eight major categories, with *IAA Entries* preceding *STAR Entries* in each category. 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.

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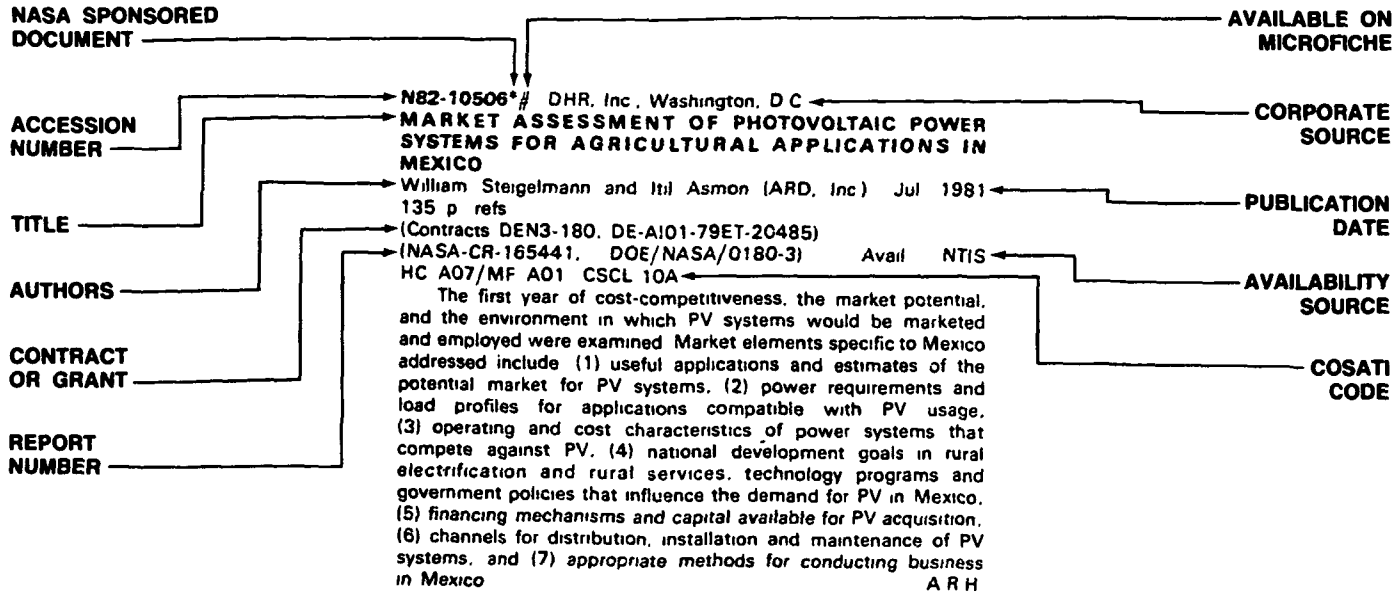

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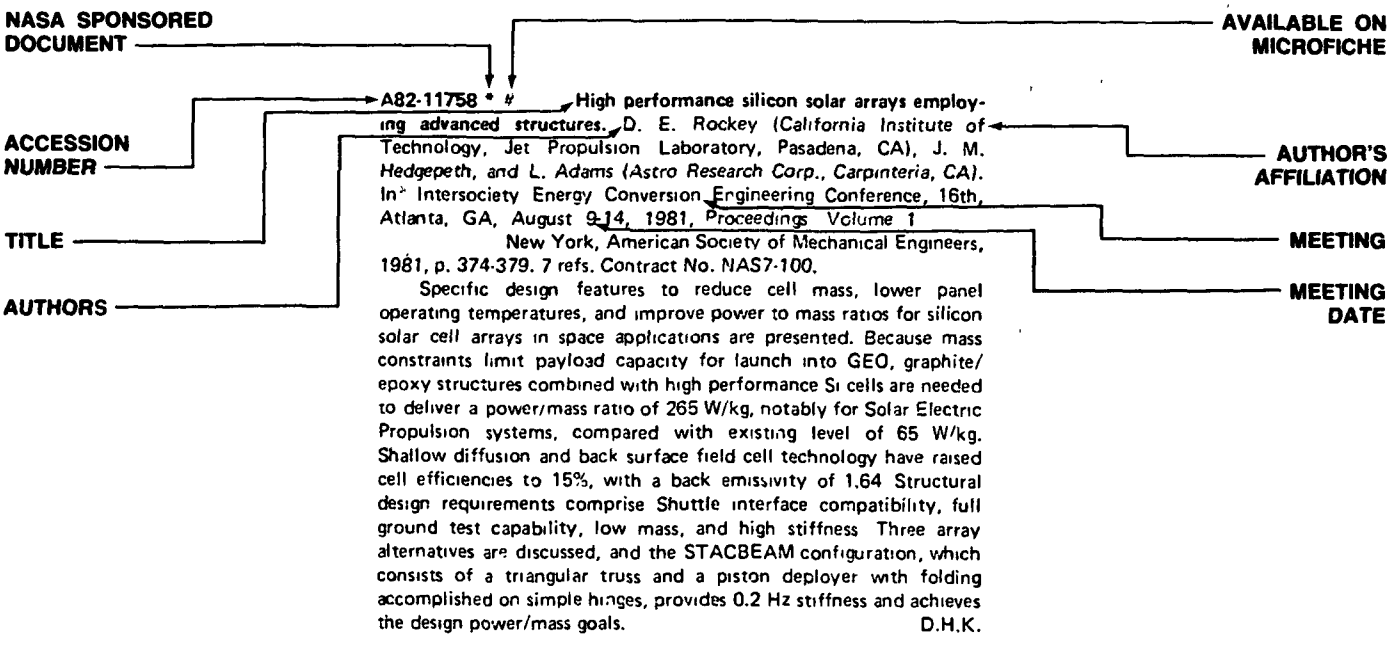

A Listing of Energy Bibliographies Contained in This Publication:

ENERGY

A Continuing Bibliography (Issue 33)

APRIL 1982

01
ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

Includes energy requirements, energy conservation, and environmental impacts of energy systems.

A82-10495 # **Characteristics and trends of energy consumption in transport missions with aircraft and surface vehicles (Caratteristiche e tendenze del consumo energetico nelle missioni di trasporto con aeroplani e con veicoli di superficie).** G Gabrielli *Ingegneria*, July-Aug 1981, p 193-198. 6 refs In Italian

A nondimensional factor is defined which characterizes energy consumption in transport missions. Values of this energy utilization factor are given for a number of aircraft and surface vehicles (e.g., automobiles, buses, and trains). Particular attention is given to the energy utilization factor of turbofan and turbojet aircraft B.J.

A82-10697 **Fingerprinting pollutant discharges from synfuels plants.** K J Bombaugh and K W. Lee (Radian Corp., Austin, TX) *Environmental Science and Technology*, vol. 15, Oct 1981, p. 1142-1149. 11 refs Research sponsored by the U S. Environmental Protection Agency.

An approach to the identification of ambient aerosols produced by a coal gasification plant based on their organic chemical composition is discussed The method has been field tested successfully in the region of the Lurgi process plant in the Kosovo region of Yugoslavia, which produces four major liquid by-products· naphtha, medium oil, tar and crude phenol. In the study, gas chromatography in both the sulfur and nitrogen modes and gas chromatography/mass spectroscopy with selective ion scanning was used to detect the presence of the medium oil characteristics in chromatograms of ambient aerosols and vapors collected over a 16-day period at five locations approximately 1-2 km from the plant With the aid of a calibration curve expressing the relation between GC retention time and boiling point for various compounds, chromatograms of the medium oil component were found to be similar to those gathered downwind of the plant Comparisons between the chromatograms of nitrogen species in samples of water-soluble organics from the Kosovo plant and from a Chapman-Wilputte gasifier using Virginia bituminous coal also demonstrate the potential utility of the technique for differentiating between chemicaly similar emissions from different sources A.L.W

A82-10875 **Characteristics of combustion and pollutant formation in swirling flames.** T Takagi and T. Okamoto (Osaka University, Suita, Japan). *Combustion and Flame*, vol. 43, Oct. 1981, p. 69-79. 24 refs.

The gas species concentrations and temperatures in a flame formed around a fuel jet surrounded by a swirling air flow are presented. Particular attention is given to the interrelation between the flame structure and the formation and emission characteristics of air pollutants. Two typical flame configurations are found to arise according to the primary air ratio: the type A flame has a low primary air ratio, increased NO(x) is formed in the flame and appears in the exhaust because the fuel layer burns at a relatively high temperature and the slow mixing retards the temperature decay. Low NO(x) formation occurs in the type B flame, which has a high primary air ratio, the fuel layer around the recirculation zone burns at a relatively low temperature as a result of dilution by excess air prior to combustion. Unburnt hydrocarbons are liable to be exhausted because hydrocarbons in the fuel layer around the recirculation zone, excessively diluted by the surrounding air, spill away through the circumferential part of the bulk flow Hydrocarbons are not exhausted, however, when the total air ratio is less than two. Effects of a wide range of parameters on NO(x), CO, and hydrocarbon emissions are examined in connection with the flame configurations. J.F.

A82-11540 **Annual review of energy. Volume 6.** Edited by J. M. Hollander (California, University, Berkeley, CA), M. K. Simmons (General Electric Co., Schenectady, NY), and D. O. Wood (MIT, Cambridge, MA). Palo Alto, CA, Annual Reviews, Inc., 1981 559 p. $20.

Developments in the areas of energy resources and supply technologies, energy end use and conservation, energy policy, energy-related risks and the sociopolitical aspects of energy are reviewed. Progress in solar energy technologies over the last five years is discussed, along with the implications for reactor safety of the accident at Three Mile Island, the derivation of biomass fuels from agricultural products and the application of probabilistic risk assessment to energy technologies. Attention is also given to a program for national survival during an oil crisis, energy conservation in new buildings, the development of a United States synthetic fuel industry, the role of OPEC policies in world oil availability, the social impacts of soft and hard energy systems, and the energy implications of fixed rail mass transportation systems. Additional topics include the energy consumptions of industries, the relative economics of nuclear, coal and oil-fired electricity generation, and the role of petroleum price and allocation regulations in the management of energy shortages. A.L.W.

A82-11542 **Agricultural policies and biomass fuels.** S. Flaim and D. Hertzmark (Solar Energy Research Institute, Golden, CO). In: Annual review of energy. Volume 6.
Palo Alto, CA, Annual Reviews, Inc., 1981, p. 89-121. 64 refs.

The potentials for biomass energy derived from agricultural products are examined. The production of energy feedstocks from grains is discussed for the example of ethanol production from grain, with consideration given to the beverage process and the wet milling process for obtaining fuel ethanol from grains and sugars, the nonfeedstock costs and energy requirements for ethanol production, the potential net energy gain from ethanol fermentation, the effect of ethanol fuel production on supplies of protein, oils and feed and of ethanol coproducts, net ethanol costs, and alternatives to corn as an ethanol feedstock. Biomass fuel production from crop residues is then considered, the constraints of soil fertility on crop residue removal for energy production are reviewed, residue yields with conventional practices and with reduced tillage are determined, technologies for the direct conversion of cellulose to ethanol and methanol are described, and potential markets for the products of these processes are identified. Implications for agricultural policy of ethanol production from grain and fuel and chemical production from crop residues are also discussed. A.L.W.

A82-11543 **Factors in the development of a major US synthetic fuels industry.** H. Perry and H. H. Landsberg (Resources for the Future, Inc., Washington, DC) In: Annual review of energy. Volume 6. Palo Alto, CA, Annual Reviews, Inc., 1981, p. 233-266. 48 refs. Contract No. ER-78-C-01-6654

Conditions necessary for the development of a successful synthetic fuels industry in the United States which would reduce

dependence on imported liquid fuels are examined. Attention is given to the legislative background, the current status of alternative synfuels technologies including coal gasification, coal liquefaction, oil shale, and biomass conversion, resource requirements, environmental and socioeconomic constraints, and economic factors. Estimates are also presented of the rate of commercialization to be expected at various levels taking into account both physical and nonphysical constraints, and it is concluded that the rate of commercialization of synthetic fuels production should increase rapidly after the 1990s after the demonstration of technologies acceptance of regulatory requirements, and development of the required technological infrastructure. A.L.W.

A82-11845 # **Energy conservation through utilization of mechanical energy storage.** D. B Eisenhaure, T E. Bliamptis, J. R. Downer, and P C Heinemann (Charles Stark Draper Laboratory, Inc , Cambridge, MA) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 3. New York, American Society of Mechanical Engineers, 1981, p. 2154-2160

Potential benefits regarding fuel savings, necessary technology, and evaluation criteria for the development of flywheel-hybrid vehicles are examined A case study is quoted in which adoption of flywheel-hybrid vehicles in a taxi fleet would result in an increase of 10 mpg average to 32 mpg. Two proposed systems are described, one involving direct engine power to the flywheel and the second regenerating the flywheel from braking energy through a continuously variable transmission Fuel consumption characteristics are considered the ultimate determinant in the choice of configuration, while material properties and housing shape determine the flywheel speed range Vehicle losses are characterized and it is expected that a flywheel at 12,000 rpm will experience less than one hp average parasitic power loss. Flywheel storage is suitable for smaller engines because larger engines dominate the power train mass Areas considered important for further investigation include reliability of an engine run near maximum torque, noise and vibration associated with flywheel operation, start up delays, compatibility of driver controls, integration of normal with regenerative braking systems, and, most importantly, the continuously variable transmission.

M S K

A82-12156 **The annual variation of atmospheric CO2 concentration observed in the Northern Hemisphere.** G I Pearman and P Hyson (Commonwealth Scientific and Industrial Research Organization, Div. of Atmospheric Physics, Mordialloc, Victoria, Australia). *Journal of Geophysical Research,* vol 86, Oct 20, 1981, p. 9839-9843. 28 refs NOAA-supported research

Records of the annual variation of the atmospheric carbon dioxide concentration at Mauna Loa, Point Barrow, and Weathership P are examined for secular changes. The amplitude of the annual variation appears to have increased in recent years with a best estimate of the rate of change, based on the Mauna Loa data, of 0.45 + or - 0.42%/yr This change is discussed in terms of changes in biospheric respiration and photosynthesis and the use of fossil fuels The analysis does not allow for the separation of several possible causes of amplitude change However, if the change is interpreted as reflecting enhanced biospheric growth, the effect is equivalent to a 8% change in the net summer uptake of carbon over the years 1959-1978 and to a growth of the Northern Hemisphere seasonal biosphere of 500-billion kg of carbon per year Such a conclusion is consistent with recent inventory studies, which indicate that temperate zone forests have acted as a net sink of about 10-trillion kg of carbon per year in recent decades (Author)

A82-12505 # **Environmental factors of power satellites.** Y. T Chiu and B. K Ching (Aerospace Corp , Space Sciences Laboratory, El Segundo, CA). In. International Scientific Conference on Space, 21st, Rome, Italy, March 25, 26, 1981, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1981, p. 43-52. 16 refs

The paper delineates environmental factors associated with the construction and operation of a solar power satellite, with emphasis on the idea that these factors should play a central, not a subsidiary, role in defining the limits of the system. Particular attention is given to the biospheric environment (the ground level and troposphere), including launch-site effects and rectenna site effects, the upper atmospheric environment (tropopause to turbopause), and the near-space environment (turbopause to magnetopause), including HLLV exhausts and the F region, spacecraft emissions in the magnetosphere, and possible interactions of the microwave beam with the ionosphere B.J.

A82-12547 **Energy future: Prophets, profits and policies; Proceedings of the Seventh Annual UMR-DNR Conference on Energy, University of Missouri-Rolla, Rolla, MO, October 14-16, 1980. Volume 7.** Conference sponsored by the Missouri Department of Natural Resources and University of Missouri-Rolla. Edited by J. D Morgan (Missouri-Rolla, University, Rolla, MO). Rolla, MO, University of Missouri-Rolla, 1981. 344 p $30.

Topics covered include industrial energy systems, biomass use, and energy management. Papers were presented on photovoltaic and wind electric systems, energy considerations in building design and standards, political and social aspects of energy systems, energy research technology, and environmental impacts of various hydrocarbon based fuel systems. M S K.

A82-12563 **Fuel conservation - DC-9 series 20/30/40.** *Society of Flight Test Engineers, Journal,* vol 3, Sept. 1981, p. 2-17.

Operational performance penalties and approximate fuel costs associated with the aerodynamics, flight operations, fuel gage system and performance analysis aspects of the DC-9 Series 20, 30 and 40 aircraft are presented. Degradations in aerodynamic cleanness, caused by the gradual deterioration of various seals, rigging adjustments and skin surface smoothness, are shown to lead to drag increases of less than 0.5%, which, however, represents a significant cost in view of the amount of fuel consumed. Flying off-optimum altitude or Mach number may result in excess fuel expenditures greater than those due to degraded aerodynamic cleanness. Other operational factors with substantial influence on fuel use include fuel or aircraft weight, center of gravity, flight time, the use of automatic flight control systems, APU operation, engine starting times, takeoff procedures, climb speed, en route profile, descent profile, and approach maneuvers. The DC-9 fuel gage system has been designed to be as accurate as possible in all phases, in order to minimize the necessity of carrying excess fuel for a given flight. Finally, investigations of aircraft performance may be used to identify areas requiring correction through the comparison of the indicated performance level against a reference, the assessment of engine and airframe contributions, and the investigation of the most likely areas for correction - the external control surfaces and internal systems. S.C.S.

A82-13078 **Fuel efficient flight profiles in an ATC flow management environment.** R. W Schwab (Boeing Commercial Airplane Co., Seattle, WA). In: Joint Automatic Control Conference, Charlottesville, VA, June 17-19, 1981, Proceedings. Volume 1 New York, American Institute of Chemical Engineers, 1981, 6 p (WA-1B).

The Flow Management research program was established to define the airborne navigation/guidance capabilities needed for efficient operation in the ATC Flow Management system under development, the Flow Management research is one element of the NASA Terminal Configured Vehicle program. This paper examines the Flow Management algorithms, and reviews in-plane geometry and ATC constraints, wind and temperature modeling, descent initialization, runway profile descent calculation, aeroperformance envelope determination, high profile descent calculation, and holding and path stretching. B.J

A82-13457 # **The role of avionics in the all electric airplane.** M J Cronin (Lockheed-California Co., Burbank, CA) In: Digital Avionics Systems Conference, 4th, St Louis, MO, November 17-19, 1981, Collection of Technical Papers. New York, American Institute of Aeronautics and Astronautics, 1981, p 47-55. 22 refs. (AIAA 81-2219)

The paper examines the role of avionics in the development of the all-electric airplane (AEP) as a viable and energy-efficient transport. It is noted that avionics will play a key role in the fuel and thrust management of the advanced-technology engines of the AEP via technology such as FADEC (full authority digital engine control)

Attention is also given to the important role of avionics in the flight control of future AEPs, operating with a relaxed static stability and advanced supercritical wings The samarium-cobalt motor/generator development and the proliferating use of power electronics for engine starting/motor control are also discussed B.J.

A82-14006 # **Analysis of electric utility investments into wind power.** F. March, E H. Dlott, and R. C. McArthur (Arthur D Little, Inc., Cambridge, MA). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2537*. 9 p.

This paper uses a synthetic utility typical of the northeast United States, to evaluate an investment into 1000 MW of wind power, as a fuel saver, in the mid-1980s. The results of models that simulate the production cost savings, and the financial implications to the regulated utility are displayed. Under current regulatory and financial market conditions, an investor owned utility has no incentive to invest in wind energy, particularly when the technology is considered risky. A series of policy changes affecting the regulatory rules under which the utility operates are explored using the financial model to measure common stock issued, bond coverage, allowance for funds during conservation as percent of earnings, earnings, and cost to consumer. These results are projected over a 15 year period, providing insight into which policies are likely to result in effective incentives for wind energy investment. (Author)

A82-14009 # **Siting and land-use considerations in wind energy development.** R J Noun (Solar Energy Research Institute, Golden, CO) *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec 1-3, 1981, Paper 81-2541*. 9 p 43 refs.

Public and private issues affecting land-use requirements for the development of wind energy farms in the 30 kW to 3 MW range are discussed Private concerns comprise agreements between owners of adjacent property, while public issues concentrate on legislative acts to protect wind energy access, minimizing land development restrictions in areas next to wind farms is the primary focus Existing (one, 600 kW - 20 turbines), under construction, and planned wind farms are described, noting that a small difference in wind speeds can have a large effect on the economics of wind farms Windpower is divided into quantity (the effect of turbulence on windspeed), and quality (the effect of turbulence on the lifetime of the wind turbine structure), the factors have a large impact on the physical array design of a wind farm and the life expectancy of a wind turbine Measurement on a 200 kW Mod OA indicated wake turbulence clearance at 5 rotor diameters, although 20% velocity deficits were observed at 7 diameters State legislative action to protect wind easement is reviewed, with private agreements providing specific binding clauses for airspace and wind rights between two landowners viewed as the best method M.S K

A82-14021 # **Florida's proposed OTEC pilot plant for Key West.** D L Block, L Rotundo (Florida Solar Energy Center, Cape Canaveral, FL), A. Griffin (TRW, Inc., Redondo Beach, CA), and T. Kelly (City Electric System, Key West, FL) *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2563* 6 p

A description of the organizational structure, resource, and plant design for an OTEC system near Key West, Fla , is presented. A consortium of government offices has contracted with individual industrial developers to form an initial design team and manage subcontracting Key West was chosen because of high electric rates, a proximity to warm and deep seawater, and a cooperative utility. Ocean water temperatures range from 80 F for the surface to 42 F for deep waters A 40 MWe pilot plant is planned, with a double hull design for the 600-700 ft by 100-200 ft barge, four 15 MWe power modules will use ammonia as a working fluid. Strong available currents have reduced the needed sizes of the surface water intake ducts, less than two weeks down time are projected for hurricanes The fiber reinforced composite cooling water pipe will be 2,600 ft long and designed to withstand hurricane stresses Mooring and power delivery cabling are described, and it is noted that the design for the Key West plant is transferable to anywhere in the world due to the built-in engineering considerations D.H K

A82-14024 # **An estimate of OTEC costs, market potential and proof-of-concept vessel financing.** R Manley, J Bluestein (Mitre Corp., McLean, VA), and E. J. Francis (Johns Hopkins University, Laurel, MD) *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2567* 14 p. 7 refs

The cost and financing alternatives for the OTEC proof-of-concept experimental vessel and analysis of likely future markets for the technology are discussed Financing alternatives include the benefits of 1980 legislation favoring OTEC investments as well as application of well known project financing techniques. Estimates of the cost of electricity to be provided by large-scale OTEC plants in the late 1980s are made and projections of OTEC's future competitiveness are offered Additionally, estimates of OTEC's contribution to the industrial power market through OTEC plantship applications are made. Near-term investments in OTEC proof-of-concept vessels appear favorable under the financial conditions assumed and should be more favorable under the Economic Tax Recovery Act of 1981 The long-term contributions which OTEC could make to the nation's energy supply and the consequent reductions in import of foreign oil are substantial, if the technology is allowed to mature to full-scale status. (Author)

A82-14040 # **Turboexpanders for OTEC power plants.** J Holm (Rotoflow Corp , Los Angeles, CA). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2592*. 13 p 9 refs

Centripetal (radial inflow) turboexpanders are well adapted to energy conservation schemes. A mini OTEC demonstration program, completed in 1979, uses a closed ammonia cycle to drive a 50 kw turboexpander generator unit The turboexpander, which incorporates mechanical designs of low temperature and high speed machinery, has very high levels of reliability and efficiency. Stiff shaft designs have eliminated shaft and bearing criticals in the entire operating range Rotor resonance problems are almost totally eliminated, and thrust bearing problems can be accurately monitored and controlled Condensing streams and dust in gas can also be handled without erosion Designs for radial inflow turboexpanders in sizes up to 70 MWe are presently available for use in OTEC and other power plants J F

A82-14347 * **Chronic exposure of a honey bee colony to 2.45 GHz continuous wave microwaves.** B B. Westerdahl and N. E. Gary (California, University, Davis, CA). *Space Solar Power Review*, vol. 2, no 3, 1981, p. 283-295 8 refs. Research supported by the U.S. Department of Energy, Contract No. NAS2-9539.

A honey bee colony (Apis mellifera L.) was exposed 28 days to 2.45 GHz continuous wave microwaves at a power density (1 mW/sq cm) expected to be associated with rectennae in the solar power satellite power transmission system. Differences found between the control and microwave-treated colonies were not large, and were in the range of normal variation among similar colonies. Thus, there is an indication that microwave treatment had little, if any, effect on (1) flight and pollen foraging activity, (2) maintenance of internal colony temperature, (3) brood rearing activity, (4) food collection and storage, (5) colony weight, and (6) adult populations. Additional experiments are necessary before firm conclusions can be made (Author)

A82-14404 **Renewables in the U.S. energy future - How much, how fast.** J P Holdren (California, University, Berkely, CA). *Energy* (UK), vol 6, Sept 1981, p 901-916. 40 refs

Comparisons are made of various projections of the contribution of several energy sources to the U S energy mix in the year 2000, along with conclusions on the effects of methods used to choose which systems receive emphasis. It is shown that energy-economic models predict renewable contributions of 1.5-24% of the total to be needed, depending on the set of assumptions utilized by the analyst and the definitions of renewable that were used. All studies showed a decoupling of energy consumption growth rates from an increase of economic growth, and a lessening of the rate of building large, conventionally fueled power plants. Scenarios making similar projections on the total use of renewables differed as to which technologies would make the contribution Examples are provided for the use of

solar heating and thermoelectric conversion, wind, photovoltaics, OTEC, and biomass, and it is concluded that, while many energy futures are possible, the use of economics alone as a basis does not reflect the total cost of any particular energy system. D.H.K.

A82-14416 Wing design for light transport aircraft with improved fuel economy. D. Welte, R. Birrenbach, and W. Haberland (Dornier GmbH, Friedrichshafen, West Germany). *Zeitschrift fur Flugwissenschaften und Weltraumforschung,* vol. 5, Sept.-Oct. 1981, p. 294-303 5 refs. Research supported by the Bundesministerium fur Forschung und Technologie.

Investigations related to the development of a new wing for a light transport aircraft were initiated by a German aerospace company in 1975. Flight tests for the evaluation of the new wing began in June 1979. The considered design incorporates a new wing section and a wing tip having a triangular shape. The induced drag observed in connection with the new wing tip is less than the corresponding value found for wing tips of conventional design. Tradeoff studies were conducted to optimize wing area and wing aspect ratio for the specified performance requirements. A use of the new wing design makes it possible to obtain aircraft with high maximum-lift values, low drag, and good stall characteristics. Attention is given to the wing parameter study, aspects of airfoil design, the flap design, the wing design, the aileron, and the merits of a number of different wing structures. G.R.

A82-14442 Evaporative hydrocarbon emissions from a large vehicle population. P. F. Nelson (Commonwealth Scientific and Industrial Research Organization, Div. of Fossil Fuels, North Ryde, New South Wales, Australia). *Air Pollution Control Association,* vol. 31, Nov. 1981, p. 1191-1193. 13 refs. Research supported by the SPCC of New South Wales.

Results of measurements of hydrocarbon emissions from parked cars in Sydney, Australia are presented. Concentrations of ethylene, acetylene, propylene, i-butane, n-butane, i-pentane, and n-pentane were determined for gasoline vapor, totally evaporated gasoline, and exhaust sources. Field samples were taken from the sole exhaust duct of an underground parking garage, and concentrations of each pollutant were obtained for the flow rate, emission rate for each source, and the weight fraction of the hydrocarbon species in the source. The hydrocarbons were identified by chromatography and the results were used to obtain solutions for the three sources by a least squares method. Comparisons of species concentration in the garage exhaust with the reference concentrations for the three sources indicated that evaporated gasoline was the pollutant source, with an average emission of 9.9 g/car, implying that evaporated gasoline from parked cars is a significant source of hydrocarbon emissions. M.S.K.

A82-14709 The all electric airplane - Its development and logistic support. M. J. Cronin (Lockheed-California Co., Burbank, CA). In: NAECON 1981, Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 19-21, 1981. Volume 1. New York, Institute of Electrical and Electronics Engineers, Inc., 1981, p. 241-247. 19 refs.

Developmental and logistic support aspects that must be considered as a part of the development-cycle of potentially large electric power systems are reviewed. Increasing fuel problems and their impact on the economic viability of commercial airlines are discussed. The hardware design, power generation system, environmental control system, and the engine starting system are also discussed. In addition, the impact of these large electric power systems on ground logistic support and operation from ground power units, auxiliary power units, and fixed-plant installations is considered. D.L.G.

A82-14924 Energy technology VII: Expanding supplies and conservation; Proceedings of the Seventh Conference, Washington, DC, March 24-26, 1980. Edited by R. F. Hill. Washington, DC, Government Institutes, Inc., 1980. 1600 p. $45.

Papers were presented on energy policy, including U.S. energy policy, world energy use, and Mexican, Canadian, and European energy perspectives. Topics were discussed in energy analysis, planning, and regulation, and effective energy use was examined in terms of energy management, cogeneration, energy efficient buildings, heat recovery systems, and solar sources and heat pumps. Specific attention was paid to energy saving methods for combustion heat sources, electric and advanced automobile engines, and synfuels programs. Fuel cells were investigated, along with prospects and problems in nuclear electric generation, enhanced oil recovery, and solar passive, thermoelectric, and photovoltaic systems. Finally, OTEC systems were explored, as were specific and regional biomass programs, peat and methane fuels, large wind turbine siting techniques and projects, and present and future solar instrumentation. M.S.K.

A82-14925 Energy technology VIII: New fuels era; Proceedings of the Eighth Conference, Washington, DC, March 9-11, 1981. Edited by R. F. Hill (Bridgeport, University, Bridgeport, CT). Rockville, MD, Government Institutes, Inc., 1981. 1472 p. $48.

Papers were presented on energy analysis, planning, and regulation, noting lead times necessary for energy systems development, the socioeconomic and environmental effects of energy systems, and utility planning procedures. Effective energy use was considered in terms of utility load management, cogeneration, conservation, heat pumps, and heat recovery methods. Technologies for exploitation of fossil, geothermal, and nuclear resources were discussed, with attention given to synthetic fuels, fuel cells, and fusion prospects. Finally renewable energy resources were examined regarding solar building heat systems, economics, solar pond performance, biomass, alcohol, small-scale hydro, wind turbine performance, and photovoltaic systems. M.S.K.

A82-15068 Incorporation and impact of a wind energy conversion system in generation expansion planning. K. F. Schenk and S. Chan (Ottawa, University, Ottawa, Canada). *(Institute of Electrical and Electronics Engineers, Summer Meeting, Portland, OR, July 26-31, 1981.) IEEE Transactions on Power Apparatus and Systems,* vol. PAS-100, Dec. 1981, p. 4710-4718 7 refs. Research supported by the Natural Sciences and Engineering Research Council of Canada.

A computer model is used to simulate the operation of zero, 75 MW, and 150 MW wind energy conversion systems (WECS) in conjunction with other utility generating sources over a 20 year period. The wind turbines are modelled as multistate processes with an output proportional to wind variability. Cost analyses are reported for each year of simulated operation, and emphasis is placed on optimal generator expansion plans and capacity mix for displacement, fuel savings, and the impact of WECS on capital and operating costs. Attention is also given to the system loss of load probability (LOLP) and capacity reserve margin, along with cash flow and interest during construction, costs of alternatives to WECS (coal, nuclear, hydro, etc.) were also considered. Results include the total present worth of the 75 MW WECS was greater than that for the 150 MW WECS, the LOLP increases with the 75 MW system and decreases for the 150 MW WECS, and the 75 MW WECS replaces 16.7 GW of energy. The program is judged to be effective in predicting negative energy demand for utilities by use of WECS. M.S.K.

A82-15589 Fuel and energy. J. H. Harker and J. R. Backhurst (Newcastle-upon-Tyne, University, Newcastle-upon-Tyne, England). London and New York, Academic Press, 1981. 373 p. 400 refs. $50.50.

Sources of energy for human use are reviewed, with consideration given to energy forms, conversion, efficiencies of conversion systems, identification of the sources and resources of energy, and the capabilities for various systems to meet enumerated estimates of energy demands. Primary fuels such as solids (coal), liquids (oil), and natural gas are examined for resource availability and methods of use. Processes to alter the form of primary fuels to form secondary fuels for specific applications are outlined, and methods of testing fuels for suitability are elaborated. Energy conversion with and without combustion is discussed for solar, wind, geothermal, nuclear, and chemical energy systems, and calculations of energy conversion efficiencies and economics are given, including energy conservation and recovery in industry. M.S.K.

A82-15598 Fuel conservation measures in South African airways - A review of activity and a glimpse of future developments.

D. P. du Plooy *Aeronautical Society of South Africa and South African Institute of Aeronautical Engineers, Journal,* vol. 2, no. 1, 1981, p. 52-57.

Operational, structural, and design features intended as fuel conservation measures for wide-bodied aircraft are discussed. Lower speeds, maximum operational altitude flying, and balanced loading are procedures to save fuel, while maintenance of engine efficiency after rebuild, instrument accuracy, exterior cleanliness, and control surface operational accuracy reduce drag. Modification of the horizontal stabilizer is noted, and attention is given to work on the regenerative engine, advanced airfoils, winglets, and active controls, as well as laminar and natural flow control by using a tandem wing configuration. Suggestions for improvements to air traffic control systems are offered, while the increasing use of diesel fuels in automobile engines is seen as a destabilizing force in the price of jet fuels, and alternate fuels, such as synthetic crude and liquid hydrogen are reviewed. M.S.K.

A82-15665 An energy saving transit concept for new towns. J. E. Anderson (Minnesota, University, Minneapolis, MN). *Journal of Advanced Transportation,* vol. 15, Summer 1981, p *127-141. 7 refs.*

Through study of the equation for energy use per trip it is shown how to choose the characteristics of a transit system in such a way that energy use is a minimum. It is shown that the resulting system also minimizes the general equation for cost per trip, takes very little of the urban land, emits virtually no noise, and, because it is electrically powered, does not directly pollute the air. A new town designed with such a system as the major mover of people and goods could have a much better balance between buildings and parks, the ground level would be pedestrian oriented and would provide an environment much more conducive to higher density living than present automobile-oriented towns, and many more trips could be taken by walking and cycling. The combination provides a high-quality urban environment that would use substantially less energy then that required of auto-oriented towns today. Prospects for commercialization and research and development needs are discussed. (Author)

A82-16199 Dimethyl sulfate in particulate matter from coal- and oil-fired power plants. D. J. Eatough, M L. Lee, D. W. Later, B. E. Richter, N. L. Eatough, and L. D. Hansen (Brigham Young University, Provo, UT). *Environmental Science and Technology,* vol. 15, Dec. 1981, p 1502-1506. 9 refs. Research supported by the Electric Power Research Institute and American Cancer Society. Contract No. DE-AC02-80EV-10405.

A82-16272 † Effect of wick dryness on the performance of heat pipes with separate channels (Vliianie peresykhaniia fitilia na rabochie kharakteristiki teplovykh trub s razdel'nymi kanalami). Iu F. Gerasimov, Iu. E. Dolgirev, and Iu. F. Maidanik (Ural'skii Politekhnicheskii Institut, Sverdlovsk, USSR). *Energetika,* vol. 24, Oct. 1981, p. 68-74 In Russian.

A method which accounts for the effect of wick dryness is proposed for calculating the performance characteristics of heat pipes whose evaporation zone includes a system of longitudinal steam discharge pipes of rectangular cross section. By analyzing the vapor pressure drop in the wick, it is shown that as the wick grows dry, the heat pipe temperature increases. Calculations are found to be in good agreement with experimental results V.L.

A82-16342 Model calculations of the chemical processes occurring in the plume of a coal-fired power plant. J. F Meagher and M. Luria (Tennessee Valley Authority, Muscle Shoals, AL). *Atmospheric Environment,* vol 16, no 2, 1982, p. 183-195 21 refs Research supported by the U.S. Environmental Protection Agency and Tennessee Valley Authority

Computer simulations of homogeneous gas phase chemical reactions which occur in the plume of a coal-fired power plant, were conducted to investigate the influence of various environmental parameters on the production of secondary pollutants. Under most conditions examined, hydroxyl radicals appeared to be the most important species in the homogeneous conversion of stack gases into secondary pollutants, and the conversion rates calculated for the oxidation of SO2 to SO4(2-) were consistent with those determined experimentally. The concentration and relative properties of NO(x) from the power plant and reactive hydrocarbons from background air were found to determine the plume reactivity, and under typical summer conditions, the hydroxyl radical concentration reached a maximum at a HC/NO(x) ratio of about 20. The presence of ozone bulges under a wide variety of environmental and plant operational conditions was also predicted. D.L.G.

A82-16348 Alternative transportation vehicles for military-base operations. D. A. Freiwald and W. J. Barattino (Los Alamos National Laboratory, Los Alamos, NM). *International Journal of Hydrogen Energy,* vol. 6, no 6, 1981, p. 631-636.

It is noted that heretofore little attention has been given by the military services to developing alternatives to gasoline and diesel-fueled ground-transportation vehicles because reliable alternative vehicle technology that could meet military performance requirements was not available. Descriptions are given of two promising types of propulsion systems for military-base vehicles hydrogen-fueled internal combustion and fuel cell/electric hybrids (methanol or hydrogen fuel cells). It is thought that the military services could be a catalyst in reducing petroleum consumption within the U.S. transportation sector. The principal advantage of the military market is that on each base the organization already exists that is capable of generating and/or distributing an alternative fuel as well as maintaining the vehicle at properly scheduled intervals. C.R.

A82-17076 Energy and ceramics. Edited by P. Vincenzini (CNR, Istituto Statale d'Arte della Ceramica, Faenza, Italy) Amsterdam, Elsevier Scientific Publishing Co. (Materials Science Monographs. Volume 6), 1980. 1310 p. $192 75.

Consideration is given the improvement of energy use efficiency in such ceramic industry processes as the firing of bricks and tiles, through the use of ceramic fiber insulation, progressive kiln aggregates, new kiln furniture designs, new ceramic compositions and additives, and process optimization techniques. Such alternative energy sources as peat, and industrial by-product materials that include fly ash and waste glass are studied, and attention is given the application of silicon carbide, sialon, and silicon nitride to energy production and conversion systems such as adiabatic diesel engines and nuclear reactor components. Also covered are thermoelectric and piezoelectric materials, solar cells, and materials for MHD and other high-temperature applications. O.C.

A82-17281 Fuel conservation now. R. A Davis (Boeing Commercial Airplane Co., Renton, WA). In: Safe and efficient *management of energy; Proceedings of the Thirty-third Annual* International Air Safety Seminar, Christchurch, New Zealand, September 15-18, 1980. Arlington, VA, Flight Safety Foundation, Inc , 1980, p. 83-95.

Boeing is developing improvements for the existing production run of second generation transports, the 727 and 737 aircraft, in order to meet the escalation of jet transport fuel prices. The improvements include reduction in aircraft weight and aerodynamic drag, engine fuel efficiency, and aircraft operational improvements. Applications of a Kapton lightweight wire insulation was shown to save approximately 386 pounds for each 727 and 170 pounds for each 737. A 1% retrofit table drag reduction package is currently available for the 727. The JT8D 'A' series of engines for the -15 and -17 versions promise specific fuel consumption improvements of 5.5% to be available in 1982. The Performance Data Computer coupled with the full range Autothrottle/Speed Control will provide fuel savings up to 7% for the 727 and up to 6% for the 737. J.F.

A82-17282 Energy savings with today's technology. H. Dibley (British Airways, Heathrow, Middx., England). In: Safe and efficient management of energy, Proceedings of the Thirty-third Annual International Air Safety Seminar, Christchurch, New Zealand, September 15-18, 1980. Arlington, VA, Flight Safety Foundation, Inc., 1980, p. 97-133.

The crew of an aircraft seeks to maximize the energy available in the atmosphere and in the aircraft's fuel so as to ensure the efficient and safe operation of a flight. This is accomplished by displaying clear data in front of the crew, by providing the crew with comprehensve but readily useable information for fuel management (enabling minimum fuel reserves to be carried out), and by relieving

the crew of an unnecessary mental work load to use this information. The optimum profile for minimum fuel use involves (1) climbing with maximum thrust at an optimum speed to optimum cruise altitude for a given aircraft weight and wind gradient, (2) cruise climbing as weight decreases; (3) unrestricted descent to the destination field at optimum descent speed with the idle thrust; and (4) selection of a route which takes advantage of the wind structure to fly the minimum air miles. This can be accomplished by supplying the crew with meteorological information, the fuel flight plan, as well as knowledge of the fuel reserves. A minimum safe altitude display on the pilot's panel is also suggested. J.F.

A82-17289 **Computer flight planning for fuel efficiency.** L. M. Reinkens (Lockheed Aircraft Service Co., Ontario, CA). In: Safe and efficient management of energy; Proceedings of the Thirty-third Annual International Air Safety Seminar, Christchurch, New Zealand, September 15-18, 1980. Arlington, VA, Flight Safety Foundation, Inc., 1980, p. 258-269.

The need to improve fuel efficiency is forcing the aviation industry to reassess the use of computer flight planning (CFP). In the past decade, CFP was based on mechanizing manual techniques; the demand now is for CFP to take technology one step further into (1) inexpensive on-line conversational systems available throughout the world; (2) refined optimization techniques in route and profile selection to minimize fuel uplift, maximize payload, and extend range; (3) reanalysis enroute to reflect take-off variations and minimize fuel consumption; (4) reanalysis in the event of diversion to an alternate, (5) remote data base entry; and (6) refined reserve fuel consumption. The proposed interactive system and conversational network are given, differences in cruise speeds, fuel, and payload requirements of the Boeing 737 and 747 are illustrated. J.F.

A82-17420 **The all-electric airplane - A new trend.** M. J. Cronin (Lockheed-California Co., Burbank, CA). *Lockheed Horizons,* Winter 1981-1982, p. 28-39.

After a brief, historical consideration of the progress of aeronautics and of the feasibility of electrical-propulsion aircraft such as the photovoltaic Solar Challenger, a description is given of the direct operating cost reductions and system efficiencies derived from the replacement of bleed air/hydraulic/pneumatic/electrical aircraft power systems by a single, electric power system. In such a system, electric generators are the sole source of power for such functions as (1) the primary/secondary flight control system; (2) de-icing and anti-icing, (3) environmental controls, (4) electronics and avionics loads; and (5) landing gear actuation and other mechanical functions. Estimates are presented of cycled weight savings and of the power extraction penalties that may be obviated by the all-electric system. The integration of power-by-wire and fly-by-wire systems is also discussed. O.C.

A82-18120 **Energy for the year 2000.** Edited by R. Wilson (Harvard University, Cambridge, MA). New York, Plenum Press (Ettore Majorana International Science Series: Physical Sciences. Volume 6), 1980. 408 p. $42.50.

Possible energy mixes for the U.S. in the 1979-2000 AD time frame are considered. The manufacturing and operational characteristics of photovoltaics are discussed, as are other solar options, such as flat plate collectors, biomass energy production, wind energy conversion systems, and OTEC plants. Attention was given to wave energy conversion and to the role of utilities in the diversification of energy sources. United States energy policy is explored, and various energy scenarios are compared. Breeder reactor technology is detailed, along with reactor safety and the quantitative assessment of risk for reactor safety. Finally, coal conversion is examined, including gasification and fluidized bed technologies. M.S.K.

A82-18643 **Macro-engineering: The rich potential; Proceedings of the Third Symposium, San Francisco, CA, January 6, 1980. Symposium sponsored by the American Association for the Advancement of Science and American Institute of Aeronautics and Astronautics. Edited by R. Salkeld (System Development Corp., Santa Monica, CA), F. P. Davidson, and C. L. Meador (MIT, Cambridge, MA). New York, American Institute of Aeronautics and Astronautics, 1981. 186 p. Members, $19.; nonmembers, $24.**

After considering the relationship of large-scale enterprises to social attitudes and social change, attention is given to: (1) increasing the degree of communication between project-managers and clients in developing countries, (2) the creation of a public-service data utility, and (3) the development of the Great Recycling and Northern Development (GRAND) canal concept for water management on the North American continent. Also discussed are: (4) a solar thermal aerostat research station consisting of a large-diameter, solar-heated sphere capable of stratospheric stationkeeping, (5) a macroengineering solution to the macroproblem posed by the application of solar power satellites to the energy needs of India, (6) a multipurpose microwave space facility for the 1990s, and (7) the disposal of nuclear wastes in space. O.C.

N82-10254# KVB, Inc., Irvine, Calif

BASELINE DATA ON UTILIZATION OF LOW-GRADE FUELS IN GAS TURBINE APPLICATIONS. VOLUME 3: EMISSIONS EVALUATION Final Report

T Sonnichsen Jun 1981 108 p refs Sponsored in part by Electric Power Research Inst

(EPRI Proj 1079-3)

(DE81-903764, EPRI-AP-1882-Vol-3) Avail NTIS HC A06/MF A01

A series of field tests was conducted on two residual-oil-fired gas turbine/heat recovery steam generators (HRSG) comprising a Westinghouse PACE 260-MW combined-cycle unit Base load emission levels were determined A series of tests was also made at reduced operating loads Emission measurements included (1) gaseous constituents measured by continuous monitoring instrumentation (O2, CO2, NO, NO sub x, and SO2) and by wet chemistry methods (SO3, aldehydes, and chlorides), and (2) particulate characteristics (mass loding, smoke spot number, submicron particle size, and particle morphology) Corrected NO sub x emissions at base load were 170 ppM and 200 ppM with and without HRSG afterburners in service, respectively The NO sub x emissions decreased with water injection by 50% and were unchanged with the turbine wash The NO sub x increased with load DOE

N82-10277# Minnesota Univ., St Paul Underground Space Center

EARTH SHELTER 2 1979-1980 USC SERIES

1980 236 p refs Presented at the Earth Sheltered Housing Conf and Exhibition, Minneapolis, 9-11 Apr 1980, sponsored by the Underground Space Center of the Minnesota Univ and the Am Underground Space Association, and Minnesota Soc Am Inst of Architects, and Minnesota Soc of Professional Eng Sponsored by DOE

(CONF-800438) Avail NTIS HC A11/MF A01

Abstracts are presented of 22 conference papers which discuss criteria for constructing earth-sheltered structures for residential and commercial purposes Aesthetics and the manipulation of form, space, and natural light are examined as well as ionizing radiation levels, legal liabilities in design, construction, and ownership, and the impact of restrictive covenants The locations and energy conservation efficiency of 80 earth-covered structures in Oklahoma are also examined A R H

N82-10334# Massachusetts Inst of Tech., Cambridge Energy Lab

INTEGRATION OF DECENTRALIZED GENERATORS WITH THE ELECTRIC POWER GRID

Susan Finger Apr 1981 193 p refs

(Contract DE-AM01-76EI-02295)

(DE81-029731, MIT-EL-81-011) Avail NTIS HC A09/MF A01

The economic interactions of customer-owned electrical generators with the central electric power grid was studied The reciprocal effects of the operation and expansion plans of the utility, and the resulting price of electricity, and the demand patterns and expansion plans of customers are discussed The system is modeled in an open-loop feedback mode that allows both the utility and the customers to update their plans and expectations for the next time period based on the other's actions in the current time period and based on any new information such as the current time period and based on any new information such as the current price of oil The utility and the customers solve similar operation and expansion problems, except that each has control over different variables DOE

N82-10506*# DHR Inc., Washington, D C
MARKET ASSESSMENT OF PHOTOVOLTAIC POWER SYSTEMS FOR AGRICULTURAL APPLICATIONS IN MEXICO
William Steigelmann and Itil Asmon, (ARD, Inc.) Jul 1981 135 p refs
(Contracts DEN3-180, DE-AI01-79ET-20485)
(NASA-CR-165441, DOE/NASA/0180-3) Avail NTIS HC A07/MF A01 CSCL 10A

The first year of cost-competitiveness, the market potential, and the environment in which PV systems would be marketed and employed were examined Market elements specific to Mexico addressed include (1) useful applications and estimates of the potential market for PV systems, (2) power requirements and load profiles for applications compatible with PV usage, (3) operating and cost characteristics of power systems that compete against PV, (4) national development goals in rural electrification and rural services, technology programs and government policies that influence the demand for PV in Mexico, (5) financing mechanisms and capital available for PV acquisition, (6) channels for distribution, installation and maintenance of PV systems, and (7) appropriate methods for conducting business in Mexico A R H

N82-10514# Massachusetts Inst of Tech., Cambridge
OESYS: A SIMULATION TOOL FOR NONCONVENTIONAL ENERGY APPLICATIONS ANALYSIS. THEORETICAL AND OPERATIONAL DESCRIPTION WITH USER DOCUMENTATION
Thomas L Dinwoodie Aug 1980 190 p refs
(Contract DE-AM01-76EI-02295)
(DE81-029701, MIT-EL-80-022) Avail NTIS HC A09/MF A01

A method is developed for assessing both the operational and economic performance of variable mixes of energy conversion technologies within their specific service environments This method is incorporated into OESYS (Optional Energy Systems Simulator), a computer model with the specific capability to assess conditions of economic viability and service reliability for energy project evaluation The OESYS program is especially well suited to handle stochastic (weather dependent) generation technologies, and simultaneously handles the generation, transfer, and demand of multiple energy quality levels (electricity, high/low grade thermal, liquid/gaseous fuels, etc) The model can be applied to most use sectors, including residential, commercial, industrial, and institutional, or combinations of use sectors A model summary description is given A theoretical description of the types of energy applications handled by OESYS, an operational description of the model, user documentation, and three sample studies are included DOE

N82-10517# Atlanta Univ., Ga Dept of Chemistry
COOPERATIVE PROGRAM OF APPLIED ENERGY RESEARCH TECHNOLOGY DEVELOPMENT Final Technical Report, 1 Oct. 1979 - 31 Dec. 1980
1980 140 p refs Prepared in cooperation with Georgia Inst of Technology, Atlanta
(Contract DE-FG05-79ET-60058)
(DE81-028916, DOE/ET-60058/T1) Avail NTIS HC A07/MF A01

Studies conducted by groups at Atlanta University and the Georgia Institute of Technology Engineering Experiment Station are described These efforts were proposed as exploratory studies in the area of alternative energy technologies as preliminary work leading to a multi-year program of specific developmental efforts Topics chosen were supportive of on-going research programs at the two institutions Work proposed included pertinent literature search, computer modeling, initial choices of systems, and preliminary parametric studies DOE

N82-10544# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst
ENERGY END-USE REQUIREMENTS IN MANUFACTURING, VOLUME 3
F Krawiec, Dilip R Limaye (Synergic Resources Corp.), Steve Isser (Synergic Resources Corp.), Roy Beatty (Synergic Resources Corp.), Glenn Colville (Synergic Resources Corp.), and Karen Lang (Synergic Resources Corp.) Jul 1981 624 p
(Contracts DE-AC02-77CH-00178, EG-77-C-01-4042)
(DE81-027976, SERI/TR-733-790R-Vol-3) Avail. NTIS HC A99/MF A01

Data on the US and state manufacturing subsectors' energy end use requirements disaggregated by 2 and 4 digit SIC and temperature level in 1990 are presented DOE

N82-10551# Science Applications, Inc., La Jolla, Calif
PROGRAMMER'S MANUAL FOR THE DOEHPE (DOE HEAT PUMP EFFICIENCY) PROGRAM
23 Oct 1980 76 p refs
(Contract DE-AC03-79CS-10757)
(DE81-769452, SAI-444-80-533-LJ) Avail NTIS HC A05/MF A01

The computer code DOEHPE, which is used to calculate air source heat pump seasonal and annual performance factors and energy consumption is described The program computes heating season performance factors, seasonal energy efficiency ratios, representative regional annual performance factors, representative regional annual energy consumption and national energy consumption from the standard measurements of heat pump capacity and power input and heat pump descriptive information as input data The calculation for single and dual speed compressor heat pumps and single speed compressor heating only heat pumps are described Representative regional performance factors are computed for each of six major climatic regions shown for the US, and for each of the standard design heating requirements shown. DOE

N82-10552# Oak Ridge National Lab., Tenn Energy Div
ANNUAL CYCLE ENERGY SYSTEM
Robert E Minturn 1981 6 p refs Presented at the Heat Pump Contractors' Program Integration Meeting, Washington, D C, 2-4 Jun 1981
(Contract W-7405-eng-26)
(DE81-024911, CONF-810672-16) Avail NTIS HC A02/MF A01

The annual cycle energy system (ACES) program which incorporates in a practical system the outstanding energy conservation potential that exists when the unidirectional heat pump and the interseasonal storage of energy are combined to provide heating, cooling, and domestic hot water to buildings is described Information on the system, its applicability to different geographic areas, and the methodology for designing and building systems are enumerated It is shown that the system is rugged, reliable, and appreciably more conservative of purchased energy than all practical alternatives An ACES residential design methodology was also developed It is concluded that the system is constant in efficiency and capacity during winter operation, independent of extremes in weather, contributes to the reduction of peak demand and increases in daily and seasonal load factors DOE

N82-10561# Oak Ridge National Lab., Tenn Energy Div
WATER-RELATED CONSTRAINTS TO THE DEVELOPMENT OF GEOTHERMAL ELECTRIC GENERATING STATIONS
R C Robertson, Alf D Shepherd, Carey S Rosemann, and Michael W Mayfield Jun 1981 160 p refs
(Contract W-7405-eng-26)
(DE81-025138, ORNL/TM-7718) Avail NTIS HC A08/MF A01

The water related constraints concerning geothermal energy are discussed Three different constraints are (1) water requirements of geothermal power stations, (2) resource characteristics of the most promising hydrothermal areas and regional and local water supply situations, and (3) legal issues confronting potential users of water at geothermal power plants in the states in which the resource areas are located A total of 25 geothermal resource areas were studied It is found that each had a hydrothermal resource temperature in excess of 150 C and an estimated 30 year potential of greater than 100-MW(e) capacity DOE

N82-10562# Montana Dept of Natural Resources and Conservation, Helena
MONTANA GEOTHERMAL HANDBOOK: A GUIDE TO AGENCIES, REGULATIONS, PERMITS AND FINANCIAL AIDS FOR GEOTHERMAL DEVELOPMENT
Steven Perlmutter and Jeff Birkby 1980 52 p
(Contract DE-FC07-79ID-12014)
(DE81-024315, DOE/ID-12014/T1) Avail NTIS HC A04/MF A01

The handbook is divided into three parts a list of the permits required for various thermal projects, and an estimate of time

needed to obtain them, a brief discussion of the statutes and regulations referred to; and a description of the state and federal grant and loan funding available to a prospective geothermal developer DOE

N82-10572# KA-Planungs G m b H , Heidelberg (West Germany)
PRELIMINARY INVESTIGATION ON A PRIMARY ENERGY SAVING HEAT SUPPLY SYSTEM FOR THE RESIDENTIAL DISTRICT 'MARIA LINDENHOF' IN DORSTEN, WEST GERMANY Final Report
Alfred Bechtel, Klaus Berlinghoff, Hans Grossmann, Helmut Kaschube, and Friedrich Reinmuth Bonn Bundesministerium fuer Forschung und Technologie Dec 1980 126 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-157, ISSN-0340-7608) Avail NTIS HC A06/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 26,50

Ways and means to operate a heating station by gas motor-driven heat pumps, using river water as heat source are investigated The economic viability of the scheme is considered A comparison with conventional technologies clearly shows the feasibility and effectiveness of this application, and at the same time supplies guidelines for design and dimensioning Because of possible energy saving, the present investigation supports the realization of the project Author (ESA)

N82-10573# Renault Vehicles Industriels (France) Direction des Etudes et Recherches
ENERGY CONSUMPTION AND HEAVY-DUTY VEHICLES [LA CONSOMMATION D'ENERGIE ET LES POIDS LOURDS]
Yves Bonnetain 1980 18 p In FRENCH Presented at S I A Journees Poids Lourds, Paris, 8-9 Oct 1980
Avail NTIS HC A02/MF A01

Research and analysis which leads to energy conservation in the operation of tractor-trailers (semis) was reviewed Two approaches are emphasized design improvements on the vehicle itself, and policies or dashboard instrumentation which result in a more efficient use of the vehicle Evidence is presented to show that immediate and significant reductions in fuel consumption are possible merely by instigating more efficient driving practices, e g , speed laws, governors on engines, etc
Author (ESA)

N82-10583 Texas Univ at Dallas
OIL AND GAS INDUSTRY AND ENVIRONMENTAL POLLUTION: APPLICATION OF SYSTEMS RELIABILITY ANALYSIS FOR THE EVALUATION OF THE STATUS OF ENVIRONMENTAL POLLUTION CONTROL IN THE NIGERIAN PETROLEUM INDUSTRY Ph.D. Thesis
Azhinoto Ozodio Ikpah 1981 377 p
Avail Univ Microfilms Order No 8118224

Current environmental pollution control policies, regulations, oil field management practices and programs for detection, inventory, prevention and control of oil spills/pollution in Nigeria were examined The status of pollution control in the Nigerian petroleum industry was evaluated Spill event data which were analyzed based on shore, category systems, cause/effect relationip, clean-up method, violation and other parameters pertinent to pollution control in the oil industry Spill data indicated that frequency of spill events is high, dispersant is indiscriminately used, more spills occur onshore, water disposal method is poor, and equipment failure, operators' maintenance error and third party account for a large number of spills Pipes, valves and gaskets are spill vulnerable components, and the product spilled is generally crude oil Few spill events were considered violations of federal laws Standard engineering designs and criteria are employed in production of oil in Nigeria, but the level of investments on strictly pollution control equipments and personnel is minimal It is concluded that legal and institutional arrangement for pollution control in the Nigerian petroleum industry need modification and updating Dissert Abstr

N82-10585# Oak Ridge National Lab , Tenn Fossil Energy Information Center
ENVIRONMENTAL COMPLIANCE PROGRAM HANDBOOK
Aug 1981 332 p
(Contract W-7405-eng-26)
(DE81-030226, ORNL/EIS-171) Avail NTIS HC A15/MF A01

Only by demonstrating that energy technologies can be built and operated without adverse environmental impact can these technologies be considered as proven and ready for commercialization by the private sector This handbook is one of a series covering federal laws and regulations and the laws and regulations of selected states that pertain to air quality, water quality, and the identification and disposal of solid and hazardous wastes The data summary sheets are part of a computer file This handbook identifies and provides abstracts to those pertinent laws and regulations which were in force in the State of Ohio in early 1980 The permit forms are those in use during that time frame T M

N82-10586# Michigan Univ , Ann Arbor Dept of Aerospace Engineering
STUDY OF THE FORMATION OF SUBMICRON PARTICULATES GENERATED BY COAL COMBUSTION Quarterly Progress Report, 1 Apr. - 30 Jun 1981
P M Sherman and D R Glass Jul 1981 28 p refs
(Contract DE-FG22-80PC-30305)
(DE81-027447, DOE/PC-30305/T3, QPR-3) Avail NTIS HC A03/MF A01

The formation of the very small particles was investigated so that combustion and heat transfer conditions which will prevent their formulation can be identified Emphasis was largely on perfecting techniques for obtaining electron microscope data which can be correlated with variations in heat transfer and combustion parameters Improvements include better sealing of the furnace tube provision for measurement of the entire flow field downstream of the flame, better control of the exhaust stream, better control of the coal dust feeder, and better control of the temperature of the secondary air Program focus on particles in the 50 A to 0 1 micron range These were largely overlooked in the past because they are difficult to detect T M

N82-10590# Argonne National Lab , Ill
STUDIES OF THE REGENERATION OF ACTIVATED BAUXITE USED AS GRANULAR SORBENT FOR THE CONTROL OF ALKALI VAPORS FROM HOT FLUE GAS OF COAL COMBUSTION
S H D Lee, S D Smith, W M Swift, and Irving Johnson May 1981 51 p refs
(Contract W-31-109-eng-38)
(DE81-030192, ANL/CEN/FE-81-1) Avail NTIS HC A04/MF A01

Regeneration of activated bauxite by water leaching and thermal swing method was studied It was found that granular activated bauxite was very effective when used as a filter medium in granular bed filters to remove gaseous alkali metal compounds from simulated hot flue gas of PFBC Activated bauxite that captured alkali chloride vapors easily and effectively regenerated for reuse by a simple water leaching method Data were obtained on (1) the leaching rate of the absorbed NaCl (2) effects on the leaching rate of absorbed NaCl loading, leaching temperature, and the amount of water, and (3) water retention in activated bauxite after leaching Physical changes and particle attrition of activated bauxite resulting from regeneration are discussed The sorption mechanisms of activated bauxite toward alkali chloride vapors are interpreted DOE

N82-10591# Edgerton, Germeshausen and Grier, Inc , Idaho Falls, Idaho
INEL GOETHERMAL ENVIRONMENTAL PROGRAM Annual Report, 1980
L S Cahn, T L Thurow, and J A Martinez Apr 1981 73 p refs
(Contract DE-AC07-76ID-01570)
(DE81-025671, EGG-2113) Avail NTIS HC A04/MF A01

An overview of continuing environmental research and monitoring programs conducted at the Raft River Geothermal Site is provided The monitoring programs are designed to collect data on the physical, biological and human environments of the development area Primary research during 1980 emphasized completing baseline studies on terrestrial fauna, establishing an air quality monitoring network, investigating potential sources of fluoride in the Raft River valley, and studying water level changes in the shallow monitor wells in response to development of the geothermal resource. DOE

N82-10592# Colorado State Univ , Fort Collins Dept of Atmospheric Science

EFFECTS OF ATMOSPHERIC VARIABILITY ON ENERGY UTILIZATION AND CONSERVATION Progress Report, 1 Jan. - 30 Jun. 1981

Elmar R Reiter, C C Burns, H Cochrane, G R Johnson, H Leong, and J D Sheaffer Jul 1981 99 p refs
(Contract DE-AS02-76EV-01340)
(DE81-026308, DOE/EV-01340/1) Avail NTIS HC A05/MF A01

The research was focused on four major tasks planetary wave variability and climate fluctuations, regional energy demand modelling, energy demand modelling for air conditioning, and economic factors in climate-sensitive space-conditioning systems design Efforts in each of these areas are outlined and described in detail Predicting the impact of climate variability on energy utilization involves understanding both the mechanisms underlying atmospheric variability and the response of energy demand systems to atmospheric variations Summary descriptions of significant progress in both areas are presented DOE

N82-10594# Hart (Fred C) Associates, Inc, New York, N Y
METHODOLOGY FOR DETERMINING THE IMPACT OF ENVIRONMENTAL REGULATORY PROGRAMS Final Report

B T Delaney, D D Roderique, and T S Sekulic May 1981 165 p refs Sponsored by Electric Power Research Inst
(DE81-903429, EPRI-CS-1834, TPS-79-743) Avail NTIS HC A08/MF A01

Major federal environmental legislation and regulatory programs affecting the management of air, water, land and solid waste were reviewed Existing and future environmental regulatory programs and their potential impact on the development and commercialization of advanced, coal-based energy conversion systems are examined It is determined that the analysis and interpretation of technical information and data collected can be directed towards the development of a methodology by which environmental impacts are systematically reviewed and problem areas identified DOE

N82-10598# Argonne National Lab, Ill
ECONOMIC AND ENVIRONMENTAL TRADEOFFS IN COAL CONVERSION

C D Livengood, H S Huang, and P S Farber 1980 20 p refs Presented at the Ann Meeting of the Air Pollution Control Assoc, Montreal, 22-27 Jun 1980
(Contract W-31-109-eng-38)
(CONF-800608-8) Avail NTIS HC A02/MF A01

The costs of environmental control systems and the difficulties of solid waste disposal are discussed Unless significant cost breakthroughs are achieved, SRC-1 does not appear economically competitive for new large power plants The use of SRC is favored in plants converting from oil The recent increased interest in reducing emissions from existing coal fired plants as a control measure for acid rain could open up a significant new market for highly processed coal such as SRC-1 DOE

N82-10599# ECP, Inc, El Segundo, Calif
CRYSTALLIZED FLY-ASH FEASIBILITY STUDY Final Report

May 1981 78 p refs Sponsored in part by Electric Power Research Inst
(EPRI Proj 1210-1)
(EPRI-EL-1836) Avail NTIS HC A05/MF A01

A study to determine the feasibility for production and use of crystallized fly ash is presented The raw materials (fly ash, fluxing, nucleating and crystallizing agents), molten state and crystallization analysis and characterization of crystallized fly ash are discussed in detail The development of the process along with the structural and insulation characteristics of the crystallized fly ash as a mechanical support element for electrical conductors are also described in detail DOE

N82-10601# Harvard Univ, Cambridge, Mass School of Government
RELAXING ENVIRONMENTAL STANDARDS DURING OIL-SUPPLY DISRUPTIONS. PAST, PRESENT AND FUTURE M.A. Thesis

Thomas Hansen Birdsall 13 Apr 1981 132 p refs
(Contract DE-AC01-80PE-70278)
(DE81-024250, DOE/PE-70278/T15) Avail NTIS HC A01/MF A01

Relaxation of environmental standards during oil supply disruptions were examined The following two policy questions are addressed (1) should environmental standards such as sulfur emissions limitations be relaxed during oil supply disruptions, and (2) if relaxing a particular standard appears desirable, when, where and how should it be relaxed It is argued that disruptions could suddenly result in marginal pollution abatement costs much greater than the benefits from, or demand for, the marginal improvement in air quality from such abatement, justifying temporary variances A set of criteria for evaluating variance policies are developed on the basis of both the theoretical rationale for variances and institutional or implementation considerations Present federal variance policy are described and the criteria are used to evaluate current policy DOE

N82-10605# Harvard Univ, Cambridge, Mass School of Government
CASE STUDIES IN THE APPLICATION OF AIR QUALITY MODELLING IN ENVIRONMENTAL DECISION MAKING: SUMMARY AND RECOMMENDATIONS

Catherine G Miller May 1981 92 p refs
(Grant EPA-R-805558-01)
(PB81-213233, EPA-600/4-01-034) Avail NTIS HC A05/MF A01 CSCL 13B

The application of air quality models to examine the problems encountered when trying to use these models in makin environmental policy decisions was undertaken It is shown that technical and political constraints exist but that unresolved policy issues, the management of the decision process and conflicting institutional and organizational interests also cause problems Reommendations are made on how to improve the technical planning and management of the decision process so that the air quality models can become a better policy tool within the state of the art, political and organizational constraints GRA

N82-10608# Geological Survey, Champaign, Ill
COAL FLY ASH: A REVIEW OF THE LITERATURE AND PROPOSED CLASSIFICATION SYSTEM WITH EMPHASIS ON ENVIRONMENTAL IMPACTS

William R Roy, Richard G Thiery (Illinois State Natural History Survey), Rudolph M Schuller, and John J Suloway (Illinois State Natural History Survey) Apr 1981 75 p refs
(PB81-215014, IL/SGS/EGN-96) Avail NTIS HC A04/MF A01 CSCL 13B

The scientific literature on fly ash generated by coal burning power plants cites is reported General conclusions are formulated, on the basis of data compiled from this review, on the physiochemical characteristics of the solid waste and the possible environmental impacts of its disposal GRA

N82-10717# Department of Agriculture, Washington, D C National Economics Div
ENERGY EXPENDITURE AND DIETARY CHANGE

Larry G Traub and Thomas A Stucker May 1981 27 p refs
(PB81-218471 AGESS-810512) Avail NTIS HC A03/MF A01 CSCL 10A

Comparative expenditures for food and costs of energy in the food system under alternative diets was studied The types of diet analyzed are the current average diet consumed, and a diet consistent with specifications of the dietary guidelines It is shown that the greatest savings under a diet altered to conform with the dietary guidelines is in electrical generation, and the least energy savings in refined petroleum use GRA

N82-11175# Coordinating Research Council, Inc, Atlanta, Ga
INFORMATIONAL REPORT ON THE MEASUREMENT AND CHARACTERIZATION OF DIESEL EXHAUST EMISSIONS

J M Perez, F J Hills, D Schuetzle, and R L Williams Dec 1980 286 p refs
(PB81-221251 CRC-APRAC-CAPI-1-64-517) Avail NTIS HC A13/MF A01 CSCL 07D

Guidance on selection of methods for collection and analysis of the constituents in diesel exhaust to enable a complete chemical characterization of the exhaust is provided A thorough review of the state of the art for measuring diesel emissions was prepared Methods were compiled and their engineering applicability was evaluated Available methods were reviewed to establish the state of the art In some cases, sufficient documentation for the use of the method was available in the literature In other cases, cooperative round-robin testing of the method was conducted

and these findings are reported The methods allow complete assessment of the constituents that are of current interest in diesel exhaust GRA

N82-11233# Bechtel Corp , San Francisco, Calif
ALTERNATIVE FUEL FOR THE STEEL INDUSTRY OF NORTHERN INDIANA: A PREFEASIBILITY STUDY OF A CENTRAL COAL GASIFICATION PROJECT
May 1981 275 p refs Sponsored in part by Northern Indiana Public Service Co
(Contract DE-FG01-80RA-50146)
(DE81-029314, DOE/RA-50146/1) Avail NTIS HC A12/MF A01

A survey of the demand for natural gas indicates a wide variation, from a low of 220 billion Btu per day to a high of 387 billion Btu per day After an examination of the market demand, it was concluded that the synthetic fuels plant should be sized to produce 120 billion Btu per day of gas Due to the costs of installing additional gas distribution systems and modifying fuel burning equipment, it was concluded that a medium Btu gas should be produced that would have special properties to meet the requirements of existing equipment The Lurgi and Texaco gasification processes were chosen as the basis for the study The most significant environmental constraint will be air quality Although the use of either process is feasible, NIPSCO selected the Texaco case for the development of the economics A cash flow analysis indicates that the price of medium Btu gas required to yield a 15 percent DCF return on equity is $5 67 per million Btu in 1981 dollars This is approximately equal to the current price of imported oil It is based on a 20 year financial analysis using a 3 1 debt to equity ratio and assumes an annual escalation in cost and gas price of 10 percent DOE

N82-11239# TRW, Inc , Redondo Beach, Calif
LABORATORY STUDY FOR REMOVAL OF ORGANIC SULFUR FROM COAL Final Report
1 Jul 1981 210 p refs
(Contract DE-AC22-80PC-30141)
(DE81-025132, DOE/PC-30141/T4) Avail NTIS HC A10/MF A01

A description of laboratory experimental equipment and a detailed discussion of the results is presented Initial and concluding engineering design and cost estimations are also presented and the last two sections contain recommendations for future work and an appendix of laboratory data The TRW Gravimelt Process involves the treatment of mine-cleaned coal with molten potassium and or sodium hydroxide to chemically extract both organic and pyritic sulfur into the molten alkali The coal mineral content is broken down to forms insoluble in water but soluble in a second liquid, usually dilute sulfuric acid The high density of the melt causes the desulfurized coal to float to the surface, where it is skimmed off The coal is then washed with water to completely recover the alkali metal and the coal is dried If the coal is next washed with a second liquid, almost all of the mineral matter is extracted into the solution DOE

N82-11245# Aerospace Corp , Los Angeles, Calif
NEAR-TERM GOALS FOR ALCOHOL FUELS FROM BIOMASS. AN OVERVIEW OF RESOURCE REQUIREMENTS, LAND USE, ENVIRONMENTAL, AND SOCIOECONOMIC IMPACTS
J Halsey, D Hazard, K Kawaoka, K Stephens, and G DAlessio (DOE) Argonne, Ill Argonne Natl Lab Dec 1980 111 p refs
(Contract W-31-109-eng-38)
(DE81-029987, ANL/EES-TM-149) Avail NTIS HC A06/MF A01

The biomass resources needed to meet national alcohol production goals are examined, available technologies for utilizing agricultural products and byproducts are reviewed, and potential environmental and socioeconomic impacts of near-term alcohol production are identified Near-term (1985 to 1986) land resource requirements and impacts are emphasized with particular attention to the major corn producing states Results indicate that (1) the grain availability for ethanol production does not appear to be limiting for these near-term production capacity goals; (2) major expansion of acreage planted in corn should not result from these goals, (3) environmental impacts on and from farm lands should not increase significantly, (4) food prices may increase due to the near-term goals, but farmers should benefit overall, and (5) the expansion of alcohol production in the longer term (1986 to 2000 and beyond) will necessitate the use of additional biomass feedstocks and residues DOE

N82-11249# International Science and Technology Inst , Inc , Washington, D C
ASSESSMENT OF OIL-SHALE TECHNOLOGY IN BRAZIL Final Technical Report, 27 Oct. 1980 - 27 Jul. 1981
27 Jul 1981 143 p refs
(Contract DE-AC01-80ER-30010)
(DE81-027574, DOE/ER-30010/1) Avail NTIS HC A07/MF A01

This assessment investigates whether US oil shale developers might benefit from the experience gained by the Brazilians in the operation of their Usina Prototipo do Irati oil shale demonstration plant at Sao Mateus do Sul, and from the data generated from their oil shale research and development programs A chapter providing background information on Brazil and the Brazilian oil shale deposits is followed by an examination of the potential recovery processes applicable to Brazilian oil shale The evolution of the Brazilian retorting system is reviewed and compared with the mining and retorting proposed for US shales Factors impacting on the economics of shale oil production in Brazil are reviewed and compared to economic analyses of oil shale production in the US Chapters examining the consequences of shale development in terms of impact on the physical environment and the oil shale worker complete the report DOE

N82-11252# Department of Energy, Oak Ridge, Tenn
SOLVENT-REFINED COAL-1 DEMONSTRATION PROJECT. FINAL ENVIRONMENTAL IMPACT STATEMENT, VOLUME 1 OF 2 Final Report
Jul 1981 700 p refs
(DE81-025983, DOE/EIS-0073-Vol-1) Avail NTIS HC A99/MF A01

The potential environmental impacts associated with the construction and operation of a 6000-tpsd-capacity coal liquefaction facility at Newman, Kentucky which will demonstrate the technical operability, economic viability, and environmental acceptability of an SRC-I process are assessed Impacts assessed include the following effects of the project on occupational and public health resulting from the production and use of SRC products, potential impacts on terrestrial and aquatic ecology, potential and expected impacts on land use, withdrawal and alteration of prime agricultural land, projected effects on flood-plain and wetland areas, potential impacts on surface water and groundwater, potential impacts on ambient air quality, potential change of the cultural landscape, potential impacts on sites of archaeological significance, and changes to existing economic and social characteristics of the site area Long-range and cumulative impacts of a future commercial expansion of the proposed facility at the proposed site to an approximately 30,000-tpsd capacity are also addressed A construction and operational monitoring plan to assess the effectiveness of the planned mitigatory measures for the duration of the demonstration phase is presented DOE

N82-11263# California Univ , Livermore Lawrence Livermore Lab
POSSIBLE USE OF COAL IN HAWAII, 1980 - 2000
R B Bell 12 Feb 1981 52 p refs
(Contract W-7405-eng-48)
(DE81-028266, UCRL-53121) Avail NTIS HC A04/MF A01

The possibilities for the use of coal in the State of Hawaii are explored The nature of the Hawaiian energy sector the possible role coal could play in that sector, and some of the costs and consequences of introducing coal into the State are addressed The technical issues connected with coal use are presented DOE

N82-11265# Edgerton, Germeshausen and Grier, Inc , Idaho Falls, Idaho
ALCOHOL FUELS IN THE UNITED STATES
R R Stiger 1981 12 p refs Presented at tht Am Nucl Soc. Ann. Meeting, Miami Beach, Fla , 7 Jun 1981
(Contract DE-AC07-76ID-01570)
(DE81-026013, CONF-810606-75) Avail NTIS HC A02/MF A01

An overview of the social and technical issues surrounding the production of alcohol for fuels is presented A brief analysis of the United States Alcohol Program is followed by a discussion of technical and economic factors that affect the production of alcohol fuels DOE

N82-11270# Water Resources Council, Washington, D C
COAL LIQUEFACTION DEMONSTRATION PLANT NEAR MORGANTOWN, WEST VIRGINIA: WATER ASSESSMENT REPORT Summary Report
21 Aug 1980 14 p refs Prepared in cooperation with Ohio River Basin Commission
(PB81-216103) Avail NTIS HC A02/MF A01 CSCL 08H

A preliminary assessment of the commercial project as currently planned is presented Topics covered include the need for water management policies for the Ohio River Basin to regulate water distribution, as well as a pollution monitoring system GRA

N82-11273# Research Triangle Inst, Research Triangle Park, N C
COAL GASIFIER PARAMETERS INFLUENCING ENVIRONMENTAL POLLUTANT PRODUCTION
D A Green, J G Cleland, D P Daugherty, W J McMichael, F O Mixon, and R S Truesdale Jun 1981 95 p refs
(Grant EPA-R-804979)
(PB81-221301, RTI/1934/00-03F, EPA-600/7-81-098) Avail NTIS HC A05/MF A01 CSCL 21D

A series of fixed-bed coal gasification and pyrolysis tests were performed in a laboratory scale reactor of 6 6 cm inside diameter Chemical analyses were conducted on the product gas, the aqueous condensate, the tar, and the solid residue from the tests The effects of process variables, such as feed mode, catalytic treatment, pressure, mesh size, and coal type, upon byproduct and pollutant yields are described The production of gaseous sulfur compounds, benezene and derivatives (BTX), phenolics (phenol, cresols, and xylenols), and tar were measured, and the fate of trace elements such as arsenic, selenium, and lead were determined Byproduct production associated with the pyrolysis phase of gasification was investigated with emphasis on the effects of particle size, residence time, and atmosphere Continuous operation was found to result in greatly reduced tar and phenolic production GRA

N82-11274# TRW, Inc, McLean, Va Energy Systems Group
ENVIRONMENTAL RESEARCH PLAN FOR GAS SUPPLY TECHNOLOGIES VOLUME 2: ENVIRONMENTAL RESEARCH PLAN Final Report
L M Tipton 29 May 1981 168 p refs 2 Vol
(Contract GR1-5080-351-0316)
(PB81-222317, GRI-80/0013 2) Avail NTIS HC A08/MF A01 CSCL 21D

Federal environmental regulations affecting gas supply technologies are reviewed The technological and environmental state of the art of each gas supply technology was analyzed with the help of a series of experts, in gas supply technology Based on regulatory requirements technology status, and current environmental knowledge, the environmental issues associated with each technology area were identified Environmental research being performed by government, industry and educational institutions was identified by computerized literature search and reviewed applicability recommended research activities for GRI funding were developed and a suitable prioritization methodology was devised GRA

N82-11275# Cornell Univ, Ithaca, N Y
ETHANOL PRODUCTION IN SOUTHERN TIER EAST REGION OF NEW YORK. TECHNICAL AND ECONOMIC FEASIBILITY Final Report
Robert J Kalter Mar 1981 348 p refs Sponsored by New York State Energy Research and Development Authority
(PB81-226979, Rept-81-7, NYSERDA-81-7) Avail NTIS HC A15/MF A01 CSCL 07A

This is the third of five region-specific feasibility studies on regional production of ethanol It was found that deproteinized whey resources in this region of New York could support ethanol production in amounts ranging from about 1 5 million to 5 million gallons a year while also producing a high-protein, high-mineral animal feed Ethanol is an octane booster which can be used as a gasoline extender to produce gashol GRA

N82-11276# Missouri River Basin Commission, Omaha, Nebr
SYNTHETIC FUEL DEVELOPMENT FOR THE UPPER MISSOURI RIVER BASIN. SECTION 13. WATER ASSESSMENT REPORT
Apr 1981 129 p refs Sponsored in part by the Water Resources Council
(PB81-224537) Avail NTIS HC A07/MF A01 CSCL 21D

The results of an assessment of water requirements, water supply availability and other water implication of synthetic fuel development in the Upper Missouri River Basin are summarized The availability of water to support certain hypothetical levels of synfuel development for three types of coal conversion technologies is determined The major effects that synfuel development could have on the water resources of the region are identified GRA

N82-11310*# Jet Propulsion Lab, California Inst of Tech, Pasadena
AN OPTIMIZATION MODEL FOR ENERGY GENERATION AND DISTRIBUTION IN A DYNAMIC FACILITY **c81**
F L Lansing *In its* The Telecommun and Data Acquisition Rept 15 Oct 1981 p 206-222 refs

Avail NTIS HC A11/MF A01 CSCL 05A

An analytical model is described using linear programming for the optimum generation and distribution of energy demands among competing energy resources and different economic criteria The model, which will be used as a general engineering tool in the analysis of the Deep Space Network ground facility, considers several essential decisions for better design and operation The decisions sought for the particular energy application include the optimum time to build an assembly of elements, inclusion of a storage medium of some type, and the size or capacity of the elements that will minimize the total life-cycle cost over a given number of years The model, which is structured in multiple time divisions, employ the decomposition principle for large-size matrices, the branch-and-bound method in mixed-integer programming, and the revised simplex technique for efficient and economic computer use T M

N82-11317# Argonne National Lab, Ill
SITE AND NEIGHBORHOOD DESIGN (SAND)i DEVELOPMENT OF SIMPLIFIED AUTOMATED BUILDING THERMAL LOAD PROCEDURES, PHASE 1
G T Diderrich and R A Hrabak Jul 1980 116 p refs
(Contract W-31-109-eng-38)
(DE81-027138, ANL/CNSV-TM-68) Avail NTIS HC A06/MF A01

Preliminary efforts toward the development of simplified procedures for estimating the thermal-loads of buildings are presented The acquisition implementation, and documentation of the thermal load procedures and associated data files actually used by the five SAND participants are described DOE

N82-11318# American Society of Heating, Refrigerating and Air-Conditioning Engineers, New York Subcommittee for Simplified Energy Analysis
ENERGY ANALYSIS SAMPLE BUILDING DATA
Mar 1981 34 p refs
(Contract DE-AC01-78CS-20057)
(DE81-027188, DOE/CS-20057/T5) Avail NTIS HC A03/MF A01

Sample building data for energy calculations necessary for the comparative analysis between the proposed energy calculation procedure and the procedures using comprehensive hourly simulation of HVAC systems are presented The comparison calculation includes data for the terminal reheat system, double-duct system, heat reclaim system, and standard VAV system for a hypothetical 20-story office building in Washington, DC Each is evaluated in conjunction with electric centrifugal chiller and gas-fired boiler DOE

N82-11320# Battelle Pacific Northwest Labs, Richland, Wash
SAMPLING DESIGN FOR THE 1980 COMMERCIAL AND MULTIFAMILY RESIDENTIAL BUILDING SURVEY
W M Bowen, A R Olsen, and A L Nieves Jun 1981 98 p
(Contract DE-AC06-76RL-01830)
(DE81-028783, PNL-3883) Avail NTIS HC A05/MF A01

The extent to which new building design practices comply with the proposed 1980 energy budget levels for commercial and multifamily residential building designs (DEB-80) can be assessed by (1) identifying small number of building types which account for the majority of commercial buildings constructed in the U S A (2) conducting a separate survey for each building type and (3) including only buildings designed during 1980 For each building, the design energy consumption (DEC-80) will be determined by the DOE2 1 computer program The quantity X = (DEC-80 - DEB-80) These X quantities can then be used to compute sample statistics Inferences about nationwide compliance with DEB-80 may then be made for each building type Details of the population, sampling frame, stratification, sample size and implementation of the sampling plan are provided DOE

N82-11321# DCS Corp Washington, D C
ASSESSMENT OF BUILDING DIAGNOSTICS
George E Courville Jul 1981 118 p refs Prepared for ORNL
(Contract W-7405-eng-26)
(DE81-027078, ORNL/Sub-80/61602/1) Avail NTIS HC A06/MF A01

The building diagnostics requirements for in-situ or field measurements on energy consumption in conditioned spaces and on heat gain and loss in residential and nonresidential buildings are evaluated Energy audit programs, energy performance monitoring, energy flow in buildings, and use of computer technology are considered A diagnostics program is outlined DOE

N82-11323# National Bureau of Standards, Washington, D C
ENERGY ANALYSIS FOR A SAMPLE BUILDING BY THE PROPOSED ASHRAE SIMPLIFIED METHOD
T Kasuda and K Ishii Jan 1981 265 p
(Contract DE-AC01-78CS-20057)
(DE81-027189 DOE/CS-20057/T4) Avail NTIS HC A12/MF A01

An energy analysis of a sample office building located in Washington, DC using the proposed ASHRAE method is presented Calculations for space load are presented The calculations for the energy distribution systems (air conditioning, outdoor air control, humidity control, airduct systems) are given Equipment system calculations, and calculations for the annual energy consumption for air conditioning are presented DOE

N82-11376# Department of Energy, Washington, D C
ELECTRIC POWER SUPPLY AND DEMAND FOR THE CONTIGUOUS UNITED STATES, 1981 - 1990
Jul 1981 584 p refs
(DE81-027126, DOE/EP-0022) Avail NTIS HC A25/MF A01

The outlook for electric power supply and demand in the United States decade 1981 to 1990 is reviewed from the perspective of reliability and adequacy of service Electric power supply adequacy as projected for the nine Regional Reliability Council areas of the contiguous United States is reported as well as interruptible load data reported by the Councils Coeneration is discussed Each of the 27 electric regions (sub-areas of the nine Council areas) in the contiguous US are studied A glossary of terms is given Appendices describe the Council structure, and include a copy of the ERA-411 Manual, which contains all the items to which the Councils were asked to respond The utilities with included data, the Staff Report, Estimated Electric Demand and Supply for Summer 1981, Contiguous United States dated May 1981 are included DOE

N82-11414# Brookhaven National Lab, Upton, N Y Energy Storage and Conversion Div
CHEMICAL HEAT PUMP PROGRAM: AN OVERVIEW
Alessio Mezzina 1981 5 p Presented at the Heat Pump Contractors' Program Integration Meeting, McLean, Va, 2-4 Jun 1981
(Contract DE-AC02-76CH-00016)
(DE81-025086, BNL-29592, CONF-810672-22) Avail NTIS HC A02/MF A01

Chemical heat pumps comprise reversible reactions which can be driven by low grade heat Thermal energy is absorbed in one direction and liberated in the reverse direction, thus, serving as a basis for system designs applicable to space conditioning or process heat management and offering the capability for high density energy storage as an integral part of the system The program background, rationale, technology, and research and development needs are described DOE

N82-11418# E-Tech, Inc, Atlanta, Ga
INVESTIGATION OF DIRECT EXPANSION IN GROUND SOURCE HEAT PUMPS
Mark D Kalman 1981 6 p refs Presented at the DOE Heat Pump Contractors' Program Integration Meeting, McLean, Va, 2-4 Jun 1981 Submitted for publication
(Contract W-7405-eng-26)
(DE81-024139, CONF-810672-5) Avail NTIS HC A02/MF A01

A fully instrumented subscale ground coupled heat pump system was developed, and built, and used to test and obtain data on three different earth heat exchanger configurations under heating conditions (ground cooling) Various refrigerant flow control and compressor protection devices were tested for their applicability to the direct expansion system Undistributed Earth temperature data were acquired at various depths The problem of oil return at low evaporator temperatures and low refrigerant velocities was addressed An analysis was performed to theoretically determine what evaporator temperature can be expected with an isolated ground pipe configuration with given length, pipe size, soil conditions and constant heat load Technical accomplishments to data are summarized DOE

N82-11419# Pittsburg Univ, Pa Dept of Mechanical Engineering
WELL-WATER-SOURCE HEAT PUMP FIELD PERFORMANCE STUDY
R S Dougall 1981 5 p refs Presented at the DOE Heat Pump Contractors' Program Integration Meeting, McLean, Va, 2-4 Jun 1981 Submitted for publication
(Contract W-7405-eng-26)
(DE81-024136, CONF-810672-7) Avail NTIS HC A02/MF A01

Two well-water source heat pumps (WWSHPs) were instaled in two single-family residences in rural south-central Pennsylvania to supply heating in the winter and cooling during the summer The heat pump installations are being instrumented with an automated data gathering system for evaluating the performance of the systems The instrumentation and data acquisition system design was completed and a preliminary design of the control logic and data reduction software for the minicomputer to be located at the sites was obtained DOE

N82-11477# Environmental Protection Agency, Ann Arbor, Mich Standards Development and Support Branch
AN EVALUATION OF THREE-WAY CONTROL SINGLE AND DUAL BED CATALYSTS AS APPLIED TO HEAVY-DUTY GASOLINE ENGINES
Thomas Nugent Apr 1981 30 p refs
(PB81-224982, EPA-AA-SDSB-81-4) Avail NTIS HC A03/MF A01 CSCL 21G

A test program to evaluate the applicability of three-way control (TWC) and dual-bed catalysts (TWC and Oxidation Catalysts) in combination with a closed-loop control stoichiometric (feedback) carburetor on a production 1978 IHC 404 CID heavy duty gasoline engine was conducted Testing was conducted according to the Federal test procedure for the heavy-duty transient cycle The test program consisted of forty-six cold-start tests, fifty-eight confimatory hot-start tests run to insure accuracy and precision of the cold-start tests, and fourteen hot-start tests run to identify the effects of air/fuel ratio control points on NOx emissions The effects of various combinations of catalysts, EGR, air/fuel control points, carburetor response times and air pump capacity on emissions, fuel economy and engine power were examined GRA

N82-11479# Environmental Protection Agency, Ann Arbor, Mich Office of Mobile Source Air Pollution Control
EPA EVALUATION OF THE FUEL-MAX DEVICE UNDER SECTION 511 OF THE MOTOR VEHICLE INFORMATION AND COST SAVINGS ACT
Edward Anthony Barth Jun 1981 140 p
(PB81-229866, EPA-AA-TEB-511-81-10A, EPA-AA-TEB-511-81-10B) Avail NTIS HC A07/MF A01 CSCL 13F

The 'FUEL-MAX' device is an air bleed device that replaces the EGR valve It is claimed to conserve fuel The purpose of the EGR system is to control oxides of nitrogen (NOx) Removal of the EGR valve to install the 'FUEL-MAX' disables the EGR system and would be expected to result in a large increase in NOx emissions Test data submitted by the applicant confirmed this prediction as well as indicating that 'FUEL-MAX' might improve fuel economy Although the data did no adequately quatify the amount of this improvement, EPA chose to conduct confirmatory testing GRA

N82-11480# Environmental Protection Agency, Ann Arbor, Mich Test and Evaluation Branch

EPA EVALUATION OF THE AUTOMOTIVE CYLINDER DEACTIVATOR SYSTEM (ACDS) UNDER SECTION 511 OF THE MOTOR VEHICLE INFORMATION AND COST SAVING ACT

Edward Anthony Barth May 1981 99 p
(PB81-228256, EPA-AA-TEB-511-81-7) Avail NTIS HC A05/MF A01 CSCL 13F

The conclusions of the evaluation of the automotive cylinder deactivator sytem device under provisions of Section 511 of the Motor Vehicle Information and Cost Savings Act are announced This device is designed to deactivate engine cylinders as a means of increasing a vehicle's fuel economy GRA

N82-11524# Water Resources Council, Washington, D C

GREAT PLAINS GASIFICATION PROJECT, MERCER COUNTY, NORTH DAKOTA; WATER ASSESSMENT REPORT SECTION 13(C)

Dec 1980 46 p refs Prepared in cooperation with Missouri River Basin Study Group
(PB81-216111) Avail NTIS HC A03/MF A01 CSCL 08H

The features and location of a project to produce synthetic fuels from a coal gasification plant are described as well as the design of the plant and the support activities, such as mining and reclamation The availability of the water supply is discussed including competing uses and water rights The impacts of plant operations on water quantity and quality are assessed for the Missouri and Knife Rivers and for ground water levels Changes to wetlands are also considered GRA

N82-11525# Water Resources Council, Washington, D C

GREAT PLAINS GASIFICATION PROJECT, MERCER COUNTY, NORTH DAKOTA; WATER ASSESSMENT REPORT

4 Aug 1980 14 p refs Prepared in cooperation with Missouri River Basin Study Group
(PB81-216129) Avail NTIS HC A02/MF A01 CSCL 08H

A water assessment of synfuels development in the Upper Missouri River Basin was conducted Findings assessment show that water supplies are physically available within the mainstream of the Missouri River in North Dakota to supply the requirements of the gasifiction facilities and the supporting activities -- mining and reclamation, electricity, and project-induced population increases GRA

N82-11535# Applied Physics Lab, Johns Hopkins Univ, Laurel, Md

ENERGY PROGRAMS AT THE JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY Quarterly Progress Report, Jan. - Mar. 1981

R vonBriesen, J E Tillman, F C Paddison, C S Leffel, Jr, and S Kane Apr 1981 44 p refs
(Contracts DOE-EX-76-A-36-1008, DE-A101-79ET-27025)
(PB81-218141, JHU/APL/EQR/81-1) Avail NTIS HC A03/MF A01 CSCL 08G

The laboratory is engaged in developing energy resources, utilization concepts, and monitoring and storage methods The report is divided into three sections The first, geothermal energy development planning and technical assistance, contains reports on the progress of geothermal related tasks on which effort was concentrated during the quarter The second section, siting of critical facilities, contains reports on geologic investigations in western Connecticut and areas in adjacent New york, development of seismotectonic domains, and fracture permeability in siting hazardous waste repositories The third section, energy conservation and storage techniques, reports on institutional barriers to landfill methane recovery and the need for state legislation T M

N82-11574# Oak Ridge National Lab, Tenn Health and Safety Research Div

ENERGY ANALYSIS OF HUMAN ECOSYSTEMS IN AN APPALACHIAN COAL COUNTY

A P Watson 1980 31 p refs Presented at the Intern Symp on the Human Side of Energy, Laramie, Wyo, 7-9 Jul 1981
(Contract W-7405-eng-26)
(DE81-025177, CONF-8007107-2) Avail NTIS HC A03/MF A01

Preliminary results from a energy analysis of the coal fuel cycle in an Appalachian coal county has provided systematic assessment of hidden energy subsidies in extraction, transport, processing, and combustion Current results indicate a major loss due to depletion of the coal resource base by use of inefficient mining techniques Although of smaller magnitude, reductions in work force and community productivity from occupational accidents and disease and road maintenance requirements for transport also appear to be significant DOE

N82-11589# Brookhaven National Lab, Upton, N Y National Center for Analysis of Energy Systems

MODELING ENERGY-CONSERVATION POTENTIALS OF COMMUNITY ENERGY-SYSTEM TECHNOLOGIES

Peter I Kleeman 1981 8 p refs Presented at 12th Ann Pittsburg Conf on Modeling and Simulation, 30 Apr - 1 May 1981
(Contract DE-AC02-76CH-00016)
(DE81-026059, BNL-29720, CONF-810477-2) Avail NTIS HC A02/MF A01

A mathematical model is presented for estimating energy-conservation potentials of community-energy-system technologies in meeting community energy service demands The model is formulated to identify optimal community composition, technology choices, and fuel use under various fuel price, energy service demand, and other system-parameter assumptions DOE

N82-11613# Department of Energy, Washington, D C Office of Policy, Planning and Analysis

INTERRELATIONSHIPS OF ENERGY AND THE ECONOMY: A SUPPLEMENT TO THE NATIONAL ENERGY POLICY PLAN REQUIRED BY TITLE VIII OF THE US DEPARTMENT OF ENERGY ORGANIZATION ACT (PUBLIC LAW 95-91)

Jul 1981 70 p refs
(DE81-027526, DOE/PE-0030) Avail NTIS HC A04/MF A01

This study developed a fairly wide range of estimates for the impact of energy prices on such key variables as real gross national product, inflation, and the US trade balance The retrospective analysis suggests that potential economic output in the near future is being affected adversely by such energy price results from the recent past as lower investment, reduced labor force participation, slower growth in labor productivity, and reduced access to real energy resources Policies that seek to stimulate the supply side of the economy (including policies that seek to stimulate the specific development of energy resources) are directed at offsetting such past effects 1981-90 projections are presented of the impacts upon the economy in the three energy price scenarios developed in the document Energy Projections to the Year 2000 DOE

N82-11614# Wisconsin Center for Public Policy, Madison

SOLPLAN REPORT: AN ASSESSMENT OF BARRIERS AND INCENTIVES TO CONSERVATION AND ALTERNATIVE-ENERGY USE IN THE RESIDENTIAL SECTOR IN WISCONSIN

C K Fulenwider, Lonnie S Weiss, Carol Pfefferkorn, Don E Wiener, and Stephen L Feldmam Mar 1981 453 p
(Contract DE-FG02-79CS-30292)
(DOE/CS-30292/3) Avail NTIS HC A20/MF A01

The Alternative Energy Policy Project of the Wisconsin Center for Public Policy focused upon two principle objectives gathering the heating industry generally, the alternative-energy industry commercialization, and building consensus around alternative energy policy to develop guidelines for alternative energy policy for the state Particular attention was paid to public involvement in the policy process and to assessing barriers and incentives from as many key sectors of the energy field as possible Data were gathered from the general public, alternative energy users, the heating industry generally, the alternative-energy industry specifically, and key decision makers T M

N82-11616# South Carolina Energy Research Inst., Columbia
RESIDUAL-ENERGY-APPLICATIONS PROGRAM: EAST-FACILITY REQUIREMENTS DOCUMENT
P W Yngve and F H Zander 31 Jul 1981 237 p refs
(Contract DE-AC09-77ET-12866)
(DE81-027489, DOE/ET-12866/8-Vol-2) Avail NTIS HC A11/MF A01

The objectives of the EAST facility are to perform research and development on heat energy recovery and conversion equipment, establish high confidence in system performance, system availability, and system operating, maintenance, and material costs, and provide a national competence in technologies required for the installation and operation of heat recovery systems Detailed descriptions of seven potential test articles which represent a wide range of types and sizes of heat recovery systems were contained EAST operations, including test planning, test policies, systems testing, and facility organization and staffing were discussed Additionally, information is included on a preliminary site analysis for the EAST Facility and other test support system requirements are described TM

N82-11624# State Univ of New York at Albany
SITE SELECTION FOR SMALL WIND ENERGY CONVERSION SYSTEMS FOR US DEPARTMENT OF ENERGY FIELD EVALUATION PROGRAM
Bruce H Bailey Oct 1980 67 p Sponsored by New York State Energy Research and Development Authority
(PB81-226862, NYSERDA-81-2) Avail NTIS HC A04/MF A01 CSCL 10A

The site selection procedure followed to locate two qualified sites for the installed and monitoring of two commercially available small wind energy conversion systems as part of the U S Department of Energy's Field Evaluation Program is described The aim of the evaluation program is to gain operating experience with wind systems in actual locations and to identify the siting and operational issues involving wind energy conversion systems The two sites selected were approved as test sites for the program GRA

N82-11626# Mitre Corp., McLean, Va Energy and Resources Div
US ENERGY STRATEGIES: SOME OPTIONS FOR ELIMINATING OIL IMPORTS BY THE YEAR 2000
Edward G Sharp, Elaine G Carlson, Daniel J Entingh, John J Fearnsides, Robert P Foreman, Willard E Fraize, David Gray, Rodney K Lay, John G Leigh, Milton Lytton et al Apr 1981 23 p refs
(PB81-226052, MTP-81W0002) Avail NTIS HC A02/MF A01 CSCL 10A

Topic areas discussed include reasonable choices which eliminate the need for oil imports, potential domestic liquid fuel supplies, capital requirements for increased domestic liquid fuel supplies, potential for reducing liquid fuels demand, and domestic natural gas Other domestic energy resources and future domestic energy demands are discussed GRA

N82-11627# National Highway Traffic Safety Administration, Washington, D C Technology Assessment Div
THIRD AUTOMOTIVE FUEL ECONOMY RESEARCH CONTRACTORS COORDINATION MEETING
Charles L Gauthier, ed Dec 1980 777 p refs Proceedings of Conf held in Washington, D C, 1-2 Dec 1980
(PB81-222754) Avail NTIS HC A99/MF A01 CSCL 10A

Topic areas covered include industry analyses, driver energy conservation, heavy duty trucks, consumer research and market demand, vehicle weight reduction, and diesel engine studies are presented Spark ignition engine and drivetrain improvements GRA

N82-11641# Acurex Corp., Mountain View, Calif Energy and Environmental Div
KINETICS OF NO/ SUB X FORMATION DURING EARLY STAGES OF PULVERIZED-COAL COMBUSTION Quarterly Report, 4 Apr. - 30 Jun. 1981
W V Krill, E K Chu, G C Snow, S Pessagno, and H Tong 31 Jul 1981 54 p refs
(Contract DE-AC22-80PC-30295)
(DE81-029071, DOE/PC-30295/3, QR-3) Avail NTIS HC A04/MF A01

Kinetics of NO/sub x/ formation during early stages of pulverized coal combustion, are reported The well stirred nature of the reactor gas phase region and coal transport air are verified in cold flow and combustion tests A single pass trajectory of coal paticles through the stirred region was achieved Preliminary thermal NO/sub x/ formation characteristics of the gas phase and the reactor temperature environment are measured for use with the kinetic model DOE

N82-11642# Acurex Corp., Mountain View, Calif
SURVEY OF PARTICULATE EMISSION MACRO- AND MICRO-SAMPLING AND SIZING METHODS
William O Lipscomb Feb 1981 116 p refs
(Contract DE-AC18-80FC-10193)
(DE81-028348, DOE/FC-10193/T1, Acurex-TR-81-01/SR) Avail NTIS HC A06/MF A01

Methods for sampling and fractionating flue gas particulates were developed The survey was composed of three parts (1) macro methods, (2) micro methods, and (3) real time-monitoring/sizing methods A survey and cursory evaluation of *commercially available macro, micro, and real time measurement* systems is presented It is concluded that macro and micro methods utilizing impactors and cyclones are available DOE

N82-11644# Argonne National Lab., Ill Energy and Environmental Systems Div
SOLID AND HAZARDOUS ENERGY WASTES: SYNFUELS. 1: REVIEW OF RESEARCH ACTIVITIES
L Fradkin, T Surles, and W DeCarlo May 1981 164 p refs Sponsored in part by EPA
(Contract W-31-109-eng-38)
(DE81-028503, ANL/EES-TM-142) Avail NTIS HC A08/MF A01

Chemical and biological research on solid, liquid, and gaseous waste streams from coal conversion and oil shale technologies is summarized Brief descriptions, the objectives, current activities, and future plans, of ongoing projects were obtained References to publications that resulted from the various research projects are included References to work on hazardous and solid synfuel waste are included in the appendixes DOE

N82-11646# California Univ., Berkeley Lawrence Berkeley Lab Energy and Environment Div
INTERGRATED ASSESSMENT FOR ENERGY-RELATED ENVIRONMENTAL STANDARDS: A SUMMARY OF ISSUES AND FINDINGS
John P Holdren Oct 1980 60 p refs
(Contract W-7405-eng-48)
(DE81-028552, LBL-12779) Avail NTIS HC A04/MF A01

Environmental impacts of energy technologies arise from many stages in the flow of an energy source from discovery to end-use, propagate via disruptions in many media, and manifest themselves as many different undesirable effects The aim of the investigation is to understand the capacities and limitations of the assessment mechanisms available for use in the formulation of environmental standards applied to energy technologies TM

N82-11651# Lovelace Biomedical and Environmental Research Inst., Albuquerque, N Mex Inhalation Toxicology Research Inst
LOW-BTU-GASIFIER EMISSIONS TOXICOLOGY Status Report, Dec. 1980
R F Henderson, ed Apr 1981 67 p refs
(Contract DE-AC04-76EV-01013)
(DE81-031000, LMF-85) Avail NTIS HC A04/MF A01

Inhalation hazards to plant workers and the general population that may be associated with low Btu coal gasification were assessed To achieve this goal, it is necessary to characterize the potential toxicants in liquid and solid process and waste streams The experimental low Btu gasifier at METC was sampled to determine aerosol components in gaseous process streams and to assess potential toxicants in liquid and solid effluent streams TM

N82-11652# Arizona Univ., Tucson Dept of Mining and Geological Engineering
SULFUR POLLUTION CONTROL. PHASE 1: THE DISPOSAL PROGRAM Final Report, Sep. 1978 - Jun. 1980
Michael Rieber, Benjamin Okech, and Roger Fuller Jan 1981 263 p refs

(Contract DI-BM-JO-88144)
(PB81-222612, BM-OFR-94(3)-81) Avail. NTIS HC A12/MF A01, also available in set of 4 reports HC E99 CSCL 07A

Sulfuric acid production from sulfur based acid plants and smelters is analyzed and industry competition, with particular emphasis on voluntary versus abatement acid, is reviewed Production costs for both acid plants and smelters are estimated Large scale users prefer sulfur based acid production if the heat value of the reaction is utilized as a steam credit Voluntary acid is a more stable supply source than smelter acid Voluntary acid output is a reaction to price and demand conditions An output forecast is made based on APC regulations, implementation, and estimated metals production GRA

N82-11654# Exxon Research and Engineering Co., Florham Park, N J

CONTROL OF UTILITY BOILER AND GAS TURBINE POLLUTANT EMISSIONS BY COMBUSTION MODIFICATION, PHASE 2 Final Report, Jun. 1976 - Jun. 1979

E H. Manny and A R Crawford Mar 1981 178 p refs
(Contract EPA-68-02-1415)
(PB81-222267, EPA-600/7-81-039; EE 5E 81) Avail: NTIS HC A09/MF A01 CSCL 13B

The applicability of combustion modification (CM) techniques to control NOx and other pollutant emissions from utility boilers and gas turbines without causing deleterious side effects was studied Comprehensive, statistically designed tests were used to evaluate the effect of CM In staged low excess air tests of low-NOx, dual-fired utility boilers, special attention was paid to the determination of potentially adverse side effects, increased combustible emissions, unwanted changes in particulate mass loading and size distribution, reduced boiler efficiency, increased furnace slagging, and tube wall corrosion may be applied to coal fired utility boilers The extent of furnace tube wall corrosion and slagging could not be determined conclusive GRA

N82-11655# Arizona Univ., Tucson Dept of Mining and Geological Engineering.

SULFUR POLLUTION CONTROL. PHASE 1: THE DISPOSAL PROGRAM (SECTIONS 5 THROUGH 7) Final Report

Michael Rieber, Roger Fuller, and Osmario Dellaretti Jan. 1981 190 p refs
(Contract DI-BM-JO-188144)
(PB81-222804, BM-OFR-94(2)-81) Avail: NTIS HC A09/MF A01 CSCL 13B

Sulfur recovery from domestic sour natural gas and petroleum refining on a current basis and projected to the mid-1990's on a regional basis was estimated The current basis depends importantly on gas production projection for the Overthrust Belt and the associated H2S The regional basis depends on projected increases in the sulfur content and weight of imported crude oils, total crude oil imports, and anticipated refinery response GRA

N82-11657# TRW, Inc., McLean, Va Energy Systems Group

ENVIRONMENTAL RESEARCH PLAN FOR GAS SUPPLY TECHNOLOGIES. VOLUME 1: EXECUTIVE SUMMARY Final Report

L M Tipton and P D. Junkin 29 May 1981 78 p refs 2 Vol.
(Contract GR1-5080-351-0316)
(PB81-222309, GRI-80/0013 1) Avail: NTIS HC A05/MF A01 CSCL 21D

The environmental impacts and constraints associated with gas supply technologies are summarized. Specific environmental research needs based on state of the art technology and current environmental knowledge are identical Technologies considered include those producing, unconvential natural gas (tight gas sands, Devoian shale, coalbed methane, and geopressured methane), SNG from coal and peat and SNG from biomass (land based, water based and waste GRA

N82-11661# Research Triangle Inst., Research Triangle Park, N C.

VAPOR-PHASE CRACKING AND WET OXIDATION AS POTENTIAL POLLUTANT CONTROL TECHNIQUES FOR COAL GASIFICATION Final Report, Nov. 1976 - Apr. 1981

W J McMichael, S K Gangwal, D A Green, and F. O Mixon Jun. 1981 56 p refs
(PB81-219594; RTI/1934/00-01F, EPA-600/7-81-096) Avail: NTIS HC A04/MF A01 CSCL 13B

Bench-scale experiments were used to determine rates of hydrocracking and wet oxidation as a function of process conditions and catalyst used A microreactor system, capable of holding 1 0 cc of material to be screened for catalytic activity, was used in the hydrocracking studies Benzene and alkylated benzene compounds were used as model compounds in determining the potential of various materials fo cracking rates. Thiophene was used as a model compound for catalyst poisoning studies Cracking rates were determined for coal-derived materials produced from bituminous and subbituminous coals and materials containing iron and nickel compounds T.M

N82-11671# Environmental Protection Agency, Las Vegas, Nev Exposure Assessment Research Div

GEOTHERMAL ENVIRONMENTAL ASSESSMENT: BEHAVIOR OF SELECTED GEOTHERMAL BRINE CONTAMINANTS IN PLANTS AND SOILS Final Report

K. W. Brown Jun 1981 36 p refs
(PB81-222333, EPA-600/4-81-052) Avail NTIS HC A03/MF A01 CSCL 13B

The behavior of selected elements found in the Roosevelt Hot Springs KGRA geothermal fluids was investigated in both plant and soil systems The kinetics of these potential environmental containments were studied by using soil columns and selected cultivated and native plant species GRA

N82-11679# PEDCo-Environmental, Inc., Cincinnati, Ohio

EPA UTILITY FGD (FLUE GAS DESULFURIZATION) SURVEY Quarterly Report, Jan. - Mar. 1981

M Smith, M Melia, N Gregory, and K Scalf Aug 1981 308 p refs
(Contract EPA-68-01-6310)
(PB81-225773, EPA-600/7-81-012C) Avail NTIS HC A14/MF A01 CSCL 13B

Information contributed by the utility industry, process suppliers, regulatory agencies, and consulting engineering firms is summarized Domestic FGD systems are tabulated alphabetically by development status (operational, under construction, or in planning stages), utility company, process supplier, process and waste disposal practice Data on boiler design, FGD system design, fuel characteristics, and actual performance are presented Unit by unit dependendability parameters, and problems and solutions associated with the boiler and FGD systems are discussed Process flow diagrams and FGD system economic data are also presented T.M

N82-11680 Maryland Univ., College Park

SELECTED STUDIES OF FOUR HIGH-TEMPERATURE AIR-POLLUTION SOURCES Ph.D. Thesis

Mark Steven Germani 1980 406 p
Avail. Univ Microfilms Order No 8121096

The atmospheric emissions of five copper smelters, a coal-fired power plant, a municipal incinerator and the Mt Erebus volcano in Antarctica were examined Many chalcophilic elements, e g., As, Se, Pb, Cd, Zn, W and In, are strongly enriched with respect to the Earth's crustal abundance pattern in particulate material emitted from copper smelters Vapor-phase concentrations of several elements in a high temperature gas stream and tested at a coal-fired power plant were determined and compared with those from a municipal incinerator The results from the coal-fired power plant and incinerator indicate that 5-10 times more Hg is emitted from the power plant Particulate and vapor-Erebus show large enrichments for many elements, most notably the volatile chalcophilic elements, As, Se, In, Cd and Sb, and the halogens, F Cl and Br. About 95% of the Cl, 24% of the As and > 90% of the F are present in the vapor phase High concentrations of F are present in the lava lake as evidenced by the ratio of Cl to F found in the vapor-phase samples Dissert Abstr

N82-11712# California Univ., Livermore Lawrence Livermore Lab

COMPUTER MODELS TO SUPPORT INVESTIGATIONS OF SURFACE SUBSIDENCE AND ASSOCIATED GROUND MOTION INDUCED BY UNDERGROUND COAL GASIFICATION

R T Langland and B C. Trent (Science Applications, Inc., Steamboat Springs, Colo.) 1981 14 p refs Presented at the 7th Ann Underground Coal Conversion Symp., Fallen Leaf Lake, Calif., 8-11 Sep 1981
(Contract W-7405-eng-48)
(DE81-027131, UCRL-86437, CONF-810923-1) Avail NTIS HC A02/MF A01

Two computer codes compare surface subsidence induced by underground coal gasification at Hoe Creek, Wyoming, and Centralia, Washington Calculations with the STEALTH explicit finite-difference code are shown to match equivalent implicit finite-elemet method solutions or the removal of underground material Effects of removing roof material, varying elastic constants, investigating thermal shrinkage, and burning multiple coal seams are studied A coupled finite-difference continuum rigid-block caving code is used to model underground opening behavior Numerical techniques agree qualitatively with empiricial studies but, so far, underpredict ground surface displacement. The two methods, numerical and empirical, are most effective when used together It is recommended that the thermal characteristics of coal measure rock be investigated and that additional calculations be carried out to longer times so that cooling influences can be modeled DOE

N82-11731# Massachusetts Inst of Tech., Cambridge
OCEANS AND OCEAN CURRENTS: THEIR INFLUENCE ON CLIMATE
Reginald E Newell, Long S. Chiu, Wesley Ebisuzaki, Alfredo Navato, and Henry B Selkirk 1980 56 p refs Presented at the Conf on Climate and Offshore Energy Resources, London, 21 Oct 1980 Sponsored in part by the National Science Foundation, Washington, D C.
(Contract DE-AS02-76EV-12195)
(DE81-027263, DOE/EV-12195/41, CONF-8010198-2) Avail NTIS HC A04/MF A01

Particular attention is given to influences that may be related to offshore energy generation The role of the ocean currents and seasonal, as well as nonseasonal variations, are discussed The effects of the Southern Oscillation, a non-seasonal signal in the climate system second only to the Ice Ages, are emphasized T M

N82-11985# PEDCo-Environmental, Inc., Cincinnati, Ohio
FGDIS PRIMER: MAJOR EQUIPMENT/COMPONENT CLASSIFICATIONS, PROBLEM/SOLUTION ACCESS CODES, AND DEFINITIONS RELATED TO FGD SYSTEMS AS CONTAINED IN THE FLUE GAS DESULFURIZATION INFORMATION SYSTEM (FGDIS)
May 1981 135 p
(Contract EPA-68-02-3173)
(PB81-225948) Avail NTIS HC A07/MF A01 CSCL 05B

The major equipment and component classification used in the Flue Gas Desulfurization Information system is presented Such things as the problem and solution codes used in conjunction with the FGD system performance data, as well as definitions of common terminology used to describe FGD systems and power plants in geneal are included Along with the classifications of the various complex equipment items and components that comprise FGD systems, brief functional descriptions and illustrations are provided GRA

N82-11988# Los Alamos Scientific Lab., N Mex
NATIONAL COAL-MARKET CONDITIONS FOR THE YEAR 2000: REGIONAL-ISSUE IDENTIFICATION AND ANALYSIS, HIGH SCENARIO
Frank Wolak Jul 1981 18 p refs
(Contract W-7405-eng-36)
(DE81-026425, LA-8906-MS) Avail NTIS HC A02/MF A01

Coal market data inputs necessary to operate the model used for the solid-waste impacts of coal-fired electricity production are described The ROCKY3 model generated minemouth prices and quantities produced for each coal type from each coal supply region and the delivered price and quantity to each coal consumption region of each coal type from all of the coal supply regions DOE

N82-11994*# Jet Propulsion Lab., California Inst of Tech., Pasadena
EVALUATION OF THE MICRO-CARBURETOR
Merkel F Weiss, Robert A Hall, and Steven D Mazor Aug 1981 83 p refs
(Contracts NAS7-100, DE-AI01-79CS-50080)
(NASA-CR-164958; JPL-Pub-81-75) Avail NTIS HC A05/MF A01 CSCL 13F

A prototype sonic, variable-venturi automotive carburetor was evaluated for its effects on vehicle performance, fuel economy, and exhaust emissions. A 350 CID Chevrolet Impala vehicle was tested on a chassis dynamometer over the 1975 Federal Test Procedure, urban driving cycle The Micro-carburetor was tested and compared with stock and modified-stock engine configurations Subsequently, the test vehicle's performance characteristics were examined with the stock carburetor and again with the Micro-carburetor in a series of on-road driveability tests The test engine was then removed from the vehicle and installed on an engine dynamometer Engine tests were conducted to compare the fuel economy, thermal efficiency, and cylinder-to-cylinder mixture distribution of the Micro-carburetor to that of the stock configuration Test results show increases in thermal efficiency and improvements in fuel economy at all test conditions Improve fuel/air mixture preparation is implied from the information presented Further improvements in fuel economy and exhaust emissions are possible through a detailed recalibration of the Micro-carburetor *Author*

N82-11995# California Univ., Berkeley Lawrence Berkeley Lab
URBAN ECOSYSTEM AND RESOURCE-CONSERVING URBANISM IN THIRD WORLD CITIES
R L Meier, Sam Berman, Tim Campbell, and Chris Fitzgerald Mar 1981 195 p refs
(Contract W-7405-eng-48)
(DE81-029854, LBL-12640) Avail NTIS HC A09/MF A01

A comprehensive overview based on urban ecosystems was employed in field studies of representative cities in developing regions The rising overall demand of cities in the developing regions was examined with emphasis on petroleum and caloric foodstuffs Policies necessary to conserve energy and to adapt to increased costs and the possibility of food and water shortages are addressed DOE

N82-12204# Starck (Hermann C.) Berlin, Goslar (West Germany). Werk Goslar
DEVELOPMENT OF A PROCESS FOR RECOVERY OF VALUABLE COMPONENTS FROM COMPLEX HYDRODESULFURIZATION CATALYSTS ESPECIALLY TUNGSTEN, MOLYBDENUM, VANADIUM, NICKEL AND COBALT Final Report
Bruno Krismer, Hans-Georg Nadler, and Hartmut Pungs Bonn Bundesministerium fuer Forschung und Technologie Dec 1980 20 p In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-186, ISSN-0340-7608) Avail NTIS HC A02/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 4.20

For the nonpolluting recovery of the valuable components W, Mo, Co, Ni and V from complex hydrodesulfurization catalyst residues, an economical process was developed in which the valuable elements are reduced out by carbothermal reactions in the electric arc furnace as a first process step The metal obtained is ground, roasted, and the oxides are dissolved in a combined acid-base dissolving process The valuable elements are separated by liquid-liquid extraction steps which make it possible to isolate the valuable materials in the desired grade of chemical purity Author (ESA)

N82-12205# Ruhrchemie A G., Oberhausen (West Germany) Abt Umweltschutz
THERMAL PROCESSING OF USED CATALYSTS Final Report
Dieter Ernst and Sebastien Speth Bonn Bundesministerium fuer Forschung Technologie Dec 1980 24 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-189, ISSN-0340-7608) Avail NTIS HC A02/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 5.05

A preliminary treatment of the used catalysts following fluidized bed thermal processing is presented It is possible to obtain a starting material free from organic impurities, which is suited to the usual recovery of the valuable components of the

catalysts In the course of the operation optimization, it was possible to successfully complete the feeding of the fluidized bed reactor with used catalysts from widely varying sources The waste gas purification and fine dust separation comply with emission regulations The unit is to be regarded as a demonstration plant, especially if waste heat utilization can be integrated to improve economic performance Author (ESA)

N82-12278# Aerospace Corp, El Segundo, Calif Energy and Resource Div

SOLAR HEATING AND COOLING OF BUILDINGS (SHACOB). REQUIREMENTS DEFINITION AND IMPACT ANALYSIS-2. VOLUME 1: ENERGY-CONSERVING DESIGN FOR RESIDENTIAL STRUCTURES

C K Cretcher Nov 1980 140 p refs Sponsored by Electric Power Research Inst

(EPRI Proj 553-2)

(DE82-900206, EPRI-EM-1506-Vol-1) Avail NTIS HC A07/MF A01

The impact of stringent energy conserving building standards on electric utility service areas and their customers was analyzed The demands on the seven broadly representative electric utilities were aggregated to represent the total new construction electric heating demands in the years 1990 and 2000 to be compared to the aggregate obtained similarly for a nominal, less stringent standard, viz, ASHRAE 90-75 Results presented include the percentage of energy savings achieved in both heating and cooling seasons and typical demand profile changes A utility economic impact analysis was performed for the cases investigated to determine changes in operating costs and potential capacity sales A third cost component considered is the incremental cost of superinsulation (over ASHRAE 90-75) to the customer The aggregate net cost to the utility/customer entity is utilized as a measure of overall economic benefit DOE

N82-12283# Midwest Research Inst, Golden, Colo Solar Energy Research Inst

COMPARISON OF RESIDENTIAL WINDOW DISTRIBUTIONS AND EFFECTS OF MASS AND INSULATION

M Hannifan, C Christensen, and R Perkins Jul 1981 7 p refs Presented at the 6th National Passive Solar Conf, Portland, Oregi 8-12 Sep 1981

(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)

(DE81-027938, SERI/TP-721-1300, CONF-810925-9) Avail NTIS HC A02/MF A01

The energy requirements and comfort implications of various window distributions and window areas (representing conventional, sun-tempered, and passive solar designs) are investigated for single-family residences in Albuquerque, NM, Denver, CO, and Madison, WI Three distinct mass levels ranging from lightweight to heavyweight interiors and three distinct insulations levels, including energy-conserving, night-insulated, and superinsulated cases, are analyzed Energy requirements are reported for residences with electric resistance heating and mechanical air conditioning Comfort conditions reported are based on interior average air temperatures and mean-squared errors DOE

N82-12403# Weiss Technik G m b H, Reiskirchen (West Germany)

PRACTICAL DEMONSTRATION OF HEAT PUMPS FOR UTILIZATION OF ANIMAL-GENERATED HEAT Final Report

Hans-Ulrich Amberg Bonn Bundesministerium fuer Forschung und Technologie Sep 1980 47 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-80-100, ISSN-0340-7608) Avail NTIS HC A03/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 10,30

Airconditioning of pigpens to eliminate effects of temperature extremes is reported A stall air conditioner was, installed as heat pump in a pigpen for final fattening The heat, recovered from the exhaust air, is supplied to the outside air so that heated fresh air is blown into the stall The test was accomplished on a farm with intensive pig breeding with 120 preliminary fattening places and 240 final fattening places The stall air conditioner offers the possibility to attenuate the extreme temperature variations during the year Author (ESA)

N82-12404# Escher Wiss G m b H, Ravensburg (West Germany) Abt Papiermaschinen

AIR CIRCUIT WITH HEATING PUMP Final Report

Herbert Holik, Hans Joachim Bauder, Hubert Brugger, Anton Reinhart, and Karl-Heinz Spott Bonn Bundesministerium fuer Forschung und Technologie Dec 1980 56 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-80-188, ISSN-0340-7608) Avail NTIS HC A04/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 11,80

A pump which draws energy from exhaust air from a paper drying process to heat up the blow air was studied The use of a heat pump instead of a steam heated exchanger can reduce primary energy consumption for blown air heating by more than half and the costs for air heating up to half The amortization times for the heat pump extend from 5 to 10 years Since in the pulp and paper industry, amortization times of less than two years are required for such relatively small investments, the heat pump so far is only used to heat blown air under highly favorable conditions The rising energy prices shorten the heat pump amortization time The 100% fuel price increase brought the heat pump with diesel engine drive already to very favorable amortization times of 2 to 5 years A 20% increase will make the heat pump economically advantageous with an amortization time between 1 and 2 years Author (ESA)

N82-12424# Unitex Corp, Salt Lake City, Utah

HIGH-TEMPERATURE COUNTER-FLOW RECUPERATOR Final Report

F Rudloff May 1981 324 p refs

(Contract DE-AC07-80ID-12077)

(DE81-031923, DOE/CS-12077/T1) Avail NTIS HC A14/MF A01

The commercial potential of a helical recuperator design in recovering waste heat from industrial furnaces is reported The helical recuperator concept consists of a cylindrical column with an interior helical interface which separates the preheat air and the combustion gas The column operates in a teer flow mode and is formed from modular sections The material evaluation consisted of exposing material samples to a soda-lime glass furnace environment for a fifteen week period ECP-3, X-81, and Unichrome were the best suited for use in a soda-lime environment and ECP-3 was the best candidate with respect to manufacturing Two potential design modifications were identified a finned design and a double helix design For materials that showed the greatest potential for use in the glass environment, the double helix design made from ECP-3 was the most economical producing payback periods of 6 to 14 years DOE

N82-12513# Washington Univ, Seattle

CHEMICAL AND GEOCHEMICAL STUDIES OFF THE COAST OF WASHINGTON Progress Report, Sep. 1980 - Jul 1981

R Carpenter, comp Jul 1981 14 p refs

(DE81-030319, DOE/EV-70024/44) Avail NTIS HC A02/MF A01

A series of marine chemical and geochemical investigations involving both laboratory studies and field studies off the coast of Washington is addressed Most of the field work was on the Washington continental shelf, slope, and the submarine canyons indenting the shelf north of the Columbia River The aim is to provide basic data required to characterize underlying chemical and physical processes and their rates which control the distributions, concentrations, and ultimate fate of some of the potentially hazardous agents associated with fossil fuel and/or nuclear power production or transportation Laboratory and field experiments and theories derived from are used iteratively to investigate (1) vertical transfer of trace chemicals from surface seawaters to underlying waters and sediments, (2) processes which may transfer certain chemicals from sediments back into the overlying water column, (3) redox processes which besides changing valence states of certain chemicals may alter their precipitation/dissolution tendencies, their biological availability and/or toxicity, and (4) accumulation histories of potentially hazardous chemicals in sediments during the past 100 years DOE

N82-12521# Skelly and Loy, Harrisburg, Pa

FEASIBILITY ANALYSIS OF TRENCH STRIP AND AUGER MINING Summary Report

Jun 1981 209 p refs
(Contract DE-AC01-79ET-11268)
(DE81-027557, DOE/ET-11268/14) Avail NTIS HC A10/MF A01

The feasibility of using Trench Strip and Auger Mining as a means to extract coal reserves which are presently considered uneconomical to mine or which would present undesirable environmental effects if extracted using conventional surface mining methods is assessed The conclusion is that Trench Strip and Auger Mining, when used as a primary mining system, is a viable alternative to conventional surface mining Economically, a savings in the selling price of at least $12 per ton (from $28 to $16) can be realized with this concept Environmentally, the amount of surface area disturbed can be reduced to half, and the amount of overburden handled can be reduced to one-seventh that of a conventional mine It was also discovered that the trench mine gave similar results on certain surface minable sites that are economically and environmentally sound DOE

N82-12526# Department of Energy, Washington, D C Assistant Administrator for Applied Analysis
ANALYSIS REPORT: APPLIED ANALYSIS MODEL SUMMARIES
Dec 1980 173 p
(DE81-029278, DOE/EIA-0293) Avail NTIS HC A08/MF A01

Brief statements of each model's purpose are presented Information on the models' characteristics, uses, and requirements is provided and sources for additional information are reported T M

N82-12579# Department of Energy, Washington, D C
DEPARTMENT OF ENERGY PROJECTS Quarterly Status Report
30 Jun 1981 525 p
(DE82-000038, DOE/MA-0006/2) Avail NTIS HC A22/MF A01

The report is designed to provide Department of Energy (DOE) management with a summary of the important baseline data that exists in the DOE project data base This data base is maintained chiefly from periodic field management reports required by DOE Order 5700 4 Since most of the current estimates in this report are from field project managers, they do not necessarily have full headquarters approval The current budget data sheet estimates that appear in the report are considered appropriate for reporting external to the Department DOE

N82-12580# Data Resources, Inc , Lexington, Mass
MODELS FOR FORECASTING ENERGY USE IN THE US FARM SECTOR Final Report
L R Christensen Electric Power Research Inst Jul 1981 200 p refs Sponsored by Electric Power Research Inst
(EPRI Proj 682-1)
(DE81-904220, EPRI-EA-1956-Vol-1) Avail NTIS HC A09/MF A01

Econometric models were developed and estimated for the purpose of forecasting electricity and petroleum demand in US agriculture A structural approach is pursued which takes account of the fact that the quantity demanded of any one input is a decision made in conjunction with other input decisions Three different functional forms of varying degrees of complexity are specified for the structural cost function, which describes the cost of production as a function of the level of output and factor prices Demand for materials (all purchased inputs) is derived from these models A separate model which break this demand up into demand for the four components of materials is used to produce forecasts of electricity and petroleum is a stepwise manner DOE

N82-12581# Merix Corp , Wellesley, Mass
ENERGY CONSERVATION IN DISTILLATION Final Report
T W Mix, J S Dweck, M Weinberg, and R C Armstrong Jul 1981 299 p refs
(Contract DE-AC07-76CS-40259)
(DE81-028650, DOE/CS-40259/1) Avail. NTIS HC A13/MF A01

An audit of major industrial and processes and key colums in each major process indicated that approximately twoquads of energy were consumed for distillation in the US in 1976 Energy usage by industry is included: petroleum refineries, 66% chemical (including petrochemical) industry, 29% natural gas liquids processing, 5% Techniques and current practices for conserving distillation energy are reviewed, and guidelines indicating those process conditons which favor the use of each energy conserving technique are enumerated Expressions for payout time for tray and control retrofit options are developed based on energy savings and increased throughput Calculations for industrial colums suggested that both types of retrofits would frequently have short (.6 months) payout times based on either criterion Extractive distillation is also discussed, and criteria enabling the estimation of the energy which may be conserved using this technique are developed Good housekeeping practices and field techniques for checking the energy efficiency of industrial distillations are also discussed DOE

N82-12582# Prototech, Inc , Newton Highlands, Mass
ENERGY SAVINGS BY MEANS OF FUEL-CELL ELECTRODES IN ELECTRO-CHEMICAL INDUSTRIES Progress Report, 1 Feb. - 30 Apr. 1981
A Bar-Ilan, Walter Juda, and Brian P Finnigan 31 Jul 1981 26 p refs
(Contract DE-AC02-78ET-25309)
(DE81-030975, DOE/ET-25309/T1, COO-4881-31) Avail NTIS HC A03/MF A01

Life testing of palladium-loaded and low platinum-loaded anodes on type C supports and with type no 01 current collectors was continued and terminated Additional life-test data are reported for high Pt-loaded and a second low Pt-loaded anode The 6 in x 6 in depth cell was operated at reduced hydrogen back pressures, and the effect of the resulting flooding of the hydrogen chamber upon cell performance was determined Furthermore, two 6 in. x 6 in depth cells were fabricated from the same type platinum support and current collector, but following different preparation procedures Cell performance was compared at various submergence depths under identical operating conditions DOE

N82-12583# Los Alamos Technical Associates, Inc , N Mex
THE SEVERITY OF INSTITUTIONAL BARRIERS AFFECTING ENERGY-FROM-MUNICIPAL-WASTE TECHNOLOGIES
G E Dials, J M Greenwood, L L Lewis, and E M Cole Jun 1981 58 p refs Presented at Inst Barriers Assessment Workshop, Washington, D C , 19 Feb 1981 Prepared for Argonne National Lab , Ill
(Contract W-31-109-eng-38)
(DE82-000133, ANL/CNSV-TM-79) Avail NTIS HC A04/MF A01

The results from a workshop during which EMW experts were asked to indicate the importance of these barriers are summarized The basic results of the workshop participants' scoring of the institutional barriers according to their importance are described. More elaborate analyses conducted on the workshop results are reported A summary of the workshop results and a listing of the most important EMW technology/institutional barrier combinations are included T.M

N82-12587# Argonne National Lab , Ill Energy and Environmental Systems Div
ASSESSMENT OF THE POTENTIAL OF COAL-FUELED HEAT ENGINES IN TOTAL AND INTEGRATED ENERGY SYSTEMS
J C Bratis, M L Jain, and T J Marciniak Jun 1981 80 p refs
(Contract W-31-109-eng-38)
(DE82-000169, ANL/FE-81-56) Avail NTIS HC A05/MF A01

The potential of several prime movers, especially those that use coal, for use in total and integrated energy systems in the residential and commercial sector was investigated The prime movers considered are diesels, Stirlings, internally and externally fired gas turbines, and steam turbines Total energy systems based on the prime movers are compared to the conventional system for four communities that represent different ratios of residential to commercial area The energy savings, environmental effects, and economic benefits are shown It is found that for both scenarios, neither coal nor oil using total energy systems have a definite economic advantage DOE

N82-12589# Department of Energy, Washington, D C Industrial Data Systems Div
NATIONAL INTERIM ENERGY-CONSUMPTION SURVEY:

EXPLORING THE VARIABILITY IN ENERGY CONSUMPTION

Robert Latta, Thomas H Woteki, Lynda Carlson, Wendel Thompson, and Kenneth Vagts Jul 1981 70 p refs
(DE81-029910, DOE/EIA-0272) Avail NTIS HC A04/MF A01

The variation in total energy consumption and consumption by end use are described The report concentrates on regression models for describing the variability in natural gas and electricity consumption for households living in single family detached houses Sample data and the subsets used in the analyses are described A theoretical model for describing a household's energy consumption is presented Graphical summaries of the data which serve to explain the specific models fit to the data are also presented The empirical models fit to the data, and the method of fitting, are discussed Results, speculation on interpretation of the model coefficients, and potential uses of the model are summarized . DOE

N82-12593# Rocket Research Corp , Redmond, Wash

UTILIZATION OF WASTE HEAT FROM MAJOR TRANSFORMER SUBSTATIONS. VOLUME 1: GENERIC STUDY Final Report

N T Christensen Aug 1981 190 p refs Sponsored by Electric Power Research Inst 2 Vol
(EPRI Proj 1274-1)
(DE81-904212, EPRI-EM-1968-Vol-1) Avail NTIS HC A09/MF A01

Large substation transformers reject substantial thermal energy Since these units are usually close-coupled to facilities requiring low-temperature thermal energy for space conditioning, the ability to recover and efficiently utilize this energy is of significant interest The intent of this project was to analytically evaluate the technical and economic potential of transformer waste heat recovery and utilization and verify the analysis with subscale testing A general system was designed and optimized for the recovery of transformer waste heat Simplified analytical techniques were developed to assist utilities in both preliminary analysis and detail design analysis of specific systems, including system economics Critical component performance parameters were identified for the preparation of detailed specifications Criteria was established for the specific application of such systems through system economics A national mail survey was conducted to determine the quantity and usability of transformer waste heat in the United States DOE

N82-12594# Rocket Research Corp , Redmond, Wash

UTILIZATION OF WASTE HEAT FROM MAJOR TRANSFORMER SUBSTATIONS. VOLUME 2: SITE-SPECIFIC STUDY Final Report

N T Christensen Aug 1981 93 p Sponsored by Electric Power Research Inst 2 Vol
(EPRI Proj 1274-1)
(DE81-904236, EPRI-EM-1968-Vol-2) Avail NTIS HC A05/MF A01

The applicability of transformer waste heat utilization was examined by analyzing a site-specific application The site is located in Seattle, Washington, the energy source is the Broad Street Substation and the energy user is the Pacific Science Center A description of the system is presented in Section I A preliminary heat source/heat service analysis is given in Section II Transformer waste heat availability and system heat demand, the thermal performance and hydraulic analysis, overall system efficiency, operation flexibility, major component selection, and the thermal storage system are discussed The substation site, the transmission system, and the retrofit of the Pacific Science Center are described System cost details and a cash flow projection are given DOE

N82-12597# Commission of the European Communities, Luxembourg

APPLICATION OF DIFFERENT KFA-MODELS IN THE FRAMEWORK OF THE ENERGY RESEARCH PROGRAMME OF THE EUROPEAN COMMUNITIES Final Report

1980 98 p refs
(EUR-6758-EN) Avail NTIS HC A05/MF A01

Four West German energy models are presented, (1) an energy policy to decrease dependence on oil and gas imports, (2) fuel parameters of various nuclear power plant systems, (3) investments in environmental protection inthe energy sector and their effects on the gross national product, and (4) the use of FORTRAN in modular dynamic simulation N W

N82-12604# Mid-American Solar Energy Complex, Minneapolis, Minn

WOOD RESOURCES AND UTILIZATION PATTERNS IN THE NORTH CENTRAL REGION AND ENERGY NEEDS FOR THE MANUFACTURE OF WOOD PRODUCTS

Steven A Sinclair Mar 1981 37 p refs
(Contract DE-AC02-79-CS-30150)
(DE81-030356, MASEC/R-81-005) Avail NTIS HC A03/MF A01

The resources of the region are discussed on a state-by-state basis The discussion of standing timber growth and removal is in terms of commercial growing stock, however, the total forest biomass may be estimated by simply adding the potential logging residue to the growing stock figure The energy needs of various wood and paper products, plants, standard industrial classification codes 24 and 26, are highlighted In addition, the ability of various wood manufacturing facilities to generate their energy needs from wood residues and by-products is explored T M

N82-12613# Systems Technology Corp , Xenia, Ohio

CONVERSION OF MUNICIPAL SOLID WASTE TO ENERGY, JACKSONVILLE, FLORIDA, PHASE 1

Jul 1981 237 p refs
(Contract DE-AC01-79CS-0231)
(DE82-000808, DOE/CS-20231/1) Avail NTIS HC A11/MF A01

The development of new technology and to foster the commercialization of innovative concepts for energy recovery from municipal solid waste (MSW) was studied A program to implement the Scientific energy engineering auger combustion system was evaluated The commercial version of the system, with a capacity of 350 TPD, was developed The evaluation of applying resource recovery involved the determination of (1) the amount and characteristics of solid waste, (2) the location and requirement of candidate energy customers and materials markets, (3) the applicable incineration/heat recovery and resource recovery technologies, and (4) the institutional, legal, and environmental requirements for constructing a facility An implementation plan is developed to define the specific steps required to employ a waste to energy technology DOE

N82-12621# Gersham, Brickner and Bratton, Inc , Washington, D C

WASTE-TO-ENERGY SYSTEMS INSTITUTIONAL BARRIERS ASSESSMENT WORKSHOP

Jun 1981 57 p Workshop Held in Washington, D C , 19 Feb 1981 Prepared for Argonne National Lab , Ill
(Contract W-31-109-eng-38)
(DE82-000098, ANL/CNSV-TM-78) Avail NTIS HC A04/MF A01

Nontechnical institutional barriers affecting implementation of the waste to energy technology, priorization, of identifed barriers, and utilization of information and data to formulate an institutional research plarr, were identified The following important results are recorded for commercialized and noncommercialized combustor, siting existing laws, multipurisdictional ination, permiles and regulations, and the lack of data on environmental impacts DOE

N82-12635# Gilbert Associates, Inc , Reading, Pa

MODULAR HYDRO DAM APPROACH TO THE ECONOMIC DEVELOPMENT OF ULTRA LOW-HEAD HYDROPOWER

K R Broome 1981 19 p Presented at the Hydropower Conf , Washington, D C , 22 Jun 1981
(Contract DE-AC07-76ID-01570)
(DE81-027817, CONF-8106137) Avail NTIS HC A02/MF A01

The potential for developing economical new ultra low head sites using an innovative concept known as the modular hydro dam (MHD) were explored This concept, combines the benefits of shop fabrication and installation of equipment in truck transportable, waterproof power modules, with prefabricated gate sections that can be located between the power modules The technical, economic, environmental, and institutional feasibility of the MHD concept are examined Capital and operating costs are estimated It is concluded that the potential for power generation at ultralow head sites justifies the development of the MHD concept DOE

N82-12636# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho
DOE SMALL-HYDROPOWER DEMONSTRATION PROGRAM
B N Rinehart and L E Felton Jun 1981 15 p refs Presented at Waterpower 1981 Conf., Washington, D C, 22 Jun 1981
(Contract DE-AC07-76ID-01570)
(DE81-027819; CONF-8106137-2) Avail NTIS HC A02/MF A01

Hydroelectric power demonstration projects were developed at small dams The project methods and results are presented S L

N82-12637# Brookhaven National Lab., Upton, N Y Div of Energy and Economic Analysis
MODELLING ENERGY-ECONOMIC INTERACTIONS IN DEVELOPING COUNTRIES: A LINEAR-PROGRAMMING APPROACH
Peter Meier and Vinod Mubayi 1981 51 p refs Presented at the 9th Intern Conf. on Operational Res., Hamburg, 23 Jul. 1981, sponsored by International Federation of Operations Research Societies
(Contract DE-AC02-76CH-00016)
(DE81-026048, BNL-29747, CONF-810726-2) Avail NTIS HC A04/MF A01

An energy economic assessment model for application to energy assessments in developing countries is described A simple comprehensive treatment of the energy sector is emphasized The input output model is directly incorporated in the Energy system LP The major supply sectors, as well as the major energy using industries, are modelled as capacity expansion problems, in which explicit distinction is made between capital stock and energy flows For most developing countries the notion of energy supply curves is far fetched, since energy prices are set by planning authority, not established by market clearing equilibrium DOE

N82-12641# Audi NSU Auto Union A G., Neckarsulm (West Germany) Entwicklung Neckarsulm
FUEL SAVINGS IN HOT WATER HEATING PLANTS BY APPLICATION OF HEAT PUMPS OPERATED WITH NATURAL GAS (NATURAL GAS HEAT PUMP). PROJECT: GAS ENGINE *Final Report*
Klaus Wissler Bonn Bundesministerium fuer Forschung und Technologie Dec 1980 61 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-125, ISSN-0340-7608) Avail. NTIS HC A04/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 11.60

Energy consumption in residential heating using a heat pump driven by an internal combustion engine is discussed A natural gas rotary engine was developed as a drive unit for a heat pump with 120 to 150 kW heating capacity The engine was derived from an automotive prototype engine, it had an output of 50 kW at 6000 rpm The efficiency was improved by an increased compression ratio and a rotor recess suitable for natural gas operation The engine used specially developed spark plugs and high performance lubrication oil To obtain longevity, the trochoid surface and the side housing surface were coated with a plasma spray wear coating, ceramic apex seals were used and the accessories were redesigned Author (ESA)

N82-12650 California Univ., Los Angeles
A COMPUTER SIMULATION MODELING STUDY TO PREDICT AIR QUALITY IMPACTS FROM A 500 MW COAL-FIRED POWER PLANT Ph.D. Thesis
Gary Van Jandegian 1981 255 p
Avail Univ Microfilms Order No 8120979

A computer simulation modeling study was conducted to predict sulfur dioxide ambient air quality impacts resulting from the operation of a 500 megawatt coal-fired power plant expansion in the Trombay area of Bombay, India The AQUAL, a multiple source Gaussian plume dispersion model employs diffusion coefficients and plume rise equations and predicts maximum and average 3 hour and 24 hour ground level pollutant concentrations for up to 250 receptor points within 20 kilometers of a power plant stack(s) Results of the modeling exercises are used to recommend proper SO2 controls such as flue gas desulfurization, fuel switching to low sulfur oil and natural gas, etc Dissert Abstr

N82-12657*# Mechanical Technology, Inc., Latham, N Y
ELECTRIC AND HYBRID VEHICLES ENVIRONMENTAL CONTROL SUBSYSTEM STUDY Final Technical Report
15 May 1981 288 p refs Sponsored in part by DOE Prepared for JPL
(Contract JPL-955682)
(NASA-CR-164995, JPL-9950-570, MTI-81TR36) Avail NTIS HC A13/MF A01 CSCL 13B

An environmental control subsystem (ECS) in the passenger compartment of electric and hybrid vehicles is studied Various methods of obtaining the desired temperature control for the battery pack is also studied The functional requirements of ECS equipment is defined Following categorization by methodology, technology availability and risk, all viable ECS concepts are evaluated Each is assessed independently for benefits versus risk, as well as for its feasibility to short, intermediate and long term product development. Selection of the preferred concept is made against these requirements, as well as the study's major goal of providing safe, highly efficient and thermally confortable ECS equipment S L

N82-12658*# TRW, Inc., McLean, Va Energy Systems Planning Div
ELECTRIC AND HYBRID VEHICLE ENVIRONMENTAL CONTROL SUBSYSTEM STUDY Final Report
Kenneth L. Heitner 4 Dec. 1980 198 p refs Sponsored in part by DOE Prepared for JPL
(Contract JPL-955683)
(NASA-CR-164996, JPL-9950-569; Rept-97649-E005-UX-02) Avail: NTIS HC A09/MF A01 CSCL 13B

An environmental control subsystem (ECS) in electric and hybrid vehicles is studied. A combination of a combustion heater and gasoline engine (Otto cycle) driven vapor compression air conditioner is selected The combustion heater, the small gasoline engine, and the vapor compression air conditioner are commercially available. These technologies have good cost and performance characteristics. The cost for this ECS is relatively close to the cost of current ECS's Its effect on the vehicle's propulsion battery is minimal and the ECS size and weight do not have significant impact on the vehicle's range S.L

N82-12660# Aerospace Corp., Germantown, Md
ENERGY TECHNOLOGIES AND THE ENVIRONMENT. ENVIRONMENTAL INFORMATION HANDBOOK
Jun 1981 515 p refs
(Contract DE-AT03-76EV-74010)
(DE81-029809, DOE/EP-0026) Avail NTIS HC A22/MF A01

Information on the environmental consequences of energy technologies that will be in use during the next 20 years are reviewed. Information on environmental issues, control technologies, and energy production and conservation processes is discussed References are given for the statements, data, and conclusions Environmental aspects of energy technologies and references that can be relied upon through changing policies and changing world energy prices are presented. DOE

N82-12661# Bioassay Systems Corp., Woburn, Mass
DEVELOPMENT OF TESTING PROCEDURES AND BIBLIOGRAPHIC INFORMATION RELEVANT TO THE TESTING OF SOLID WASTES RESULTING FROM SYNTHETIC FUELS PRODUCTION Progress Report, 1 Apr. - 30 Jun. 1981
J M Smith and D. M Hanson Jun 1981 17 p refs
(Contract DE-AC22-80PC-30098)
(DE81-030822, DOE/PC-30098/T2) Avail NTIS HC A02/MF A01

The data tables outlining which bioassay procedures were applied to various synfuel wastes were finalized Justification for each of the assays (Health and Ecological Effects) proposed in the test battery were written In addition, the extraction and assay schedules were developed for Task 3 DOE

N82-12667# Energy and Environmental Analysis, Inc., Arlington, Va
IMPACT OF FUEL-ECONOMY SHORTFALL: TRENDS IN TECHNOLOGY-WEIGHTED EPA VERSUS ON-ROAD MPG. PERIODIC ANALYSIS MEMORANDUM NO. 1

1 Apr 1981 23 p refs
(Contract DE-AC01-79PE-70032)
(DE81-030841, DOE/PE-70032/T1) Avail NTIS HC A02/MF A01

The fuel consumption impacts of revised estimates of the shortfall between the EPA-measured and on-road fuel economy of light-duty vehicles (passenger cars and light-duty trucks less than 8500 lbs GVW) are examined The analysis uses the DOE Highway Fuel Consumption model to project fuel demand The technologies and technology-specific shortfall relations are examined The procedure used to develop aggregate technology-weighted fuel economy shortfall relations for the Highway Fuel Consumption model is outlined The fuel demand impacts of alternative assumptions regarding technology-specific shortfall are compared DOE

N82-12671# Aerospace Corp, Germantown, Md
TECHNOLOGY CHARACTERIZATIONS: ENVIRONMENTAL INFORMATION HANDBOOK, SECOND EDITION
Jun 1981 340 p refs
(Contracts DE-AT03-76EV-74010, DE-AC01-81EV-10450)
(DE81-029993, DOE/EP-0028) Avail NTIS HC A15/MF A01

Environmental characterization information for a range of energy supply systems is presented Environmental residuals and physical resource requirements are the principal information provided The specific energy technologies included are nuclear, petroleum, natural gas, synthetic fuels, coal, solar, geothermal, and hydroelectric Each technology is characterized in terms of the resources required, costs, residuals released, energy products, and occupational safety and health data The information is based on a facility of particular size and design, with the data presented on the basis of annual quantities or total facility lifetime quantities (e g , construction materials), as appropriate In addition, the data are normalized to 1 trillion Btu energy output to facilitate cross technology comparison and use of the data in computerized data bases DOE

N82-12673# Bioassay Systems Corp, Woburn, Mass
DEVELOPMENT OF TESTING PROCEDURES AND BIBLIOGRAPHIC INFORMATION RELEVANT TO THE TESTING OF *SOLID WASTES RESULTING FROM SYNTHETIC-FUELS* PRODUCTION Technical Progress Report, 30 Dec. 1980 - 31 Mar. 1981
James M Smith and Douglas M Hanson Mar 1981 25 p refs
(Contract DE-AC22-80PC-30098)
(DE81-030671, DOE/PC-30098/T1) Avail. NTIS HC A02/MF A01

A bibliography containing over 80 references on material pertinent to the biological testing of snyfuel products is presented along with a compedium of information on bioassays performed on all synfuel materials within the last ten years A sample preparation procedure useful in extracting substances for bioassay testing and a bioassay test battery suitable for testing synfuel solid wastes are described DOE

N82-12674# Oak Ridge National Lab, Tenn Chemical Technology Div
KINETICS OF WET OXIDATION OF BIOLOGICAL SLUDGES FROM COAL-CONVERSION WASTEWATER TREATMENT
R K Helling, M K Strobel, and R J Torres Sep 1981 55 p refs
(Contract W-7405-eng-26)
(DE82-000525, ORNL/MIT-332) Avail NTIS HC A04/MF A01

Combustible organics in aqueous solutions or suspensions, which are characteristic of waste aqueous solutions or suspensions, which are characteristics of waste treatment effluent from coal liquefaction, may be treatable by wet oxidation The wet oxidation of model compounds (phenol in water or phenol in municipal waste sludge) in a batch autoclave reactor was found to proceed rapidly to 99% conversion in less than 15 min for temperatures between 185 and 2300C, oxygen pressures between 2000 and 1300 psig, and initial phenol concentrations of 2 5, 10, and 50 g/L The reaction occurs in three phases a slow induction period, a fast first-order reaction with a low activation energy of 4 9 kcal/gmol, followed by a slow first-order reaction During the reaction a variety of colored intermediates (catechol, succinic acid, hydroquinine) form It is postulated that the fast portion of the reaction sequence follows free-radical mechanism DOE

N82-12675# Zawadzki (Edward A) Ltd, McMurray, Pa
PRELIMINARY STUDY: USE OF LOW-SULFUR COAL AND COAL CLEANING IN CONTROL OF ACID RAIN
May 1981 38 p
(Contract DE-AC21-80MC-14784)
(DE81-028930, DOE/MC-14784/T1) Avail NTIS HC A03/MF A01

The acid rain problem and the feasibility of various control techniques are addressed Two strategies that are proposed for control of acid rain, are considered, (1) use of naturally occurring low-sulfur coal, and (2) cleaning of raw coal in preparation plants prior to firing The distribution and ownership of the US coal reserves are discussed with emphasis on the reserves having low sulfur content Some of the basic constraints on the availability and use of low-sulfur coals by utilities are enumerated A preliminary estimate of the sulfur reduction potential of US coals achievable by coal preparation is presented Also included are a brief analysis of coal cleaning costs and the effects of coal cleaning on other aspects of acid rain control DOE

N82-12680# New Mexico State Univ, Las Cruces
ASSESSMENT OF WATER SUPPLY CONTAMINATION DUE TO UNDERGROUND COAL GASIFICATION
Thomas M Niemczyk and Edward A Walters Dec 1980 105 p refs Prepared in cooperation with New Mexico Univ, Albuquerque,
(PB81-209215, WRRI-128, W81-03269, OWRT-B-061-NMEX(1)) Avail NTIS HC A06/MF A01 CSCL 13B

The potential for pollution by metal ions of groundwater as a consequence of proposed underground coal gasification was assessed focusing on subbituminous coal of the San Juan Basin in northwestern New Mexico Baseline results for major and trace metal analysis of groundwater and minerals, anionic analyses, and trace organic analyses of groundwater are presented GRA

N82-12765# Oak Ridge National Lab, Tenn
OVERVIEW OF THE BIOMEDICAL AND ENVIRONMENTAL PROGRAMS AT THE OAK RIDGE NATIONAL LABORATORY
H A Pfuderer, comp and J B Moody, comp Jul 1981 62 p
(Contract W-7405-eng-26)
(DE81-027864, ORNL-5806) Avail NTIS HC A04/MF A01

Biomedical and environmental research, to provide information on environmental, health, and safety considerations, which can be utilized in the formulation and implementation of energy technology decisions is discussed Information for the understanding of short term and long term consequences of processes in new energy technologies were researched The mechanisms responsible for biological and ecological damage caused by substances associated with energy production and repair mechanisms are investigated DOE

N82-12766# Texas A&M Univ, College Station Dept of Chemistry, Medical Microbiology and Immunology
IDENTIFICATION AND TOXICITY OF FRACTIONATED-SHALE-OIL COMPONENTS
K Wittnebel, D. C Shelly, C-N Ho, I M Warner, and J M Quarles 1981 17 p refs
(Contract DE-AS05-80EV-10404)
(DE81-028460, DOE/EV-10404/T1) Avail NTIS HC A02/MF A01

A procedure for the separation and identification of polynuclear aromatic hydrocarbons (PNAs) is presented This procedure comprises two steps First, the shale oil is separated into fractions according to ring size on a Chromosorb LC-9 normal phase column Then each of these fractions are separated into individual components and identified using an analytical reversed-phase Ultrasphere ODS 5 micrometer column In addition, toxicity studies are carried out on each fraction obtained from the amine column to indicate which class of PNAs warrants special attention and analysis The results of this approach are reported TM

N82-12842# Brookhaven National Lab, Upton, N Y
PROJECT IMPACT ANALYSIS AS AN OPTIMAL CONTROL

PROBLEM
G. Anandalingam 1981 43 p refs Presented at the Joint Meeting of the Inst of Management Sci and Operations Res Soc., Toronto, 3-6 May 1981
(Contract DE-AC02-76CH-00016)
(DE81-028465, BNL-29881, CONF-810542-5) Avail NTIS HC A03/MF A01

The effects of a major investment project on a multi-sector less developed economy are analyzed Single investment projects with external effects reaching across the entire economy are frequently encountered in developing countries The Mahaweli Ganga development project in Sri Lanka, a multi-dam irrigation and hydroelectric power project is evaluated The Mahawell project calls for an annual investment level, in 1970 prices, of $150 million over a period of six years, which is 50 percent of the annual expenditure of the government The project requires a large fraction of total investment over a medium term planning period and materially alters the existing supply and demand for major goods and services The project is sufficiently large that its effect is economy-wide The model used is a dynamic input-output optimizing model having the mathematical structure of an optimal control problem DOE

N82-12924# Oak Ridge National Lab., Tenn
LOW-LEVEL RADIOACTIVE WASTE: AN INTRODUCTORY OVERVIEW
H W Godbee and A H Kibbey 1981 9 p Presented at the ASME Short Course on Radioactive Waste Management for Nucl Power Reactors and Other Facilities, Alexandria, Va., 13-17 July, 1981
(Contract W-7405-eng-26)
(DE81-026334, CONF-810733-1) Avail. NTIS HC A02/MF A01

In 1980, the accumulated volume of buried low-level waste (LLW) in the United States amounted to over 92,000 cu m Of this, 49,700 cu m was attributed to the US commercial fuel cycle, 36,400 cu m to institutional and industrial, and 76,300 cu m to government activities. In addition, there was another 6500 cu m of LLW sent to commercial burial grounds from government agencies or other licensed activities (e g , fabrication of fuel for foreign reactors) If no more land is licensed for commercial burial, Barnwell with its limited waste acceptance will be the only site still operating in the year 2000. Of the DOE sites, only NTS and Hanford will have ample land All the other principal DOE sites except LASL will be exhausted and this site will have about 7 of usable land left DOE

N82-13014# Systems Control, Inc., West Palm Beach, Fla Technology Industries Div
ANALYSIS OF INTEGRATED FUEL-EFFICIENT, LOW-NOISE PROCEDURES IN TERMINAL-AREA OPERATIONS
J B McKinley Jan 1981 125 p refs
(Contract DE-AC01-80CS-50141)
(DE81-029833; DOE/CS-50141/T1) Avail NTIS HC A06/MF A01

The specific aviation energy conservation issues, terminal area fuel conservation and airport noise level relationships, are investigated The potential fuel savings and noise level reduction in the Los Angeles International (LAX) terminal area between 1980 and 1990 attributable to compliance with the noise requirements of FAR Part 36 were quantified These savings are due to the retiring, retrofiting and re-engining of older narrow-body aircraft (DC-8, B707, etc) and the growth of wide body aircraft operations (DC-10, B747, B767, etc) Current noise abatement procedures that could be relaxed without adversely impacting current (1980) noise levels, and at the same time conserving additional fuel Two FAA computer models were used The Integrated Noise Model (INM) Version 2 7, was used for noise analysis, and INKMOD, a preliminary fuel burn model, for the fuel analysis The results of this detailed analysis revealed that due to the changing aircraft mix at LAX to include more wide body aircraft and fewer narrow body aircraft operations, airport noise level will decrease by 8 5 and 9 2 square miles on the 75 Ldn contour for 1985 and 1990, respectively, from the 1980 baseline DOE

N82-13018# Corporate-Tech Planning, Inc., Waltham, Mass
AUGMENTATION OF RESEARCH AND ANALYSIS CAPABILITIES FOR TIMELY SUPPORT OF AUTOMOTIVE FUEL ECONOMY ACTIVITIES. VOLUME 1: SUMMARY Final Report, Dec. 1977 - Nov. 1979
Theodore Taylor, Jr Dec 1980 43 p 3 Vol
(Contract DOT-HS-7-01789)
(PB81-219479, DOT-HS-805903) Avail NTIS HC A03/MF A01, also available in set of 3 reports HC E15 as PB81-219461 CSCL 13F

A series of research tasks were undertaken to assess the potential fuel economy improvements for passenger cars and light trucks during the 1980 to 1985 time frame, and later to 1990 Specific subject areas of investigation include. spark ignition engine improvements, fuel economy potential of alternate engines; reductions in tire rolling resistance, aerodynamic drag, and engine friction (through improved lubricants), weight reduction of domestic and certain import passenger vehicles, including a teardown of a Chrysler - Dodge Omni for an analysis of materials and weight and a technology assessment of carbon composites as a future substitute materials Manufacturing and consumer costs for the fuel economy improvement areas identified, identification of unregulated diesel emission problem areas in need of research and a determination of the cost benefits of petroleum conservation by means other than fuel economy standards are included. GRA

N82-13019# Corporate-Tech Planning, Inc., Waltham, Mass
AUGMENTATION OF RESEARCH AND ANALYSIS CAPABILITIES FOR TIMELY SUPPORT OF AUTOMOTIVE FUEL ECONOMY ACTIVITIES. VOLUME 2: APPENDICES A THROUGH C Final Report
Theodore Taylor, Jr Dec 1980 220 p 3 Vol
(Contract DOT-HS-7-01789)
(PB81-219487, DOT-HS-805904) Avail NTIS HC A10/MF A01, also available in set of 3 reports HC E15 as PB81-219461 CSCL 13F

The potential fuel economy improvements for passenger cars and light trucks during the 1980 to 1985 time frame, and later to 1990 were assessed Automotive technology, product planning, manufacturing costs and transportation energy economics were addressed. Tire rolling resistance, aerodynamic drag, and improved lubrications are covered along with manufacturing and consumer costs, unregulated diesel emission research, and alternate means of petroleum conservation GRA

N82-13020# Corporate-Tech Planning, Inc., Waltham, Mass.
AUGMENTATION OF RESEARCH AND ANALYSIS CAPABILITIES FOR TIMELY SUPPORT OF AUTOMOTIVE FUEL ECONOMY ACTIVITIES. VOLUME 3: APPENDIX D Final Report, Dec. 1977 - Nov. 1979
Theodore Taylor, Jr Dec 1980 204 p refs 3 Vol
(Contract DOT-HS-7-01789)
(PB81-219495; DOT-HS-805905) Avail NTIS HC A10/MF A01, also available in set of 3 reports HC E15 as PB81-219461 CSCL 13F

Alternative means of petroleum conservation were surveyed and a preliminary estimate of their possible costs and benefits was derived The potential for petroleum conservation was analyzed for each sector of the economy These include electric utilities, residential and commercial buildings, selected industries, and nonautomotive industries GRA

N82-13191# Ames Lab., Iowa
POWER-PLANT FLY-ASH UTILIZATION: A CHEMICAL-PROCESSING PERSPECTIVE
G Burnet and M J Murtha 1981 12 p refs Presented at the Portland Cement Assoc Conf on Manufacturing Process, Albuquerque, N Mex., 14-15 Jan 1981 Prepared jointly with Iowa State Univ of Science and Technology
(Contract W-7504-eng-82)
(DE81-025452, IS-M-321, CONF-810151-1) Avail NTIS HC A02/MF A01

Solid wastes from coal combustion, including fly ash, are classified as hazardous under present EPA definitions Research on fly ash utilization including extraction of metals and uses for process residues is discussed One process investigated uses a lime-soda sinter method to form soluble aluminate compounds from mixtures of fly ash, limestone, and soda ash The aluminates are extracted, treated to remove silicates, and precipitated the precipitate is calcined to metallurgical grade alumina The extract residue shows promise as a raw material for the production of Portland cement Process economics, effects of alumina and silica contents of the fly ash, sintering temperatures and time, and sales credits for by-products are discussed DOE

N82-13192# AeroChem Research Labs, Inc, Princeton, N J
RATE COEFFICIENTS OF COMBUSTION/FUEL CONVERSION REACTIONS BY HIGH-TEMPERATURE PHOTOCHEMISTRY Progress Report, 1 Sep. 1980 - 30 Jun. 1981
William Felder Jul 1981 7 p refs
(Contract DE-AC02-77ER-04169)
(DE81-027965, DOE/ER-04169/T1, AeroChem-TN-219, COO-4169-6) Avail NTIS HC A02/MF A01

Reliable kinetic data on isolated elemetary combustion reactions spanning a broad temperature range are required for modeling and scaling studies and reducing the pollutant formation from fossil-fuel burning devices A new technique, High Temperature Photochemistry (HTP) combines the technology of the High-Temperature Fast-Flow Reactors developed to study kinetics of metal atom/oxide reactions with the flash photolysis technique Aspect of a partially complete HTP study on chemical reactions CH3 oxidation by O2 and O atoms are presented DOE

N82-13243*# Engineering Societies Commission on Energy, Inc, Washington, D C
BARRIERS TO THE UTILIZATION OF SYNTHETIC FUELS FOR TRANSPORTATION Final Report
Harry W Parker and Matthew J Reilly Oct 1981 25 p
(NASA Order C-57307-D, Contract DE-AI01-81CS-50006)
(NASA-CR-165517, DOE/NASA-7307/1) Avail NTIS HC A02/MF A01 CSCL 21D

The principal types of engines for transportation uses are reviewed and the specifications for conventional fuels are compared with specifications for synthetic fuels Synfuel processes nearing the commercialization phase are reviewed The barriers to using synfuels can be classified into four groups technical, such as the uncertainty that a new engine design can satisfy the desired performance criteria, environmental, such as the risk that the engine emissions cannot meet the applicable environmental standards, economic, including the cost of using a synfuel relative to conventional transportation fuels, and market, involving market penetration by offering new engines, establishing new distribution systems and/or changing user expectations TM

N82-13255# Comptroller General of the United States, Washington, D C
NATURAL GAS PLAN NEEDED TO PROVIDE GREATER PROTECTION FOR HIGH-PRIORITY AND CRITICAL USES Report to the Congress
23 Mar 1981 57 p
(PB81-228488, EMD-81-27) Avail NTIS HC A04/MF A01 CSCL 21D

Natural gas legislation and programs implemented over the past decade and currently ongoing at the Federal, state, and local levels are discussed Some of the shortcomings, inconsistencies, and incompatibilities between legislative intent and program implementation at the various levels are highlighted GRA

N82-13256# Bechtel Power Corp, San Francisco, Calif
ENVIRONMENTAL AND ECONOMIC COMPARISON OF ADVANCED PROCESSES FOR CONVERSION OF COAL AND BIOMASS INTO CLEAN ENERGY Final Report, Sep. 1977 - Dec. 1978
R A Stenzel, B T Kown, M C Weekes, J D Ruby, B R Gilbert, C M Harper, Y G Yim, and R T Milligan Aug 1981 402 p refs
(Contract EPA-68-02-2616)
(PB81-234239, EPA-600/7-81-133) Avail NTIS HC A16/MF A01 CSCL 21D

Biomass and coal conversion into clean energy is compared on an economic and environmental basis in three regional scenarios (1) electric power from direct combustion of wood versus conventional coal combustion, (2) synthetic pipeline gas from anaerobic digestion of wheat straw and manure versus high-Btu gasification of coal (HYGAS), and (3) synthetic fuel oil from wood liquefaction versus coal liquefaction (H-Coal) Conceptual commercial-scale plants are described Capital and operating costs are presented for each of the six plants, and the biomass versus coal economics are compared General environmental impacts of biomass and coal resource collection are assessed and compared in the scenario contexts GRA

N82-13263# California Univ, Livermore Lawrence Livermore Lab
ULTIMATE IN BUILDING ENERGY ANALYSIS: DOE-2 AND BLAST
B D Hunn 1981 33 p refs Presented at the Symp Energy and Big Building Design, Philadelphia, 25-26 May 1981 Submitted for publication
(Contract W-7405-eng-36)
(DE81-028703, LA-UR-81-2288, CONF-8105107-1) Avail NTIS HC A03/MF A01

The DOE-2 and BLAST computer programs are investigated in terms of their usefulness in building energy analysis DOE-2 and BLAST are generally classed as high-level, computer-dynamic methods that are based on hour-by-hour computation The characteristics of DOE-2 and BLAST are discussed with emphasis on their solar simulation features, and their capabilities are contrasted and related Typical applications of the programs to the retrofit of existing buildings and the design of new buildings, are presented The passive solar retrofit of an office building, the use of DOE-2 as a predesign analysis tool, and the use of BLAST in a research and development application are all described Future directions in research and development needs for high level building energy analysis tools and the progress being made toward increased use of these tools are discussed DOE

N82-13267# Connecticut Dept of Transportation, Wethersfield
CONSTRUCTION OF A RECYCLED PORTLAND CEMENT CONCRETE PAVEMENT Construction Report, Oct. 1979 - May 1980
Keith R Lane Sep 1980 43 p refs
(HPR Proj 646)
(PB81-233553, FHWA/CT-80/12, Rept-646-1-80-12) Avail NTIS HC A03/MF A01 CSCL 13B

Connecticut's first experience with Portland cement concrete recycling is described The test location was on I-84 in Waterbury, a major expressway which required extensive realignment and widening The primary concern was to obtain the technical expertise to design and place a recycled pavement Secondary factors also investigated were the analysis of environmental, economic and energy factors relative to the option of recycling or new construction of a portland cement concrete pavement GRA

N82-13392# Foster-Miller Associates, Inc, Waltham, Mass
DESIGN AND DEVELOPMENT OF A RECIPROCATING LOW-TEMPERATURE FREON EXPANDER
S. J Hynek, A C Harvey, R L Demler, D H Walker, and H H Fuller 1981 17 p Presented at the Inter-Soc Energy Conversion Eng Conf, Atlanta, 9-14 Aug 1981
(Contract W-7405-eng-26)
(DE81-028609, CONF-810812-34) Avail NTIS HC A02/MF A01

The design and development of a 20-ton refrigeration system to be powered by 140 F waste hot water is described The system consists of a Rankine cycle driving a reverse-Rankine cycle, integrated in that they share a common working fluid, a common condenser, and a common crankcase housing the expander and compressor A reciprocating single-acting counterflow expander provides a combination of high efficiency in the desired capacity range, modularity, and adaptability to existing compressors Because the temperatures and pressures of the Rankine cycle fell within the design envelope of a standard refrigeration compressor, the compressor and expander could be housed within the same crankcase by converting some of the compressor cylinders to expander cylinders by replacing the cylinder heads DOE

N82-13435# Department of Energy, Bartlesville, Okla
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES, THIRD SERIES: 1977 CHRYSLER 318 CID (5.2L), 2V Interim Report
D E Koehler, W F Marshall, and K R. Stamper Jun. 1981 60 p
(PB81-233025, DOT-TSC-NHTSA-81-6; BETC/OP-79/2; DOT-HS-805814, Rept-13) Avail NTIS HC A04/MF A01 CSCL 21G

Dynamometer tests of a 1977 Chrysler 318 CID engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, oxides of nitrogen) at steady state engine operating modes were performed Engine performance data for estimating emissions and fuel economy for varied engine service and duty were obtained Basic engine characteristic data required as

input for engineering calculations involving ground transportation are provided. GRA

N82-13489# Bureau of Mines, Pittsburgh, Pa Research Center
SUPPRESSION OF COAL DUST EXPLOSION BY WATER BARRIER IN A CONVEYOR BELT ENTRY
I Liebman and J K Richmond Jun 1981 34 p refs
(PB81-233306, BM-RI-8538) Avail NTIS HC A03/MF A01 CSCL 08I

Experiments on coal dust explosion suppression were conducted in a simulated working mine environment It was shown that a coal dust explosion can be readily initiated in a conveyor belt entry and the explosion can spread into adjacent entries through opened crosscuts to propagate for long distances even though the adjacent entries are rock ducted Passive water barriers are effective in suppressing explosions on a beltway, however, barrier efficiency is reduced by opened crosscuts It is indicated that the beltway barrier should have continuous rows of water filled tubs covering long distances along the entry GRA

N82-13493*# Jet Propulsion Lab, California Inst of Tech, Pasadena
A PRELIMINARY ESTIMATE OF FUTURE COMMUNICATIONS TRAFFIC FOR THE ELECTRIC POWER SYSTEM
Roger M Barnett 15 Oct 1981 73 p refs
(Contracts NAS7-100, DE-AI01-79ET-29372)
(NASA-CR-165015, JPL-Pub-81-41, DOE/ET-29372/2) Avail NTIS HC A04/MF A01 CSCL 10B

Diverse new generator technologies using renewable energy, and to improve operational efficiency throughout the existing electric power systems are presented A description of a model utility and the information transfer requirements imposed by incorporation of dispersed storage and generation technologies and implementation of more extensive energy management are estimated An example of possible traffic for an assumed system, and an approach that can be applied to other systems, control configurations, or dispersed storage and generation penetrations is provided E A K

N82-13512# Applied Physics Lab, Johns Hopkins Univ, Laurel, Md
ALTERNATE HYBRID POWER SOURCES FOR REMOTE SITE APPLICATIONS Final Report, Feb. 1980 - Feb. 1981
W Richard Powell, Robert J Taylor, J L Baron, E E Mengel, and J C Ray Feb 1981 229 p refs
(Contracts N00024-78-C-5384, MIPR-Z-70099)
(AD-A099471, USCG-D-06-81) Avail NTIS HC A11/MF A01 CSCL 10/2

Operation of diesel electric generators at remote Coast Guard sites are discussed The electric power required by modules and subsystems in a modern lighthouse was investigated The availability of wind power, solar energy, and other renewable energy sources in the local environment at remote lighthouses and other sites is discussed A life cycle cost analysis methodology applicable to continuously variable life expectancies is developed and illustrated Diesel generator costs, including service visit expenses, are modeled Other factors relating to the analysis of alternate energy systems as supplements to diesel electric generators at remote sites are discussed Author

N82-13522# Department of Energy, Oak Ridge, Tenn. Technical Information Center
INFORMATION RESOURCES IN THE USA ON NEW AND RENEWABLE ENERGY, A DESCRIPTION AND DIRECTORY
1 Jun 1981 81 p Presented at the United Nations Conf, Nairobi, Kenya, Aug 1981
(DE81-028867; CONF-810802-2) Avail: NTIS HC A05/MF A01

The production dissemination, and availability of US scientific and technical information about new and renewable energy resources, the policy framework within which the technologies are developed, and the roles of public and private sectors are reported. A directory of sources of additional information, printed material, computerized data bases, institutional services, personal contacts, about the use of new and renewable energy is included DOE

N82-13523# Oak Ridge National Lab, Tenn Energy Div
ANNUAL CYCLE ENERGY SYSTEM EXPERIMENTAL PERFORMANCE AND NATIONAL APPLICABILITY
Van D Baxter 1981 6 p refs Presented at the IECEC Conf, Atlanta, 9 Aug 1981 Submitted for publication
(Contract W-7405-eng-26)
(DE81-028570, CONF-810812-32) Avail NTIS HC A02/MF A01

The energy conserving potential of the annual cycle energy system (ACES) was demonstrated The performance of the ACES was compared with that of two different air to air heat pumps in an identical house, the control house The ACES achieved nearly all of its theoretical performance predictions and verified its design criteria The system delivered residential heating and cooling services while consuming only 57 percent as much electricity as the best conventional alternative tested Computer studies show the ACES to be applicable to all US climatic zones except those with very low heating needs DOE

N82-13525# South Carolina Energy Research Inst, Columbia
RESIDUAL-ENERGY-APPLICATIONS PROGRAM ENVIRONMENTAL ANALYSIS REPORT
Torgny J Vigerstad and F J McCrosson Oct 1980 48 p refs
(Contract DE-AC09-77ET-12866)
(DE81-027538, DOE/ET-12866/5) Avail NTIS HC A03/MF A01

Environmental analysis performance support of a facility to test industrial scale waste heat recovery equipment and utilization are documented Topics covered include legal requirements, likely sites, and operating characteristics of equipment to be tested Environmental issues surrounding the use of the P-reactor and Par Pond as sources of heating and cooling water are addressed The Par Pond cooling system is considered for siting of the Energy Applied Systems Tests (EAST) Facility The Par Pond system has the potential to confine all potential environmental impacts of the construction and operation of the EAST Facility within the boundaries of the Savannah River Plant Characteristics of the EAST Facility are described and a general description of Par Pond is given DOE

N82-13535# Pacific Northwest Lab, Richland, Wash
TECHNOLOGY ASSESSMENT OF SOLAR ENERGY SYSTEMS: AVAILABILITY AND IMPACTS OF WOODY BIOMASS UTILIZATION IN THE PACIFIC NORTHWEST
W J Hopp, A D Chockie, and K J Allwine Sep 1981 57 p refs
(Contract DE-AC06-76RL-01830)
(DE82-000705, PNL-3933) Avail NTIS HC A04/MF A01

The biomass resource base in the Northwest were estimated Scenarios and a preliminary analysis in the collection and use of forest residues as an energy resource are presented Four issues that may serve to constrain the total amount of wood residues available for use as fuel are reviewed DOE

N82-13536# Oak Ridge National Lab, Tenn Energy Div
BUILDING A CONSENSUS ABOUT ENERGY TECHNOLOGIES
T J Wilbanks Sep 1981 12 p refs
(Contract W-7405-eng-26)
(DE82-000501, ORNL-5784) Avail NTIS HC A02/MF A01

The making and sustaining of major energy policy decisions are considered The major policy alternatives for making energy decision-making more effective are outlined The focus is on relatively large decisions about energy technologies The policy alternatives are characterized as being either focused on technology or on social action Technology focused options include technology choices and improvements Social action focused options include information, incentives, legitimacy, and institutional changes But it is clear that they pose several basic philosophical questions, such as whether to base decisions on strong central leadership or on broad consensus formation And it is clear that the options vary in being best suited for business as usual situations or emergency decision making situations DOE

N82-13539# Midwest Research Inst, Golden, Colo Solar Energy Research Inst
NEW AND RENEWABLE ENERGY IN THE UNITED STATES OF AMERICA
Jun. 1981 115 p To be presented at the 1981 United Nations

Conf on New and Renewable Sources of Energy Sponsored in part by the State Dept
(Contracts EG-77-C-01-4042, DE-AC02-77CH-00178)
(DE81-030887, DOE/S-00012) Avail NTIS HC A06/MF A01

The current technical and economic status of technologies and with and expectations for new and renewable energy sources in the United States are described The roles of the public and private sectors in developing and using these energy sources are outlined Specific technologies discussed are low, intermediate, and high temperature solar collectors, biomass, wind, and ocean energy systems, hydropower, geothermal systems, oil shale, and tar sands DOE

N82-13547# Horstmann G m b H , Heiligenhaus (West Germany)
A CENTRAL MICROPROCESSOR CONTROLLED ELECTRICAL STORAGE HEATING SYSTEM Final Report
Hendrik Horstmann Bonn Bundesministerium fuer Forschung und Technologie Dec 1980 26 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-182, ISSN-0340-7608) Avail NTIS HC A03/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 5,50

The use of a microprocessor to control the reloading of electrical storage heaters not only during the night, but whenever the electrical grid is cycled down, was tested The test setup, used to control a total of about 10 MW installed storage heating in 96 dwellings, is described It is demonstrated that additional consumers can be connected to the system without demand for more power stations Author (ESA)

N82-13553# Finnish Meteorological Inst , Helsinki
SULFUR IN THE AIR IN THE CAPITAL (HELSINKI) METROPOLITAN AREA: ITASAT-PROJECT Final Report [PAEAEKAUPUNKISEUDUN ILMAN RIKKI ITASAT-PROJEKTIN LOPPURAPORTTI]
Markku Wallin, Eija Lumme, Markku Hietamaeki, and Erkki Rantakrans 1981 86 p refs In FINNISH
(RR-614 71) Avail NTIS HC A05/MF A01

Methods for regionally producing and processing information about air quality, air protection measures, and determining alternative examples for air protection solutions are assessed The sulfur dioxide content of air is predicted The effects of various air protection measures and their cost (flue gas desulfurization, use of low sulfur heavy fuel oil) are compared S L

N82-13558# Oak Ridge Associated Universities, Tenn Inst for Energy Analysis
RESPONSE OF THE OCEANS TO INCREASING ATMOSPHERIC CARBON DIOXIDE
C F Baes, Jr Aug 1981 72 p refs
(Contract DE-AC05-76OR-00033)
(DE81-028178, ORAU/IEA-81-6(M)) Avail NTIS HC A04/MF A01

The relevant physical and chemical features of the ocean, the observational evidence of its response to increasing atmospheric carbon dioxide, and the uncertainties involved in modeling this response are considered The deep oceans are near saturation with calcite The pressure dependence of this solubility and ocean circulation produces calcite supersaturation of the upper ocean This condition is maintained by photosynthesis and the biogenically controlled precipitation of calcium carbonate After correcting the effects of biological processes on the composition of seawater, it is evident that the increasing carbon dioxide content of the atmosphere affects the distribution of carbon in the upper ocean DOE

N82-13559# Mathtech, Inc , Princeton, N J
ENVIRONMENTAL IMPACTS OF ENERGY TRANSPORTATION Final Report
J P. Price Electric Power Research Inst Sep 1981 243 p refs Sponsored by Electric Power Research Inst
(EPRI Proj TPS-76-661)
(DE82-900316, EPRI-EA-2039) Avail NTIS HC A11/MF A01

The environmental impacts of fuel transportation for the electric utility industry are reviewed The transportation of coal, oil, natural gas, liquified natural gas methanol and hydrogen are covered The major impacts coal unit trains are the creation physical barriers, potential accidents, and noise It is indicated that more emphasis should be placed on the evaluation of the environmental socio-economic impacts of fuel transportation DOE

N82-13560# Oak Ridge National Lab , Tenn
CONTROL OF HYDROCARBONS AND CARBON MONOXIDE VIA CATALYTIC INCINERATION
C H Brown, Jr and J A Klein Sep 1981 113 p refs
(Contract W-7405-eng-26)
(DE82-000508, ORNL/TM-7787) Avail NTIS HC A06/MF A01

Eight commercially available incineration catalysts are evaluated experimentally to assess their application to control hydrocarbon and carbon monoxide emissions in the tail gases from a Lurgi substitute natural gas plant, which is simulated using bottled gas mixtures Catalysts are evaluated with respect to the effects of temperature, space velocity, and the presence of hydrogen sulfide and carbonyl sulfide on hydrocarbon and carbon monoxide conversion The most effective catalysts are a precious metal based catalyst on a monolithic substrate and a nonprecious metal oxide deposited on a solid substrate formed into 3 2 mm diameter spheres DOE

N82-13565# Los Alamos Scientific Lab , N Mex
ENVIRONMENTAL AND RADIOLOGICAL SAFETY STUDIES: INTERACTION OF (238) PuO2 HEAT SOURCES WITH TERRESTRIAL AND AQUATIC ENVIRONMENTS Quarterly Progress Report, 1 Jan. - 31 Mar. 1981
Glenn R Waterbury (comp) Sep 1981 42 p refs
(Contract W-7405-eng-36)
(DE81-032019, LA-8932-PR) Avail NTIS HC A03/MF A01

The effects on the heat source of terrestrial and aquatic environments to obtain data for design of even safer systems were studied Data obtained in several ongoing experiments are presented and include data from environmental chamber experiments that simulate terrestrial conditions, experiments to measure PuO2 dissolution rates, soil column experiments to measure sorption of plutonium by soils, and aquatic experiments DOE

N82-13566# Pacific Northwest Lab , Richland, Wash
TREATMENT OF BIOMASS GASIFICATION WASTEWATERS USING REVERSE OSMOSIS
S E Petty, S D Eliason, and M M Laegreid Sep 1981 44 p refs
(Contract DE-AC06-76RL-01830)
(DE82-000698, PNL-4018) Avail NTIS HC A03/MF A01

Reverse osmosis (RO) as a treatment technology for the removal of organics from biomass gasification wastewaters (BGW) generated from an experimental biomass gasifier was evaluated Since RO is normally considered a complementary treatment technology, wastewaters were pretreated by biological or wet air oxidation (WAO) processes This membrane is similar to the NS-100, a membrane which is effective in the separation of organics from solution Separation of organics from solution was determined by COD removal Membrane degradation was observed when using full strength and WAO pretreated feeds, but not when using feeds that had undergone biological pretreatment Color removal was computed for the majority of experiments completed DOE

N82-13567# Pacific Northwest Lab , Richland, Wash
TREATMENT OF BIOMASS-GASIFICATION WASTEWATERS BY WET-AIR OXIDATION
C J English Sep 1981 30 p refs
(Contract DE-AC06-76RL-01830)
(DE82-000935, PNL-4013) Avail NTIS HC A03/MF A01

Production of synthetic natural gas from gasification of biomass results in the generation of a high strength wastewater that is difficult to treat by conventional means The use of wet air oxidation (WAO) as a treatment method for wastewaters was studied It is suggested that oxidation of biomass gasification wastewaters (BGW) organics by WAO occurs in a stepwise fashion with large organic molecules first beng hydrolyzed and then partially oxidized to low molecular weight intermediates Complete oxidation of these intermediates is more difficult and most easily accomplished at high reaction temperatures The best application of WAO to treatment of BGW appears to be as a pretreatment to biological treatment DOE

N82-13573# National Oceanic and Atmospheric Administration, Boulder, Colo Office of Weather Research and Modification
ENVIRONMENTAL EFFECTS OF POLLUTANTS FROM COAL COMBUSTION. 2: THE COLSTRIP, MONTANA POWER PLANT
C C VanValin, R F Pueschel, and D L Wellman Apr 1981 70 p refs 2 Vol
(Contract EPA-IAG-D5-E693)
(PB81-234114, NOAA-TM-ERL-OWRM-3, NOAA-81062609) Avail NTIS HC A04/MF A01 CSCL 13B

Aerosol samples from the plume of a power plant were analyzed for the presence of sulfates and nitrates with the transmission electron microscope using the BaCl2 and Nitron tests Plume profile were measured for width and thickness Tracking of the plume of the Colstrip power plant plume with the aircraft provided plume trajectories that were influenced by the underlying terrain by being diverted by as much as 20 from the wind direction at plume altitude, or by being ducted along a valley It is indicated that there is no difference in ice nucleus concentrations between plume and ambient atmosphere, and the latter shows an increase of an order of magnitude GRA

N82-13576# Research Triangle Inst, Research Triangle Park, N C.
ENVIRONMENTAL HAZARD RANKINGS OF POLLUTANTS GENERATED IN COAL GASIFICATION PROCESSES Final Report, Feb. - Apr. 1980
J G Cleland Jun 1981 400 p refs
(Contract EPA-68-02-3170)
(PB81-231698, EPA-600/7-81-101) Avail NTIS HC A17/MF A01 CSCL 13B

An evaluation and ranking of environmental hazards associated with coal gasification is reported Applied chemical analytical data were provided by (1) research with an experimental gasifier, and (2) sampling of four commercial gasification processes Gas, liquid, tar, and solid streams were analyzed for 300 substances Hazard potential was measured Coals tested range from lignite to anthracite Approximately 50 representative pollutants are emphasized and ranked according to relative environmental hazard potential GRA

N82-13607# National Oceanic and Atmospheric Administration, Boulder, Colo Office of Marine Pollution Assessment
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF: ANNUAL REPORTS OF PRINCIPAL INVESTIGATORS FOR THE YEAR ENDING MARCH 1980. VOLUME 5: HAZARDS Annual Report
Feb 1981 665 p refs Sponsored in part by the Bureau of Land Management
(PB81-225732, NOAA-81052107) Avail NTIS HC A99/MF A01 CSCL 08G

Hazards caused by the environmental conditions are reported Environmental pollution resulting from the development of oil and gas resources in Alaskan waters was investigated T M

N82-13652# Oak Ridge National Lab, Tenn
HEALTH AND SAFETY RESEARCH DIVISION Progress Report 1 Oct. 1979 - 31 Mar. 1981
Aug 1981 109 p refs
(Contract W-7405-eng-26)
(DE81-026088, ORNL-5750) Avail NTIS HC A06/MF A01

Progress in health and safety research is reported A summary of the major fields covered includes basic research in physical sciences, life sciences research and assessment, and multidisciplinary studies on the impact of alternative energy technology and policy options E.A.K

N82-13981*# Jet Propulsion Lab, California Inst of Tech, Pasadena
CONTROLLED SPEED ACCESSORY DRIVE DEMONSTRATION PROGRAM
Frank W Hoehn 15 Oct 1981 105 p refs
(Contracts NAS7-100, DE-AI01-80CS-50194)
(NASA-CR-165010, JPL-Pub-81-83) Avail NTIS HC A06/MF A01 CSCL 13F

A Controlled Speed Accessory Drive System was examined in an effort to improve the fuel economy of passenger cars Concept feasibility and the performance of a typical system during actual road driving conditions were demonstrated The CSAD system is described as a mechanical device which limits engine accessory speeds, thereby reducing parasitic horsepower losses and improving overall vehicle fuel economy Fuel consumption data were compiled for fleets of GSA vehicles Various motor pool locations were selected, each representing different climatic conditions On the basis of a total accumulated fleet usage of nearly three million miles, an overall fuel economy improvement of 6 percent to 7 percent was demonstrated Coincident chassis dynamometer tests were accomplished on selected vehicles to establish the effect of different accessory drive systems on exhaust emissions, and to evaluate the magnitude of the mileage benefits which could be derived J M S

N82-13984# Smith (Wilbur) and Associates, New York
MEASURES OF EFFECTIVENESS OF TRANSPORTATION SYSTEMS MANAGEMENT Final Report
Apr 1981 43 p refs Prepared jointly with Tri-State Regional Planning Commission
(PB81-233884, UTMA-IT-09-00890-81-1) Avail NTIS HC A03/MF A01 CSCL 13B

The basic concepts of transportation systems management (TSM) by providing simple classification schemes, geographic conditions of applicability, relative measures of effectiveness, and techniques for quantification were developed Two key elements are emphasized coordination of transportation activities, and maximization of efficiency and productivity Some of the findings reported are (1) traffic engineering improvements, (2) demand management measures achieve reductions in vehicle miles of travel, and (3) bus lanes and priority entry treatments GRA

N82-13985# Aerospace Corp, El Segundo, Calif Environment and Energy Conservation Div
EVALUATION OF TECHNIQUES FOR REDUCING IN-USE AUTOMOTIVE FUEL CONSUMPTION Final Report, Jun. 1976 - Mar. 1978
L Forrest, W B Lee, and W M Smalley Apr 1981 330 p refs Prepared in cooperation with Transportation Systems Center
(Contract F04701-77-C-0078)
(PB81-233298, DOT-TSC-NHTSA-81-13, DOT-HS-805833) Avail NTIS HC A15/MF A01 CSCL 13F

Techniques for reducing fuel consumption in the light duty road vehicle fleet are assessed Modification of vehicles, modification of traffic flow, and modification of driver behavior are considered Factors included in the evaluation are fuel economy effects, safety impacts, availability for fleet implementation, and unit price In addition, the implementation of each technique is assessed with regard to number of vehicles impacted, fuel savings effected, national cost, potential problems, and required lead time Cost effective techniques are ranked in terms of their assessed potential for reducing fleet fuel consumption GRA

N82-13986# Transportation Systems Center, Cambridge, Mass
HIGHWAY FUEL ECONOMY STUDY Final Report, Sep. 1979 - Mar. 1981
Robert L Mason and Russell W Zub Jun 1981 155 p refs
(PB81-233850, DOT-TSC-NHTSA-81-18, DOT-HS-805873) Avail NTIS HC A08/MF A01 CSCL 13F

The fuel consumption changes attributable to speed reduction and compliance with the 55 MPH speed limit are described The effects of vehicle size and type, and driver-controllable functions on vehicle fuel economy at highway speeds are discussed Most of the analytical work is related to passenger cars and light trucks, however, medium and heavy trucks, primarily commercial in application, have been included in the highway fuel economy analyses GRA

N82-14048# California Univ, Livermore Lawrence Livermore Lab
LLNL 1981: TECHNICAL HORIZONS
Jul 1981 49 p
(Contract W-7405-eng-48)
(DE81-028265, UCRL-52000-81-7) Avail NTIS HC A03/MF A01

Research programs are described in broad terms A $481 million operating budget is projected for fiscal year 1982, up nearly 13% from last year In projects for the Department of Energy and the Department of Defense, the Laboratory applies its technical facilities and capabilities to nuclear weapons design and development and other areas of defense research that include

inertial confinement fusion, nonnuclear ordnances, and particle-beam technology LLNL is also applying its unique experience and capabilities to a variety of projects that will help the nation meet its energy needs in an environmentally acceptable manner DOE

N82-14071# Arinc Research Corp, Annapolis, Md
THE USE OF FLIGHT MANAGEMENT COMPUTERS IN AIR CARRIER OPERATIONS IN THE 1980S Interim Report
I Gershkoff Washington FAA Aug 1981 113 p refs
(Contract DTFA01-80-C-10030)
(AD-A105621, Rept-1378-11-1-2482, FAA-EM-81-10) Avail NTIS HC A06/MF A01 CSCL 09/2

The use of on-board flight management computers (FMCs) in air carrier operations has the potential for significant fuel savings This report assesses the general capabilities of the FMCs currently available From this information, economic benefits and rates at which aircraft would be equipped were developed. Minimum-cost flight profiles were analyzed for various common conditions to determine the problems associated with incorporating the capabilities of FMCs into a heavy traffic Air Traffic Control environment GRA

N82-14322# Los Alamos Scientific Lab, N Mex
CHEMICAL ELEMENT CONCENTRATIONS IN LIQUIDS AND SOLIDS ASSOCIATED WITH POWER PLANTS USING FGD SYSTEMS
Lawrence Edward Wangen and Marianne Mills Jones Aug 1981 27 p refs
(Contract W-7405-eng-36)
(DE81-030422, LA-8929-MS) Avail NTIS HC A03/MF A01

Solid and liquid process steam samples from eight power plants using wet flue gas desulfurizaton (FGD) scrubbers were analyzed for the trace elements As, B Br, Cl, Cd, Co, Cr, F, Ga, I, Mo, Ni, Pb, S, Sb, Se, Th, U V, W, and Zn as well as several major and minor elements Four plants burned high-sulfur coals and three burned low-sulfur coals One plant used a low-sulfur lignite coal Four FGD systems used limestone, two used lime, and two used alkaline flyash as scrubbing reagent Elemental concentration data were used to identify chemical elements of concern regarding their potential for causing environmental harm as a result of the disposal of residues associated with FGD systems Calcium, Mg, Mn, Ni, Se, and SO4(2-) were identified as most generally problematic The elements B, Cd, F, and Mo were judged as potentially problematic in certain situations Generally FGD liquors from power plants that burned low-sulfur western coals had highest concentrations of most trace elements DOE

N82-14398# Ministry of Housing, Ottawa (Ontario) Project Planning Branch
RESIDENTIAL SITE DESIGN AND ENERGY CONSERVATION. PART 1: GENERAL REPORT
Jan. 1981 158 p
(DE81-904010, NP-1904010-Pt-1, ISBN-0-7743-6072-0) Avail. NTIS HC A08/MF A01

The energy costs that can be saved by a subdivision design format related to energy conservation that is reasonably acceptable in marketing and aesthetic terms were determined Six subdivision layouts were designed to densities ranging from 6 5 to 13 6 units per gross acre (1058 to 2232 units) or 16 25 to 34 units per gross hectare Hourly radiation temperature, and wind charactenstics for a year constitute the local climate data base Six house types (from detached to apartment units) and seventeen basic house designs (mostly picked at random) were used The method for calculating the set heat load and an analysis of the results are presented The study shows that by way of the selection of the more energy efficient traditional house designs, orientation of buildings to maximize solar transmission, and landscaping to reduce the effect of wind, there is a possible residential space heating energy saving of up to 20% for a low density housing development T M

N82-14557# Conoco Norway, Inc, Oslo
OFFSHORE PETROLEUM INDUSTRY ENVIRONMENTAL DATA REQUIREMENTS: EMPHASIS ON REMOTE SENSING
Ronald L Gratz *In* ESA Appl of Remote Sensing Data on the Continental Shelf Jul 1981 p 31-43 refs
Avail NTIS HC A13/MF A01, ESA, Paris FF 125

Data quality and coverage requirements for the remote sensing of oceanographic and meteorological factors affecting the development of offshore hydrocarbon resources are considered, using a combination of fine-grid hindcasting and surface truth measurements The establishment of data banks able to accumulate 20-30 years of climatological data for use in future designs is recommended Special measurement programs are planned for data collection during storms Remote sensing was used to measure several factors important to the petroleum industry, i e, waves, winds, currents, and sea ice Application to weather forecasting is shown The use of surface truth data in the calibration and verification of measurements for remote sensing is suggested Possible communications channels for the exchange of remote sensing data are assessed Author (ESA)

N82-14626# Open Univ, Milton (England) Energy Research Group
THE NUCLEAR CONTROVERSY: UNEQUAL COMPETITION IN PUBLIC POLICY-MAKING
Ian Sanderson May 1980 76 p refs
(ERG-035) Avail NTIS HC A05/MF A01

The public policy making process as regards nuclear power is analized and the epistemological basis for such an analysis is examined It is asserted that disputes over the development of nuclear power are not primarily about the objective facts of the matter but rather derive from differences in basic assumptions about, and evaluatory perceptions of, society, technology and the nature of progress The balance of power in such disputes is therefore not mainly determined by the 'correctness' of the facts upon which a position rests but rather by the extent to which underlying assumptions and values accord with prevailing ideological themes A meaningful debate can be guaranteed only through the establishment of institutional structures which provide a framework of truely democratic participation and equality of power and influence M G

N82-14632*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
DESIGN OF AN ENERGY CONSERVATION BUILDING
Ronald N Jensen Nov 1981 32 p refs
(NASA-TM-83175) Avail NTIS HC A03/MF A01 CSCL 10A

The concepts in designing and predicting energy consumption in a low energy use building are summarized The building will use less than 30,000 Btu/sq ft /yr of boarder energy The building's primary energy conservation features include heavy concrete walls with external insulation, a highly insulated ceiling, and large amounts of glass for natural lighting A solar collector air system is integrated into the south wall Calculations for energy conservation features were performed using NASA's NECAP Energy Program T M

N82-14644# American Bar Association, Washington, D C Special Committee on Energy Law
NEED FOR POWER AND THE CHOICE OF TECHNOLOGIES: STATE DECISIONS ON ELECTRIC POWER FACILITIES
Jun 1981 221 p refs
(Contract DE-AC01-79RG-10004)
(DE81-025960, DOE/EP-10004/1) Avail NTIS HC A10/MF A01

The decision-making processes at the state level regarding the licensing of electric generating facilities were assessed The basic issues addressed are the need for power and choice of technology state decisions which directly influence and affect the nation's energy supply, and the tradeoffs involved in meeting energy demand The areas of special emphasis included the legal mechanisms and regulatory procedures used to determine and resolve these issues The effectiveness of state decision-making was assessed, focusing on legal and administrative histories and accommodation of interests of concerned parties Recent innovations to enhance the decision-making process were also assessed where applicable No particular substantive results are advocated in the findings The recommendations presented are broad in scope DOE

N82-14645# Natural Resources Defense Council, Inc, San Francisco, Calif
PROJECTING REGIONAL POTENTIALS FOR COST-EFFECTIVE ENERGY CONSERVATION AND RENEWABLE RESOURCE APPLICATIONS: A FEASIBILITY STUDY

1980 52 p refs
(Contract DE-FG03-79CS-10045)
(DOE/CS-10045/T3) Avail NTIS HC A04/MF A01

The feasibility is discussed of preparing an instruction manual that would enable a modeler in a particular region to set up a calculation method or predicting energy use Such a manual would concern itself primarily with the three energy-consuming sectors most relevant to utilities' demand projections Data requirements for each of the three sectors (residential, commercial, and industrial) are described and some initial guidance is provided as to how these needs can be filled The methods for separate calculations of energy consumed by each end use in each sector are described Each end use is discussed separately for the residential sector, but only in aggregate for the commercial and industrial sectors DOE

N82-14648# Purdue Univ., Lafayette, Ind Energy Policy Research and Information Program

PROGRESS REPORT TO THE DEPARTMENT OF ENERGY IN SUPPORT OF BASIC ENERGY AND POLICY RESEARCH

15 Jul 1981 326 p refs
(Contract DE-AS02-79ER-10044)
(DE81-025882, DOE/ER-10044/T1) Avail: NTIS HC A15/MF A01

Research areas include light path of carbon reduction in photosynthesis· heat transfer in coal-ash slags, mechanism of plant cell enlargement in Gymnosperms, emulsion stability in enhanced oil recovery, selective transfer phenomenon in friction and wear, conceptual design of the Purdue Compact Torus/Passive Liner Fusion Reactor, integration of farm level alcohol production consistent with the economic and labor constraints of a farming operation, and newsmedia coverage of selected energy policy proposals DOE

N82-14650# Argonne National Lab., Ill Integrated Assessments and Policy Evaluation Group

ANALYSIS OF POTENTIAL COGENERATION IMPACTS ON ELECTRICITY GENERATION BY THE CENTRAL MAINE POWER COMPANY

Jerry L Gillette and Kenneth A Hub Apr 1981 36 p refs
(Contract W-31-109-eng-38)
(DE81-029991, ANL/CNSV-TM-76) Avail. NTIS HC A03/MF A01

Two types of cogeneration design - one utilizing a backpressure turbine, the other an extraction turbine - were studied It was assumed that these facilities were constructed to produce electricity that could be sold to the electric utility The analysis included a single-year study of two different capacity-purchase options under consideration by the electric utility An extended period was also analyzed so that the effects of demand growth and additions and subtractions of capacity on the cogeneration potential could be examined It is found that some savings of oil could be realized with coal-based cogeneration, and that the quantity of such savings are somewhat dependent on the purchase option, the demand growth rate, and the cogenerator design. It is concluded that both cogenerator designs have some economic viability, but that the backpressure turbine type has a decided advantage due to its significantly lower heat rate TM

N82-14651# California Univ., Berkeley Lawrence Berkeley Lab. Energy and Environment Div

ANALYSIS OF THE ENERGY IMPACTS OF THE DOE APPROPRIATE ENERGY TECHNOLOGY SMALL GRANTS PROGRAM: METHOD AND RESULTS

Bart Lucarelli, Jeff Kessel, Josh Kay, Janet Linse, Susan Tompson, and Mark Homer Aug 1981 43 p refs
(Contract W-7405-eng-48)
(DE81-029844, LBL-12253-Rev) Avail NTIS HC A03/MF A01

Methods for assessing the energy savings of projects in the appropriate technology program (AT) and how to apply these methods to obtain estimates of energy impacts was studied Program energy savings were estimated from project savings by statistical inference Direct energy savings and methods and results of the economic analysis are discussed Indirect energy savings and program energy savings and the methods used to obtain them are estimated Improvement of project selection which increase program energy savings and two approaches for conducting future energy impact studies are presented DOE

N82-14653# Department of Energy, Washington, D C Office of Market Analysis

INTERNATIONAL ENERGY INDICATORS

R M Weiss, ed Jul 1981 30 p
(DE81-028117, DOE/IA-0010/13) Avail NTIS HC A03/MF A01

Data are presented in graphs and tables on the following world crude oil production by area, annually, 1974 through 1980, and monthly, October 1980 through April 1981, OPEC crude oil productive capacity, installed, maximum sustainable, and available, by country, world crude oil and refined product inventory levels, 1975 through 1981, oil consumption in OCED countries, 1975 through 1981, USSR crude oil production and exports, 1975 through April 1981, free world (by country) and US nuclear electricity generation, 1973 through 1980 and January to May 1981 and current capacity by country, US domestic oil supply (monthly) 1977 through 1980, US gross imports of crude oil and products, 1973 and 1974 annually, and 1975 through 1980 and monthly from January to June 1981, cost of Saudi crude oil in current and 1974 dollars from December 1974 through March 1981, US coal trade from January 1975 to March 1981, US natural gas trade from January 1975 through April 1981, summary of US merchandise trade, quarterly, from Quarter I, 1977 through Quarter I, 1981, and US energy/GNP ratio, annually, 1974 through 1980, and quarterly from 1974 through March 1981 DOE

N82-14659# Energy, Inc., Idaho Falls, Idaho

ENERGY RECOVERY FROM MUNICIPAL WASTE DEVELOPMENT PROGRAM FOR IDAHO FALLS, IDAHO Final Report

Jul 1981 155 p refs
(Contract DE-AC01-79CS-20240)
(DE81-029999, DOE/CS-20240/1) Avail NTIS HC A08/MF A01

The development of a demonstration facility to show that fluidized-bed technology is a viable means to recover resources from municipal wastes in Idaho Falls is described The tasks described include (1) evaluation of the energy market of Idaho Falls to identify potential customers for recovered energy and to determine what form of energy would be economically viable, (2) evaluation of the municipal solid waste of Idaho Falls, determining its approximate composition, heating value, production rates, and seasonal variations, (3) development of a resource recovery facility concept that will be economically attractive to the city and technically feasible, and (4) evaluation of such topics as zoning, legal limitations, and environmental aspects of the facility to determine its compatibility with the city of Idaho Falls DOE

N82-14662# California Univ., Berkeley Lawrence Berkeley Lab Energy and Environment Div

POTENTIAL ENERGY SAVINGS IN THE RESIDENTIAL SECTOR OF THE UNITED STATES

John Ingersoll Jun 1981 11 p refs Presented at the Intern Conf on Energy Use Management, West Berlin, 26-30 Oct 1981
(Contract W-7405-eng-48)
(DE81-028873, LBL-12862, CONF-811006-3) Avail NTIS HC A02/MF A01

The state-of-the-art computer program, DOE 2 1, was used to simulate the hour-by-hour thermal performance of residential buildings in the four major climate zones of the United States, and a life-cycle cost analysis was applied to determine the optimal energy requirement of a typical house demonstrate that present levels of energy consumption can be reduced by a factor of two without compromising health and comfort standards Within present technology, additional energy savings can be achieved but not yet in a cost-effective way DOE

N82-14664# Oak Ridge Associated Universities, Tenn

EDUCATION AND TRAINING IMPLICATIONS OF BIOMASS ENERGY SYSTEM USE

S E Bell, R M Gove, and J R. Little Aug 1981 44 p refs
(Contract DE-AC05-76OR-00033)
(DE81-029956, ORAU-182) Avail NTIS HC A03/MF A01

Direct observations of 189 biomass-related operations combined with existing reports, feasibility studies, and expert opinion are used to assess the education and training implications of biomass energy system use The number of permanent jobs

in activities related to biomass energy production could easily reach the hundreds of thousands by the end of the century However, national employment related to biomass energy will represent only a very small portion of the employment in any major occupational category In addition, an analysis of occupational skill requirements suggests that the impacts on education and training institutions are likely to be minimal Regional shortages could develop for foresters, forestry technicians, chemists, laboratory technicians, process operators, and certain engineers, but these are likely to be in response to economy-wide growth rather than biomass energy-related activity alone DOE

N82-14803# Battelle Pacific Northwest Labs, Richland, Wash
CARCINOGENIC EFFECTS OF COAL-CONVERSION MATERIALS
R A Renne and L G Smith Apr 1981 29 p refs Presented at the Ind Hyg and Occupational Med in Coal Conversion Proj Workshop, Washington, D C, 7 Nov 1980 Submitted for publication
(Contract DE-AC06-76RL-01830)
(DE81-028108, PNL-SA-9516, CONF-801143-2) Avail NTIS HC A03/MF A01

The correlation between mutagenesis and carcinogenesis data on complex mixtures (synfuel materials) was determined The heavy distillate is highly mutagenic compared with the other materials tested and it was also highly carcinogenic in a mouse skin painting assay The fractions, we give different results from those of the mutagenesis assays The basic tar and the neutral tar skin carcinogenesis data correlate fairly well with the mutagenesis data The need for caution against depending heavily on equating PNA content with carcinogenic activity is emphasized It is recommended that primary aromatic amines are also monitored DOE

N82-14875# University of Southern California, Los Angeles Social Science Research Inst
VALUE TREE ANALYSIS OF ENERGY SUPPLY ALTERNATIVES
William G Stillwell, Detlof vonWinterfeldt, and Richard S John Jun 1981 41 p refs
(Contract MDA903-80-C-0194)
(AD-A105629, SSRI-81-2) Avail. NTIS HC A03/MF A01 CSCL 05/10

The use of value trees in multiattribute evaluations of energy supply alternatives was examined A value tree relating general values and concerns to specific value relevant attributes was constructed to compare three energy options, nuclear, coal, and a combined geothermal and conservation package Both hierarchical and non-hierarchical weighting procedures were used to rate the energy options Several additive multiattribute models were constructed and compared with holistic rankings and ratings of the three options Three basic findings were (1) hierarchical weights were steeper than non-hierarchical weights, (2) groups identified by their holistic first choice showed substantial agreement in their assessment of attribute weights, (3) convergence of MAU model parameters resulted in a 'common model', consistent with holistic evaluations of the pro-conservation group, and generally inconsistent with those of the pro-nuclear group This differential consistency between model composites and holistic evaluations is interpreted as a result of weight parameter distortions due to social desirability and a neglect to consider attribute value ranges when making weight judgments Author

N82-14900# Teknekron, Inc, McLean, Va
ENVIRONMENTAL READINESS DOCUMENT. ADVANCED ISOTOPE SEPARATION PROGRAM
Aug 1981 56 p refs
(Contract DE-AC01-79EV-10292)
(DE81-029952, DOE/EP-0029) Avail. NTIS HC A04/MF A01

The uncertainties to be resolved through research development and those that constitute a limit on the confidence that can be placed in the conclusions are addressed. The conclusions are presented, giving the probabilities of an adverse finding resulting from further environmental research. The impacts and concerns are treated without reference to specific sites or location The technology from which the environmental concerns emerge is described Drawn from the technology program office and the Environmental Development plan for the Advanced Isotope Separation Program (AIS) is provided The likelihood of adverse findings concerning the environmental acceptability of the technology, the problems and uncertainties stemming from current or anticipated environmental regulation, and the environmental and control considerations is examined On this basis, an assessment is offered of the existing or potential barriers to commercialization Environmental control research is discussed and associated costs are addressed The impact of environmental-related costs on the cost of enriching uranium by the AIS techniques is also addressed Current and possible new standards related to this technology are identified Estimates of relative chemical hazards are provided The feed and product associated with the current nuclear fuel cycle facilities and the changes that may be required by introduction of AIS into the enrichment enterprise are characterized A glossary is included DOE

N82-14910# Battelle Pacific Northwest Labs, Richland, Wash
COMPARISON OF POTENTIAL RADIOLOGICAL CONSEQUENCES FROM A SPENT-FUEL REPOSITORY VERSUS NATURAL-URANIUM DEPOSITS
M O Cloninger and O J Wick Dec 1980 15 p refs Presented at the ANS Waste Management Conf, Tucson, Ariz, 23-26 Feb 1981
(Contract DE-AC06-76RL-01830)
(DE81-028232, PNL-SA-8881, CONF-810217-19) Avail NTIS HC A02/MF A01

The long term hazard from spent fuel in a geologic repository is found to be comparable to that of a large ore deposit, although the specific nuclide concentration in an individual fuel element is not duplicated in nature A repository constructed within reasonable constraints present no greater hazard than a large ore deposit The natural hazard due to some observed radioactive releases to the biosphere in the United States far exceeds any that could reasonably be expected from a spent-fuel repository Use natural ore deposits as a basis for criteria for nuclear waste repositories is so variable that it does not allow a specific criterion to be stated in absolute terms If the naturally radioactive environment is to be used as a criterion for repositories, the radiological quality of the environment in the immediate region of a specific repository, and an acceptable potential increase in that radiological content due to the existence of the repository should be considered M D K

N82-14959# Comptroller General of the United States, Washington, D C
MILLIONS WASTED TRYING TO DEVELOP MAJOR ENERGY INFORMATION SYSTEM Report to the Congress
15 May 1981 81 p refs
(AFMD-81-40) Avail NTIS HC A05/MF A01

A Federal energy information system created to improve Federal and State energy regulation by providing computerized access to current energy data is reviewed It is concluded that the system failed because management deficiencies existed in planning, development, and implementation Moreover, the cost and progress of the system was not monitored Poor communication among system developers and intended users at the Federal and State levels, lack of continuous involvement and support from top Federal management, and disruptions in both organization and personnel are also cited as reasons for the system's failure R J F

N82-14987# California Univ, Livermore. Lawrence Livermore Lab
FUTURE OF ELECTRICITY FOR AUTOMOBILES: ADVANCED ELECTRIC VEHICLE CONCEPTS
Lawrence G. OConnell 29 Jul 1981 14 p refs Presented at 6th Elec Vehicle Council Symp, Baltimore, 21 Oct 1981
(Contract W-7405-eng-48)
(DE81-028235; UCRL-85526, CONF-811010-3) Avail. NTIS HC A02/MF A01

An electric vehicle, hybrid vehicle, and other nonpetroleum electricity based systems, such as a fuel cell vehicle are evaluated Performance criteria for such vehicles are presented and, in addition, various concepts that may be suitable for these vehicles are identified-their capabilities are discussed as well as the difficulties that must be overcome prior to commercialization in each case DOE

N82-15142# Walther Cie A G, Cologne (West Germany)
PROCESS FOR REMOVING SULFUR OXIDES FROM GASES WITH DIRECT PRODUCTION OF A USABLE FINISHED

REACTION PRODUCT Final Report, Oct. 1980
Heinz Juergen Fischer and Georg Kremer Bonn Bundesministerium fuer Forschung und Technologie Jul 1981 38 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-102, ISSN-0340-7608) Avail NTIS HC A03/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 8

During the described phase of testing, the waste-water-free Walther-process could be advanced considerably and tried in the final process conception after a coal-fired power-station block The ammonia sulfate obtained as a waste-product, meets the requirements of the fertilizer industry Further processing of this pulverous waste-product to obtain a marketable end-product was investigated and demonstrated in a pelletizing unit with subsequent drying in a drum-type drier The possibility of reheating the gases in a FGD-plant (flue-gas desulfurization plant) without application of energy from foreign source was proven by the use of a regenerative heat exchanger As regards spray-drying, a variant was investigated, a partial flow of the high-temperature flue-gas was branched before the airheater and spray-drying of the oxidized scrubbing liquid resulting from the desulfurization process was carried out in this partial flow. Author

N82-15168# KHD Humboldt Wedag A G., Cologne (West Germany) Haupabteilung Forschung und Entwicklung
BAKING OF CARBON ANODES FOR THE ELECTROLYSIS OF ALUMINUM BY ELECTRIC RESISTANCE HEATING Final Report, Apr. 1980
Ernst Schultze-Rhonhof Bonn Bundesministerium fuer Forschung und Technologie Sep 1981 41 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-168, ISSN-0340-7608) Avail NTIS HC A03/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 8,60

A distinct reduction of the energy input compared with the usual methods is possible when electric energy is substituted for fossil energy Carbon anodes in a 1 1 scale can be baked uniformly by direct electric resistance heating The characteristic chemical and physical data meets all requirements of the aluminum industry The energy input has not yet come up to expectations A R H

N82-15210# Oak Ridge National Lab., Tenn Metals and Ceramics Div
US CERAMIC HEAT EXCHANGER TECHNOLOGY: STATUS AND OPPORTUNITIES
V J Tennery 1981 5 p Presented at the Conf on Advancement in Heat Exchangers, Dubrovnik, Yugoslavia, 7 Sep 1981
(Contract W-7405-eng-26)
(DE81-029686, CONF-810946-1) Avail NTIS HC A02/MF A01

The status of ceramic heat exchanger technology in the United States is reviewed including the basis for interest in designing, building, and demonstrating these components for application in energy systems Ceramic heat exchangers for waste heat recovery and for advanced energy systems are discussed DOE

N82-15219# Wisconsin Univ., Madison Dept of Mechanical Engineering
SURVEY OF PROPOSED METHODS OF BURNING ALCOHOL IN DIESEL ENGINES
D E Foster 1980 10 p refs Presented at the Canadian Natl Power Alcohol Conf., Winnipeg, Manitoba, 20 Jun 1980
(Contract DE-AC02-79CS-50025)
(DE81-025834, CONF-8006185-1) Avail NTIS HC A02/MF A01

Different methods of burning alcohol in diesel engines are discussed. The primary difficulty in using alcohol as a diesel fuel is initiation of the flame The methods are categorized by the ignition technique used, spark or hot surface; pilot injection which includes twin injection and fumigation, cetane improvement and diesel/alcohol mixtures Each method is analyzed on the basis of the maximum amount of alcohol that can be substituted for diesel fuel and the likelihood for retrofitting on current engines. It is concluded that emulsification and fumigation are currently the two most feasible methods for adapting diesel engines to burn alcohol DOE

N82-15242# California Univ., Berkeley Lawrence Berkeley Lab Energy and Environment Div
THEORETICAL BASIS OF THE DOE-2 BUILDING ENERGY USE ANALYSIS PROGRAM
Richard B Curtis Apr 1981 15 p refs Presented at the Intern Energy Agency Conf., West Berlin, 6-10 Apr 1981
(Contract W-7405-eng-48)
(DE81-028896, LBL-12300) Avail NTIS HC A02/MF A01

A user-oriented, public domain, computer program was developed that will enable architects and engineers to perform design and retrofit studies of the energy-use of buildings under realistic weather conditions The DOE-2 1A has been named by the US DOE as the standard evaluation technique for the Congressionally mandated building energy performance standards (BEPS) A number of program design decisions were made that determine the breadth of applicability of DOE-2 1 Such design decisions are intrinsic to all building energy use analysis computer programs and determine the types of buildings or the kind of HVAC systems that can be modeled In particular, the weighting factor method used in DOE-2 has both advantages and disadvantages relative to other computer programs DOE

N82-15367# Technische Universitaet, Hanover (West Germany) Abt. Kaeltetechnik
ROTATING REGENERATIVE HEAT EXCHANGER FOR ENERGY RECOVERY IN CHEMICAL PLANTS Final Report, Jul. 1979
Reinhard Vauth Bonn Bundesministerium fuer Forschung und Technologie Jul. 1981 198 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-099, ISSN-0340-7608) Avail NTIS HC A09/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 36,30

The behavior of a rotary heat exchanger was analyzed with special regard to heat and mass transfer Parallel to measurements at such a rotary heat exchanger with non-absorbant matrix a mathematic model was developed to simulate the heat and mass transfer The correlation of experimental and theoretical results shows that the experimental data can be calculated by the mathematical model within an accuracy which is usual for calculating heat and mass transfer Within a variation of several parameters for the working medium (humid air) the influences of operating conditions on the exchange characteristic of regenerative heat exchangers with rotating matrix were examined A study of parameters with the working medium flue-gas, which was thought as a possible application of the mathematic model, confirms the results which were found with the working medium humid air Author

N82-15453# Department of Energy, Bartlesville, Okla Energy Technology Center
AUTOMOTIVE FUEL ECONOMY: POTENTIAL IMPROVEMENT THROUGH SELECTED ENGINE AND DIFFERENTIAL GEAR LUBRICANTS Final Report
Ted M Naman Jul 1981 50 p refs
(Contract DO-SC-RA-78-19)
(PB81-240467, DOT-TSC-NHTSA-81-8, DOT-HS-805895) Avail NTIS HC A03/MF A01 CSCL 21G

The effects of four engine lubricants and three differential gear lubricants on the fuel economy of two 1978 automobiles operated at 20F, 70F, and 100F ambient temperatures are evaluated The engine lubricants were evaluated using the 1978 Federal Test procedure and steady state tests from a cold start The gear lubricants were evaluated in steady state operation from a cold start GRA

N82-15488*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex
INVESTIGATION OF THE APPLICATION OF REMOTE SENSING TECHNOLOGY TO ENVIRONMENTAL MONITORING
M L Rader, Principal Investigator Aug. 1980 76 p ERTS
(Contract NAS9-15800)
(E82-10010; NASA-CR-161071, JSC-16759, LEMSCO-15175) Avail NTIS HC A05/MF A01 CSCL 13B

Activities and results are reported of a project to investigate the application of remote sensing technology developed for the LACIE, AgRISTARS, Forestry and other NASA remote sensing projects for the environmental monitoring of strip mining, industrial

pollution, and acid rain Following a remote sensing workshop for EPA personnel, the EOD clustering algorithm CLASSY was selected for evaluation by EPA as a possible candidate technology LANDSAT data acquired for a North Dakota test sight was clustered in order to compare CLASSY with other algorithms
A.R H.

N82-15514# Teknekron, Inc., McLean, Va
COAL RESOURCES AND SULPHUR EMISSION REGULATIONS: A SUMMARY OF 8 EASTERN AND MIDWESTERN STATES Final Report, Apr. 1979 - Mar. 1981
Richard A Chapman and Marcella A Wells May 1981 112 p refs Prepared for Versar, Inc., Springfield, Va
(Contract EPA-68-02-3136)
(PB81-240319, EPA-600/7-81-086) Avail: NTIS HC A06/MF A01 CSCL 13B

Coal resources, current coal use, and the effectiveness of SO2 control strategies for use by coal users, regulators, and administrators in future coal related decisions were analyzed The eight major eastern and midwestern coal producing states are discussed and each state's analysis includes a general overview of the coal industry, an overview of coal properties, a description of major coal seams, an analysis of the quantity of coal available to meet various SO2 emission regulations, and information regarding the sulfur content of coals used by utilities in 1979 Physical coal cleaning and the use of low sulfur coal as viable emission control strategies are emphasized The coal assessment processor model was developed to determine the quantity of coal that would be available in each state to meet various SO2 emission regulations using one or a combination of alternative SO2 control technologies GRA

N82-15543# Brookhaven National Lab., Upton, N Y Dept. of Energy and Environment
ROLE OF LARGE SCALE ENERGY SYSTEMS MODELS IN R&D PLANNING
J Lamontagne Nov 1980 13 p refs Presented at the ORSA/TIMS Conf., Colorado Springs, 9 Nov 1980
(Contract DE-AC02-76CH-00016)
(DE81-026058, BNL-29751, CONF-801126-3) Avail: NTIS HC A02/MF A01

The development of alternative technologies to provide new sources of energy and extend the lives of current ones is discussed The influence of model results on energy policy makers who are not knowledgable about flaws or uncertainties in the models, errors in assumptions in model inputs which can result in faulty forecasts, the overall usefulness of energy system models, and model limitations are discussed It is concluded that energy models should be clearly related to specific issues and methodologies should be clearly related to specific decisions, and allow adjustments to be easily made for alternative assumptions and for additional knowledge gained during the evolution of the energy system DOE

N82-15553# Stoller (S M) Associates, New York
POTENTIAL CONTRIBUTION OF CURRENTLY OPERATING NUCLEAR-FUELED ELECTRIC-GENERATING UNITS TO REDUCING US OIL CONSUMPTION
R H Koppe, Eric A J Olson, and Kenneth R VanHowe 30 Sep 1980 56 p Prepared for ORNL
(Contract W-7405-eng-26)
(DE81-030497, ORNL/Sub-80/40416/1) Avail NTIS HC A04/MF A01

The prospect for performance improvement in the 62 operating light water reactors was examined It is found that in the short term, capacity factor improvement of about 16 percent can be achieved, in response to a short term energy crisis In the long term a gain of 18 percent can be achieved Such gains represent a decrease in equivalent oil consumption of approximately 350,000 barrels a day Potential increases in the operating power level of these units, are evaluated This total short term power level increase would be equivalent to 138,000 barrels of oil per day DOE

N82-15554# Department of Energy, Washington, D C Office of Energy Management and Extension
ANNUAL REPORT TO THE PRESIDENT AND THE CONGRESS ON THE STATE ENERGY CONSERVATION PROGRAM FOR CALENDAR YEAR 1980
Jul 1981 40 p
(DE81-025862, DOE/CE-0016) Avail. NTIS HC A03/MF A01

The activities of the fifth year's operation (December 1979 through December 1980) of the state energy conservation program are reported The program requires states to develop and implement plans that will reduce projected energy consumption by 5% or more in 1980 Five program measures required to be eligible for financial assistance under the plan and three program measures under a supplemental plan are described and outlined The details of program operation and results to date are reported Program management in a description of selected innovative state Program measures are described The President's Program for economic recovery is evaluated DOE

N82-15555# Pacific Northwest Lab., Richland, Wash
TECHNOLOGY CHANGE AND ENERGY CONSUMPTION: A COMPARISON OF RESIDENTIAL SUBDIVISIONS
L A Nieves and A L Nieves 1981 38 p Presented at the 56th Ann Conf of the Western Econ Assoc., San Francisco, 2-6 Jul 1981
(Contract DE-AC06-76RL-01830)
(DE81-030075, PNL-SA-9049, CONF-810757-2) Avail NTIS HC A03/MF A01

The energy savings in residential buildings likely to result from implementation of the building energy performance standards (BEPS) were assessed The goals were to compare energy use in new homes designed to meet or exceed BEPS levels of energy efficiency with that in similar but older homes designed to meet conventional building codes, and to survey the home owners regarding their energy conservation attitudes and behaviors and to ascertain the degree to which conservation attitudes and behaviors are related to residential energy use The consumer demand theory which provides the framework for the empirical analysis is presented The sample residences are described and the data collection method discussed The definition and measurement of major variables are presented DOE

N82-15556# Minnesota Geological Survey, St Paul
MOORHEAD DISTRICT HEATING, PHASE 2 Final Report
R E Sundberg Jan 1981 429 p refs
(Contract DE-AC02-78CS-20074)
(DE81-029689, DOE/CS-20074/1) Avail NTIS HC A19/MF A01

The feasibility of developing a demonstration cogeneration hot water district heating system was studied The district heating system would use coal and cogenerated heat from the Moorhead power plant to heat the water that would be distributed through underground pipes to customers or their space and domestic water heating needs, serving a substantial portion of the commercial and institutional loads as well as single and multiple family residences near the distribution lines The technical feasibility effort considered the distribution network, retrofit of the power plant, and conversion of heating systems in customers' buildings to use hot water from the system The system would be developed over six years The economic analysis consisted of a market assessment and development of business plans for construction and operation of the system Rate design methodology, institutional issues, development risk, and the proposal for implementation are discussed DOE

N82-15567# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho
MICRO-HYDROPOWER IN THE UNITED STATES
R O Haroldsen and F B Simpson 1981 9 p refs Presented at WATERPOWER 1981 Conf., Washington, D C, 22 Jun 1981
(Contract DE-AC07-76ID-01570)
(DE81-028271, EGG-M-02781, CONF-8106137-5) Avail NTIS HC A02/MF A01

The interest and problems relating to the development of micro-hydropower, i e, capacities of less than 100 kW, was assessed A total of 62 individuals from 10 states and 4 groups, i e, developers, A/E firms, equipment manufacturers, and state and federal agencies, were polled to determine their perceptions of the advantages and disadvantages of micro-hydro developments and the needs for such developments Financing, technical assistance, and help with the economic analysis and regulatory aspects of micro-hydro development appeared to be the paramount needs Whether or not a specific site can be successfully developed depends on site conditions A micro-hydro plant discussed as

an example is shown to be a poor investment, e g, maximum $200 per month return on $60,000 investment. DOE

N82-15583# Vereinigte Elektrizitaetswerke Westfalen A G, Dortmund (West Germany) Bereich Marketing
ENERGY CONSUMPTION ANALYSIS AND COMPARATIVE STUDY OF THE OPERATIONAL RESULTS FROM HEAT PUMP PLANTS Final Report, Oct. 1979
Peter Mueller, Bernd Bewer, Heinz Klaus, Walter Sander, and Hans Joachim Guenther Wirthwein Bonn Bundesministerium fuer Forschung und Technologie Dec. 1980 240 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-109; ISSN-0340-7608) Avail. NTIS HC A11/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 40,50

Electric energy consumption with inclusion of the electricity consumption of the supplementary and auxiliary equipment is considered. Costs are divided into plant costs for heat pumps, heating systems and auxiliary equipment, installation costs for heat pumps, heating systems and auxiliary equipment, operating costs and maintenance costs. Specific energy consumption and cost statements were determined Operational experiences were reviewed and the energetic operational behavior, including supplementary and auxiliary equipment for a random test of plants, is discussed Author (ESA)

N82-15589# Mitre Corp, McLean, Va Metrek Div
ENERGY AND DEVELOPMENT IN CENTRAL AMERICA. VOLUME 1: REGIONAL ASSESSMENT Final Report, Oct. 1979 - Feb. 1980
Wayne Park, Wayne Park, Carole Neves, Ranvir Trehan, William Gallagher, Phillip Palmedo, Andres Doernberg, Keith Oberg, and Steven Kyle Feb 1980 128 p refs Prepared in cooperation with Energy/Development International 2 Vol
(Contract AID/SOD/PDC-C-0146)
(PB81-231540, MTR-80W601-Vol-1) Avail NTIS HC A07/MF A01 CSCL 10A

A regional energy assessment of six Central American countries is presented The purpose is to assist these countries in defining, planning, and meeting energy requirements implicit in their economic and social development goals The following topics are treated Central America Regional energy assessment, energy issues, geographical, social, and economic aspects, energy resources, current energy use and future energy use, energy strategies GRA

N82-15590# Mitre Corp, McLean, Va METREK Div
ENERGY AND DEVELOPMENT IN CENTRAL AMERICA. VOLUME 2: COUNTRY ASSESSMENTS Final Report, Oct. 1979 - Feb. 1980
Wayne Park, Carole Neves, Ranvir Trehan, William Gallagher, Phillip Palmedo, Andres Doenberg, Keith Oberg, and Steven Kyle Mar 1980 350 p refs Prepared in cooperation with Energy/Development International 2 Vol
(Contract AID/SOD/PDC-C-0146)
(PB81-231557, MTR-80W602-Vol-2) Avail NTIS HC A15/MF A01 CSCL 10A

An energy assessment for each of six Central American countries - Guatemala, El Savador, Honduras, Nicaragua, Costa Rica, and Panama is presented The program assists the U S Agency for International Development and other development organizations in defining energy programs in Central America The following issues are treated separately for each individual country, geographic, social and economic aspects, energy resources, current and future energy use, energy strategies GRA

N82-15591# Tata Inst of Fundamental Research, Bombay (India) Documentation Centre
INDIAN ENERGY ABSTRACTS
Mar 1981 46 p
(PB81-232316) Avail NTIS HC A03/MF A01 CSCL 10A

The document provides abstracting coverage of scientific and technical energy literature originating from Indian Government Departments, Universities, National Laboratories, and other research institutions including industries The scope encompasses all forms of renewable sources of energy and more efficient and less polluting use of fossil and fissile fuels DOE

N82-15592# National Academy of Sciences - National Research Council, Washington, D C Advisory Committee on Technology Innovation
SUPPLEMENT TO ENERGY FOR RURAL DEVELOPMENT: RENEWABLE RESOURCES AND ALTERNATIVE TECHNOLOGIES FOR DEVELOPING COUNTRIES Final Report
1981 248 p refs
(Contract AID/TA-C-1433)
(PB81-231011, CIR/BOSTID/38) Avail NTIS HC A11/MF A01 CSCL 10A

The publication energy for rural development renewable resources and alternative technologies for developing countries, which presented information on a variety of subjects, including direct uses of solar energy (heating, cooling, distillation, crop drying, photovoltaics), indirect uses of solar energy (wind power, hydropower, photosynthesis, biomass), geothermal energy, and energy storage is reviewed New technologies developed and advances made in technologies are discussed GRA

N82-15594# Bureau of the Census, Washington, D C
FUELS AND ELECTRIC ENERGY CONSUMED
Feb 1981 25 p
(PB81-240442, MIC-77-SR-5) Avail NTIS HC A02/MF A01 CSCL 08I

The following topics on energy consumption are reported general summary, type of operation, size of establishment, type of organization, assets and capital expenditures, fuels and electric energy consumed, and water use GRA

N82-15596# Prins Maurits Lab TNO, Rijswijk (Netherlands) Inst voor Chemische en Technologische Research
POLLUTION OF THE SOIL BY AVIATION GASOLINE
A Verweij Aug 1979 26 p ref In DUTCH, ENGLISH summary
(Contract A78/KL4/146)
(PML-1979-41, TDCK-73390) Avail NTIS HC A03/MF A01

A literature search was conducted to determine the effects of aviation gasoline spills and more general oil spills on the environment and on the condition of oil storage tanks Remedial measures are presented Attention is given to natural restoration processes as well as to actions to speed up these processes Author

N82-15598# Battelle Pacific Northwest Labs, Richland, Wash
ECOLOGICAL EFFECTS ASSESSMENT: REQUIREMENTS VS STATE-OF-THE-ART
D H McKenzie, J M Thomas, and L L Eberhardt May 1981 31 p refs Presented at the 3rd Conf on Waste Heat Management and Utilization, Miami, Florida, 12 May 1981
(Contract DE-AC06-76RL-01830)
(DE81-028092, PNL-SA-9292, CONF-810545-5) Avail NTIS HC A03/MF A01

Current requirements and the state-of-the-art in ecological effects assessments in regard to nuclear power plants are studied The current cooling system approaches, data collection programs, and ecological effects assessments are discussed A timely review and evaluation of current practice is called for The magnitude of economic and environmental resources being committed to cooling system alternatives mandates that the decision-making process result in as many optimal choices as possible In addition, the resources being devoted to environmental data collection and integration provide considerable motivation for providing meaningful input to the decision-making process It is maintained that the input should be as quantitative and as free from subjective content as is reasonably possible An alternative viewpoint suggests that the past several decades of experience be considered but a first step, and the current task to be one of designing a second step DOE

N82-15602# California Univ, Livermore Lawrence Livermore Lab.
THREE-DIMENSIONAL, FINITE ELEMENTAL MODEL FOR SIMULATING HEAVIER-THAN-AIR GASEOUS RELEASES OVER VARIABLE TERRAIN
Robert L Lee, Philip M Gresho, Stevens T Chan, and Craig D Upson Aug 1981 17 p refs Presented at the NATO/CCMS 12th Intern. Tech Meeting on Air Pollution Modeling and its Applications, Menlo Park, Calif, 25-28 Aug 1981 Submitted for publication

(Contract W-7405-eng-48)
(DE81-028689, UCRL-85520, CONF-810841-1) Avail NTIS HC A02/MF A01

A 3 dimensional finite element model was developed to predict the dispersion processes associated with heavier than air gaseous releases in the atmosphere Both 2 dimensional and 3 dimensional examples presented to demonstrate the flexibility of the model in simulating the motion of the vapor cloud generated after a liquid natural gas spill over flat or variable terrain Also presented are results to justify the slightly more complex generalized anelastic model rather than one employing the Boussinesq and/or hydrostatic approximation, which are routinely used for planetary boundary layer flows but can be inappropriate for this application DOE

N82-15605# Data Resources, Inc., Lexington, Mass
REGIONAL LOAD-CURVE MODELS: SCENARIO AND FORECAST USING THE DRI MODEL Final Report
H D Platt Aug 1981 283 p Sponsored by Electric Power Research Inst
(EPRI Proj 1008)
(DE81-904192, EPRI-EA-1672-Vol-3) Avail. NTIS HC A13/MF A01

Regional load curve models were constructed for 32 regions that were created by aggregating hourly load data from 146 electric utilities The forecast scenario is described and the forecast resulting from the use of this scenario is presented. The highlights of this forecast are two observations. first, peak demands will once again become winter phenomena In the heating season, the model is reponsive to the number of heating degree hours, the penetration rate of electric heating equipment, and the rate at which this space conditioning equipment is utilized. Winter season demands grow more rapidly than demands in other seasons and peaks begin to appear in winter months. Secondly load factors begin to increase in the forecast, reversing the trend which began in the early 1960s Nationally, load factors do not leap upwards, instead they increase gradually DOE

N82-15607# California Univ., Berkeley Lawrence Berkeley Lab Energy and Environment Div
KINETICS OF REACTIONS IN A WET FLUE GAS SIMULTANEOUS DESULFURIZATION AND DENITRIFICATION SYSTEM
S G Chang, D Littlejohn, and N H Lin Jul 1981 36 p refs Presented at the ACS Symp on Advan in Flue Gas Desulfurization, Atlanta, 30 Mar - 3 Apr 1981
(Contract W-7405-eng-48)
(DE81-029853, LBL-13063, CONF-810394-1) Avail NTIS HC A03/MF A01

A number of processes for simultaneous removal of SO2 and NO sub x are discussed They are based on either the oxidation of relatively insoluble NO to more soluble NO2 or the employment of a water soluble ferrous chelating compound as a catalyst to aid in the absorption of the insoluble NO. These ferrous compounds have the ability to form complexes with the NO and thus promote the absorption of the NO Once in solution NO sub x can be reduced by the absorbed SO2 to form molecular N2, N2O or reduced nitrogen compounds such as NOH(SO3)2(-2), NH(SO3)2(-2), NH2SO(-) and NH4(+), while SO2 is oxidized to sulfate The kinetics and mechanisms of reactions involved in this system are discussed DOE

N82-15608# University of Western Michigan, Kalamazoo Dept of Chemistry
FUNDAMENTALS OF NITRIC OXIDE FORMATION IN FOSSIL-FUEL COMBUSTION Progress Report, 29 Sep. - 28 Dec. 1980
Thomas Houser and Michael E McCarville Aug 1981 19 p refs
(Contracts DE-AC21-76ET-10592, EX-76-C-01-2018)
(DE81-030329, DOE/ET-10593/12; FE-2018-19) Avail: NTIS HC A02/MF A01

The rate and products of oxidation of HCN and the influence of additives, benzene, cyclohexane, toluene, acetylene and CO, on the rate and products were studied The only significant oxidation products in the absence of additives were CO2, H2O and N2 The complex order indicates that a complex chain mechanism is operating, however, the activation energy appears too large for a chain or surface mechanism HCN consumption dropped drastically and benzene consumption was reduced a small amount even at higher oxygen concentrations in the reactor No change in products was observed It suggested that CO and acetylene produce an intermediate during oxidation that does not form when benzene oxidizes DOE

N82-15609# Brookhaven National Lab., Upton, N Y Dept. of Energy and Environment
REAL TIME COARSE PARTICLE MASS MEASUREMENTS IN A HIGH TEMPERATURE AND PRESSURE COAL GASIFIER PROCESS TREATMENT
J Wegrzyn, J Saunders, and W Marlow Mar 1981 9 p refs Presented at the 3rd Symp on the Transfer and Utilization of Particulate Control Technol., Denver, 10-12 Mar 1981
(Contract DE-AC02-76CH-00016)
(DE81-030036, BNL-22952, CONF-810319-3) Avail NTIS HC A02/MF A01

A probe appropriate for direct extracted sampling of erosive range particulate matter from a coal gasifier outlet or a high pressure fluidized bed combustor The system consists of four modules (1) a null balance extraction probe with injection through a porous lined tube to minimize wall loss, (2) a stem type virtual impactor to separate coarse from fine particles, (3) a filter tape collector, and (4) a beta gauge total mass detector A stem type virtual impactor separates at ambient gas stream conditions the coarse particles from the sampling stream so that at upon filtration no condensible vapors, fine particles or reactive gases pass through the filter tape DOE

N82-15610# California Univ., Livermore Lawrence Livermore Lab Environmental Sciences Div
ELEMENTAL COMPOSITION OF ATMOSPHERIC FINE-PARTICLES EMITTED FROM COAL BURNED IN A MODERN ELECTRIC POWER PLANT EQUIPPED WITH A FLUE-GAS DESULFURIZATION SYSTEM
J M Ondov Jul 1981 19 p refs Presented at the Am Chem Soc Meeting, Las Vegas, Nev., 1 Dec 1980
(Contract W-7405-eng-48)
(DE81-030073, UCRL-85035, CONF-801266) Avail NTIS HC A02/MF A01

Mechanisms of fine particle formation and chemical enrichment in the flue-gas desulfurization system are dicussed Improved control devices drastically affect the quantity, chemical composition, and physical characteristics of fine particles emitted to the atmosphere from these sources Fly ash aerosols were sampled upstream and downstream from a modern lime slurry, spray tower system installed on a 430 Mw(e) coal utility boiler The concentrations of up to 35 elements and estimates of the size distributions of particles in each the fly ash fractions were determined by instrumental neutron activation analysis and by electron microscopy DOE

N82-15611# California Univ., Berkeley Lawrence Berkeley Lab Energy and Environment Div
INDOOR AIR QUALITY
C D. Hollowell Jun 1981 13 p refs Presented at the Inst of Gas Res Conf., Los Angeles, 28 Sep - 1 Oct 1981
(Contract W-7405-eng-48)
(DE81-029857; LBL-12887, CONF-810909-4; EEB-Vent-81-17) Avail: NTIS HC A02/MF A01

Common sources of indoor air pollution in buildings, the specific pollutants emitted by each source, the potential health effects, and possible control techniques are discussed Rising energy prices, have generated an incentive to reduce ventilation rates and thereby reduce the cost of heating and cooling buildings. Reduced ventilation in buildings increases exposure to indoor air pollution It is suggested that reduced ventilation adversely affects indoor air quality unless appropriate control strategies are undertaken. The strategies used to control indoor air pollution depend on the specific pollutant or class of pollutants encountered, and differ depending on whether the application is to an existing building or a new building under design and construction The first course of action is prevention or reduction of pollutant emissions at the source DOE

N82-15613# Pacific Northwest Lab., Richland, Wash.
ASSESSMENT OF THE LONG-RANGE TRANSPORT OF RESIDENTIAL WOODSTOVE FINE-PARTICULATE EMISSIONS FOR TWO FUTURE UNITED STATES ENERGY

SCENARIOS
K J. Allwine, Jr May 1981 17 p refs Presented at the Intern Conf on Residential Solid Fuels, Portland, Oreg , 1-4 Jun 1981
(Contract DE-AC06-76RL-01830)
(DE81-030096, PNL-SA-9606, CONF-810674-5) Avail NTIS HC A02/MF A01

The impact of solar energy technologies (especially woodstoves) on regional scale fine particulate air quality resulting from direct-energy-use sources was analyzed It is shown that significant interregional transport of fine particulates occurs especially into the three northeastern regions of the US It is indicated that concentrations are low relative to any current particulate standards Both maximums occurred in the Middle Atlantic region. It is predicted that the concentrations in the eastern five regions will decrease from 1975 to 2000 (both scenarios) whereas the opposite is true for the five western regions The contributions from woodstoves are projected to increase in all regions The majority of this increase is due to woodstoves For the three northeastern regions more than 50% of the impact of each region is from outside the respective region DOE

N82-15618# Battelle Columbus Labs , Ohio
USE OF COAL CLEANING FOR COMPLIANCE WITH SO2 EMISSION REGULATIONS Final Report, Jun. 1977 - Jun. 1981
E H Hall, A W Lemmon, Jr , G L Robinson, F K Goodman, J H McCreery, R E Thomas, and P A Smith Sep 1981 438 p refs
(Contract EPA-68-02-2163)
(PB81-247520, EPA-600/7-81-146, IERL-RTP-1244) Avail NTIS HC A19/MF A01 CSCL 13B

Results of an evaluation of coal cleaning as a means of controlling SO2 emissions from coal fired stationary sources are presented Coal cleaning was examined in the light of various existing and proposed SO2 emissions regulations to determine applications in which the technology would be most useful Barriers were identified that prevent wider application of coal cleaning Actions are described which should be taken to overcome these barriers Much information about coal is compiled as resource data on the coal reserve base, present and projected coal production, coal cleanability, current and projected coal use by utilities and industry, size and age distribution of coal fired facilities, and the nature of coal contracts Environmental impacts of coal cleaning are compared with those of other sulfur removal strategies such as flue gas desulfurization and the use of low sulfur coal Similarly, costs of the various SO2 control alternatives are compared GRA

N82-15621# Environmental Protection Agency, Ann Arbor, Mich Standards Development and Support Branch
HEAVY-DUTY ENGINE BASELINE PROGRAM AND NO SUB X EMISSION STANDARD DEVELOPMENT (1972-73)
Timothy Cox, Zachary Diatchun, Thomas Nugent, Glenn Passavant, and Larry Ragsdale Mar 1981 69 p refs
(PB81-244030, EPA-AA-SDSB-81-01) Avail NTIS HC A04/MF A01 CSCL 13B

The statutory NOx emission standard for 1985 heavy duty engines was determined The standard is based on a 75% reduction from the average measured emissions for uncontrolled (1972-73 model year) gasoline fueled heavy duty engines program established the amount of NOx emissions from the uncontrolled heavy duty gasoline-fueled engines A baseline testing this program consists of four sectons (1) engine procurement, (2) restorative maintenance, (3) testing the engine emission levels by transient test procedure, and (4) determination of the average measured emissions GRA

N82-15623# Research Triangle Inst , Research Triangle Park, N. C
SYMPOSIUM PROCEEDINGS: ENVIRONMENTAL ASPECTS OF FUEL CONVERSION TECHNOLOGY, 5TH Progress Report, Feb. - Aug. 1980
F A. Ayer, comp and N. S Jones, comp Jan. 1981 665 p refs Proceedings of symp held in St Louis, 16-19 Sep. 1980
(Contract EPA-68-02-3170)
(PB81-245045; EPA-600/9-81-006) Avail. NTIS HC A99/MF A01 CSCL 13B

Environmental aspects of fuel conversion technology are presented. Environmental information related to coal gasification, indirect liquefaction, direct liquefaction, program approach, environmental assessment, environmental control, and the development of pollution control guidance documents is included. GRA

N82-15624# Geological Survey, Indianapolis, Ind Water Resources Div.
EFFECTS OF COAL FLY-ASH DISPOSAL ON WATER QUALITY IN AND AROUND THE INDIANA DUNES NATIONAL LAKESHORE, INDIANA Final Water-resources Investigation Report
Mark A. Hardy Apr 1981 73 p refs
(PB81-238479; USGS/WRD/WRI-81-073; USGS/WRI-81-16) Avail: NTIS HC A04/MF A01 CSCL 13B

Dissolved constituents in seepage from fly ash settling ponds bordering part increased trace elements, and gross alpha and gross beta radioactivity in ground water and surface water downgradient from the settling ponds It is suggested that concentrations of some dissolved trace element are greater beneath interdunal pond 2 than in the pond. It is found that calcium concentrations are greater in ground water downgradient from the settling ponds than in the ponds Where organic material is present downgradient from the settling ponds, concentrations of arsenic, fluoride, molybdenum, potassium, sulfate, and strontium were greater in the ground water than in the ponds In contrast, the concentrations of cadmium, cooper, nickel, aluminum, cobalt, lead, and zinc are less. GRA

N82-15626# TRW, Inc , Research Tnangle Park, N C Progress Center
DEMONSTRATION OF WELLMAN-LORD/ALLIED CHEMICAL FGD TECHNOLOGY: DEMONTRATION TEST SECOND YEAR RESULTS Final Report, Feb. 1973 - Oct. 1979
R C Adams, S W Mulligan, and R R Swanson Aug 1981 410 p refs
(Contract EPA-68-02-3174)
(PB81-246316; EPA-600/7-81-140) Avail. NTIS HC A18/MF A01 CSCL 13B

The performance over a 2 year period of a full scale flue gas desulfurization (FGD) is reported The process is regenerable, employing sodium sulfite wet scrubbing, thermal regeneration of the spent scrubber solution, and reduction to elemental sulfur of the recovered SO2 Process energy requirements, primarily for thermal regeneration of the scrubber solution and subsequent recovery of SO2, were quite large, amounting to 12 percent of the boiler heat input derived from fuel. Operation and performance occurred after some modification to the boiler to increase inlet flue gas temperature and after implementing FGD plant improvements identified during initial operation GRA

N82-15633# Los Angeles County Sanitation District, Whittier, Calif
PARALLEL EVALUATION OF AIR-AND OXYGEN-ACTIVATED SLUDGE Final Report, Feb. 1975 - Dec. 1976
Scott Austin, Fred Yunt, Donald Wuerdeman, and Walter E Garrison Aug 1981 53 p
(Contract DI-14-12-150)
(PB81-246712, EPA-600/2-81-155) Avail. NTIS HC A04/MF A01 CSCL 13B

The merits of air and oxygen in the activated sludge process, two 1900-cu m/day activated sludge pilot plant, one air and one oxygen system, were operated Both of the pilot plants met the applicable discharge limitations for everything but three trace metals, but the oxygen system provided a more stable operation Primary differences in performance concerned ammonia nitrogen removals and energy consumption GRA

N82-15637# Energy Resources Co , Inc., Cambridge, Mass.
POTENTIAL ENVIRONMENTAL PROBLEMS OF ENHANCED OIL AND GAS RECOVERY TECHNIQUES Final Report
Ron Beck, Robert Shore, Terry Ann Scriven, and Melinda Lindquist Aug 1981 297 p refs
(Contract EPA-68-03-2648)
(PB81-240186, EPA-600/2-81-149) Avail NTIS HC A13/MF A01 CSCL 13B

This report provides (a) an identification of and analysis of available data regarding EOR/EGR related pollutants; (b) an assessment of potential environmental impacts and an identifica-

tion of possible controls, and (c) recommendations as to research needs The following processes were studied steam injection, in situ combustion, carbon dioxide miscible flooding, micellar/polymer flooding, alkaline flooding, improved waterflooding, advanced hydraulic fracturing, chemical explosive fracturing, and directional drilling The existing EOR/EGR environmental impact information (published and unpublished) is critically reviewed and summarized The effect of EOR/EGR processes on air quality, groundwater quality, water quantity, noise levels, and secondary impacts is the main area of analysis GRA

N82-15651# Research Triangle Inst, Research Triangle Park, N C
PROCEEDINGS: SYMPOSIUM ON FLUE GAS DESULFURIZATION, VOLUME 1
Franklin A Ayer Apr 1981 548 p refs Symp held at Houston, Tex, 28-31 Oct 1980
(Contract EPA-68-02-3170)
(PB81-243156, EPA-600/9-81-019A-Vol-1) Avail NTIS HC A23/MF A01 CSCL 13B

Presentations of the flue gas desulfurization (FGD) conference are presented They cover such subjects as approaches for control of acid rain, the Nation's energy future, economics of FGD, legislative/regulatory developments, FGD research/development trends, FGD system operating experience, FGD byproduct disposal/utilization, developments in dry FGD, and industrial boiler applications GRA

N82-15652# Research Triangle Inst, Research Triangle Park, N C
PROCEEDINGS: SYMPOSIUM ON FLUE GAS DESULFURIZATION, VOLUME 2
Franklin A Ayer, comp Apr 1981 551 p refs 6th Symp held at Houston, Tex, 28-31 Oct 1980
(Contract EPA-68-02-3170)
(PB81-243164, EPA-600/9-81-019B) Avail NTIS HC A24/MF A01 CSCL 13B

Proceedings on flue gas desulfurization are documented Presentations covered the following subjects approaches for control of acid rain, the nation's energy future, economics of FGD, legislative/regulatory developments, FGD research/development trends, FGD system operating experience, FGD byproduct disposal/utilization, developments in dry FGD, and industrial boiler applications GRA

N82-15833# California Univ, Livermore Lawrence Livermore Lab
METHODOLOGY AND BASIC ALGORITHMS OF THE LIVERMORE ECONOMIC MODELING SYSTEMS
Robert B Bell 17 Mar 1981 43 p refs
(Contract W-7405-eng-48)
(DE81-029430, UCRL-53131) Avail NTIS HC A03/MF A01

The methodology and the basic pricing algorithms used in the Livermore economic modeling system (EMS) are described Each algorithm's function is analyzed and a detailed derivation of the actual mathematical expressions used to implement the algorithm is presented DOE

N82-16012# Applied Decision Analysis, Inc, Menlo Park, Calif
EVALUATING R AND D OPTIONS UNDER UNCERTAINTY. VOLUME 2: ATMOSPHERIC FLUIDIZED-BED COMBUSTION COMMERCIALIZATION STRATEGIES Final Report
A B Borison, B R Judd, P A Morris, and E C Walters Aug 1981 79 p Sponsored by Electric Power Research Inst
(EPRI Proj 1432-1)
(DE81-904246, EPRI-EA-1964-Vol-2) Avail. NTIS HC A05/MF A01

A quantitative framework for analyzing commercialization decisions for emerging electrical power generation technologies was developed The framework addresses the general question of when to freeze a design for commercialization The framework was developed to help evaluate the benefits of continuing the development of two different designs for atmospheric fluidized bed combustion boilers EPRI staff participated actively in specifying the scope of the analysis and in providing technical information on the two designs The framework was demonstrated using this information, supplemented with probablistic judgments by EPRI staff about possible outcomes from the pilot and demonstration stages of development Based on the technical data and judgments supplied by EPRI staff, the analysis shows a net benefit for proceeding with the development of two designs DOE

N82-16013# Applied Decision Analysis, Inc, Menlo Park, Calif
EVALUATING R AND D OPTIONS UNDER UNCERTAINTY. VOLUME 3: AN ELECTRIC-UTILITY GENERATION-EXPANSION PLANNING MODEL Final Report
A B Borison, B R Judd, P A Morris, and E C Walters Aug 1981 114 p refs Sponsored by Electric Power Research Inst
(EPRI Proj. 1432-1)
(DE81-904237, EPRI-EA-1964-Vol-3) Avail NTIS HC A06/MF A01

An electric utility generation expansion model developed for use in research and development (R and D) planning under uncertainty is described The model provides a framework for examining broad utility and R and D planning issues, rather than the specific generation expansion decisions of individual utilities Unlike existing approaches, the model focuses directly on the demand, technological, and regulatory uncertainties and the long term dynamics that affect the impact of R and D achievements The model's somewhat aggregate approach to electric utility decision making (to allow repeated application at low cost) can be modified, as needed, for more detailed utility planning When fully implemented, the model can be applied to the analysis of issues such as technology adoption, reserve margin, unit size, reliability, storage and load management effects, lead time, and government regulation DOE

N82-16014# Brookhaven National Lab, Upton, N Y
APPLICATION OF AN LP MODEL TO STRATEGIC PLANNING OF MULTINATIONAL COOPERATIVE RD AND D PROGRAMS
V L Sailor 1981 10 p refs
(Contract DE-AC02-76CH-00016)
(DE81-029325, BNL-29857) Avail NTIS HC A02/MF A01

An analytical study was initiated to serve as a basis for defining a cooperative strategy for RD and D among International Energy Agency member nations A flexible energy system model, MARKAL, was developed as the primary tool for the analysis The flexibility of MARKAL is demonstrated by the fact that the diverse energy systems of sixteen countries and the aggregated European Economic Community have been modeled successfully MARKAL is a multi-period linear programming model which describes the energy flows, costs, and resource consumption of national energy systems over an extended period of time (1980 to 2020) Various policy options and assumptions about future world situations create a range of scenarios which control the MARKAL solutions Such options and such postulated conditions, translated into operational indicators to drive the MARKAL model and constrain its solutions, are described DOE

N82-16022*# National Aeronautics and Space Administration, Washington, D C
AERONAUTICS AND SPACE REPORT OF THE PRESIDENT. 1980 ACTIVITIES
1981 108 p
(NASA-TM-84079) Avail NTIS HC A06/MF A01 CSCL 05A

The year's achievements in the areas of communication, Earth resources, environment, space sciences, transportation, and space energy are summarized and current and planned activities in these areas at the various departments and agencies of the Federal Government are summarized Tables show U S and world spacecraft records, spacecraft launchings for 1980, and scientific payload and probes launched 1975-1980 Budget data are included A R H

02
SOLAR ENERGY

Includes solar collectors, solar cells, solar heating and cooling systems, and solar generators

A82-10007 **Solar materials science.** Edited by L. E Murr (New Mexico Institute of Mining and Technology, Socorro, NM). New York, Academic Press, 1980. 799 p $35

Solar collector (photothermal) materials are considered, taking into account the optical properties-microstructure relationship in particulate media, solar mirror materials and their use in solar concentrating collectors, the effect of soiling on solar mirrors and techniques used to maintain high reflectivity, the emissivity of metals, fundamental limits to the spectral selectivity of composite materials, composite film selective absorbers, and corrosion science and its application to solar thermal energy material problems. Solar storage and thermochemical materials are discussed, giving attention to thermal storage in salt-hydrates, a thermodynamic basis for selecting heat storage materials, the application of reversible chemical reactions to solar thermal energy systems, and materials science issues encountered during the development of thermochemical concepts. Solar conversion (photovoltaic) materials are also examined, and a description is provided of research and device problems in photovoltaics, heterojunctions for thin film solar cells, the optimization of solar conversion devices, and the basic aspects of plasma-deposited amorphous semiconductor alloys in photovoltaic conversion. The role of crystal defects in solar materials is studied along with surface and interface characteristics. G.R.

A82-10008 **Introduction to solar materials science.** R S. Claassen (Sandia Laboratories, Albuquerque, NM) and B. L. Butler (Solar Energy Research Institute, Golden, CO). In Solar materials science. New York, Academic Press, 1980, p. 3-51. 38 refs. Contracts No. DE-AC04-76DP-00789, No EG-77-C-01-4042

A broad program is underway to develop and improve the full range of technologies needed to make solar energy a significant contributor to the U S national energy supply. One important aspect of the technology development is materials Attention is given to solar collector materials, photochemical conversion and storage, and solar conversion materials Although solar energy systems require no fuel, they are characterized by high initial cost. Cost reduction is, therefore, an essential element of the solar energy program. Concern for cost is reflected in considerations of materials availability, in the development and demonstration of mass production processes which are inherently inexpensive, and in the design of solar energy systems of minimum complexity. G.R

A82-10009 **Introduction to the role of crystal defects in solar materials.** L. E. Murr and O T. Inal (New Mexico Institute of Mining and Technology, Socorro, NM). In Solar materials science. New York, Academic Press, 1980, p. 53-92. 33 refs.

It is pointed out that, to a large extent, the science of materials is dominated by the role of imperfections in determining or controlling the properties of materials. Crystal defects, or imperfections, in crystalline materials are now well documented. In general, they are grouped into regimes of zero-dimensional (or point) defects, one-dimensional (or line) defects, two-dimensional (or planar) defects, and three-dimensional (or volume) defects. Vacancies, interstitials, and substitutional impurities constitute the more common point defects, while charge balance requirements in ionic solids require pairs of such defects to be formed, or some other charge-compensating mechanisms. Dislocations constitute the more common line defects. Attention is given to crystal structures and order-disorder phenomena, crystal lattice defects, and solar-related materials structures. G.R.

A82-10010 **Surface and interface studies and the stability of solid solar energy materials.** A W. Czanderna (Solar Energy Research Institute, Golden, CO). In Solar materials science. New York, Academic Press, 1980, p 93-147 61 refs. Contract No EG-77-C-01-4042.

An overview is provided of the role that surface and interface studies of solid materials must play if the U.S is to achieve wide scale commercialization and application of the various solar technologies Surface studies applicable to solar materials are considered, taking into account the surface area, real and clean surfaces, structure and topography, surface composition or purity, surface thermodynamics, the equilibrium shape, diffusion, the nature of adsorbate/solid interactions and the amount adsorbed, and the methods used for studying the surfaces of solar materials The surface science of solar materials surfaces is discussed, giving attention to surface science in energy technologies, areas of surface science and solar energy technologies, and surface science applied to specific solar energy materials A description is presented of the role of the polypropylene/copper oxide interface in the catalyzed oxidative degradation of polypropylene. G.R.

A82-10011 **The optical properties-microstructure relationship in particulate media - Optical tailoring of solar absorbers.** A Ignatiev (Houston, University, Houston, TX) In Solar materials science. New York, Academic Press, 1980, p. 151-170 28 refs. Research sponsored by the U S. Department of Energy and University of Houston

The basic principles of electromagnetic radiation absorption in solids are examined It is found that a good solar energy absorber should have a metallic or semimetallic component and that the absorber should be composed of small particles. The understanding of the interaction of an array of small conducting particles with electromagnetic radiation is, in this connection, of interest in the study of solar energy absorption. An effective medium theory is considered The approach used by O'Neill and Ignatiev (1978) is expanded to illustrate the applicability of an approach which involves the definition of distributions of spheroidal particles in the modeling of the optical response of particulate films The investigation shows that the optical response of solar absorbers is strongly dependent on the microscopic structure of the absorber It is, therefore, possible to accomplish optical tailoring of a material through the manipulation of its microscopic structure G R

A82-10012 **Solar mirror materials - Their properties and uses in solar concentrating collectors.** R. B Pettit and E. P Roth (Sandia Laboratories, Albuquerque, NM) In Solar materials science. New York, Academic Press, 1980, p. 171-197. 32 refs. Contract No DE-AC04-76DP-00789

Solar mirror materials are used in a variety of solar collectors in order to redirect the incident sunlight onto a receiver surface. The collectors employed range from augmented flat plate collectors to high concentration tracking parabolic dish concentrators. The primary advantage in using solar mirrors to concentrate sunlight is either to increase the system efficiency (e g., be reducing thermal losses) or to reduce the system cost where relatively expensive receiver materials are utilized. In most applications, the total mirror surface area deployed is large. Thus, the mirrors must be manufactured at a relatively low cost The current state of mirror materials with application to solar concentrators is reviewed. After specular reflectance is defined, the optic ' measurement techniques developed specifically for these materials are discussed. Attention is given to the solar reflectance properties of mirror materials, taking into account glass, metallized plastics, polished aluminum, and protective coatings. G.R.

A82-10013 **The effect of soiling on solar mirrors and techniques used to maintain high reflectivity.** E P. Roth and R. B. Pettit (Sandia Laboratories, Albuquerque, NM) In Solar materials science. New York, Academic Press, 1980, p. 199-227. 24 refs. Contract No. DE-AC04-76DP-00789.

Solar mirrors are designed to achieve initially the maximum possible reflectance. However, outdoor exposure subjects the mirror materials to environmental conditions which can quickly reduce their efficiency. One effect of outdoor exposure is the reflectance loss due to the accumulation of foreign particles on the mirror surface. Specular reflectance losses as great as 25% have been observed for mirrors exposed for only a few weeks. Severe energy losses can occur in the case of concentrating collecting systems. Thus, from an

economic point of view, periodic cleaning or reduction of soil accumulation is a practical necessity. Potential methods for controlling the reflectance loss due to soiling must be based on information regarding dust accumulation and its effect on the produced energy. A field test study was initiated simulating some of the operational configurations of solar mirrors to obtain a suitable data base. The accumulation of dust and the resulting loss in specular reflectance was found to be a complex function of mirror material, weather conditions, geographical location, and operational methods. G.R.

A82-10014 The emissivity of metals. A. J. Sievers (Cornell University, Ithaca, NY). In Solar materials science. New York, Academic Press, 1980, p. 229-254. 29 refs. NSF Grant No. DMR-76-81083; Contract No. XH9-8158-1.

It is pointed out that the high-temperature thermal radiative properties of metals were not described correctly until 1978. The early radiant heat transfer models of metals are examined, taking into account model characteristics which do not correspond to the real physical conditions. A description is given of a new model, which describes correctly the temperature-dependent thermal radiative properties of metals. Attention is given to the temperature dependence of the hemispherical emissivity of platinum, high-temperature selective surfaces, aspects of spectral emissivity, questions of total emissivity, the normal spectral emissivity of the Drudy free electron model as a function of frequency, and model corrections. For a correct description of the infrared emissivity of metals, it is necessary to take into account the properties of metal surfaces. G.R.

A82-10015 Fundamental limits to the spectral selectivity of composite materials. A. J. Sievers (Cornell University, Ithaca, NY). In Solar materials science New York, Academic Press, 1980, p. 255-276. 18 refs. NSF Grant No. DMR-76-81083, Contract No. XH9-8158-1

Two approaches are considered for absorbing the solar radiation, while suppressing thermal reradiation. According to one approach, the solar radiation is transmitted through a heat mirror to a nonselective absorber. The second approach involves the absorption of solar radiation by a dark mirror which has a small thermal emissivity. The construction of the employed spectrally selective surfaces is very different for each case. The current study is concerned with the relative potential of each of the two approaches, taking into account in both cases the best configuration consistent with physical constraints. Transparent heat mirrors are considered, taking into account the spectral characteristics of conducting meshes. In an investigation of dark mirrors, attention is given to dark metal, metal plus a dielectric film, and metal plus an absorbing film. The relative merits of the two considered approaches depend upon the temperature. Should selective absorber temperatures ever rise above 800 K, the heat mirror may ultimately provide the larger figure of merit. G.R.

A82-10016 Composite film selective-absorbers. R. A. Buhrman and H. G. Craighead (Cornell University, Ithaca, NY). In Solar materials science. New York, Academic Press, 1980, p. 277-317. 17 refs. Research supported by the Solar Energy Research Institute.

A description is presented of the general nature of the optical properties of metal-insulator composite films. Attention is given to the production of composites, the composite microstructure, the Maxwell-Garnett theory, an alternative mean field theory first proposed by Bruggeman (1935), and optical properties observed in experimental studies. Approaches employed to develop a surface which is strongly absorbing over the solar spectrum but nonabsorbing at longer wavelengths are discussed. Figures of merit are considered along with questions regarding the choice of composite absorber components, graded composition coatings, and the production of high temperature selective absorbers. G.R.

A82-10017 Corrosion science and its application to solar thermal energy material problems. S. L. Pohlman (Solar Energy Research Institute, Golden, CO). In: Solar materials science. New York, Academic Press, 1980, p. 319-373. 53 refs. Contract No. EG-77-C-01-4042

Attention is given to problems that may limit the development of solar thermal systems due to material failure. Material degradation in one form or another appears to be a common problem facing the development of solar thermal power. An investigation is conducted of material problems of thermal concentrating systems that employ gas, liquid metal, molten salt, water, or organic fluids as a primary heat transfer fluid. Degradation of the reflective surfaces used to concentrate thermal energy is also considered, and material problems associated with thermal storage are discussed. A review of flat plate collector systems is conducted, and the material problems facing ocean thermal conversion systems are examined. By the application of thermodynamic data, environmental observations, and electrochemical measurements, chemical and mathematical models of corrosion processes can be developed and used to effectively predict corrosion failure. G.R.

A82-10020 The application of reversible chemical reactions to solar thermal energy systems. R. Mar (Sandia Laboratories, Livermore, CA). In: Solar materials science New York, Academic Press, 1980, p. 439-457. 33 refs.

It has been proposed to use reversible thermochemical reactions as a means for storing thermal energy in solar energy systems. The considered approach involves the storage of thermal energy in the form of chemicals created by endothermic reactions. In addition to the storage applications, there is also interest in applying reversible reactions to solar thermal energy transport and solar thermal heat pumping for space heating and cooling systems. A review is provided of all three of these applications. The characteristic features of reversible chemical reaction systems are compared to the properties of sensible and latent heat systems. Preliminary cost/benefit studies show that of the three applications considered solar chemical heat pump systems for space heating and cooling applications are the most attractive. The use of thermochemical reactions strictly for thermal energy storage in solar thermal electric power plants does not appear to be attractive. G.R.

A82-10021 Materials science issues encountered during the development of thermochemical concepts. R. Mar (Sandia Laboratories, Livermore, CA). In: Solar materials science New York, Academic Press, 1980, p. 459-485. 27 refs.

Thermodynamic considerations are to be used for a preliminary screening of reactions for solar energy applications. Attention is given to relations involving the reaction temperature, coupled reaction considerations, and entropy considerations. Reactions which meet the thermodynamic requirements must be evaluated further with respect to technical and economic feasibility. Generic materials problems are examined, taking into account catalyzed reactions, thermal decomposition reactions, and solution-dissolution reactions. Aspects of materials corrosion and compatibility are also discussed along with catalyst development activities. Concerns with catalyzed reaction systems are found to include effects of thermal cycling on reactor materials, catalyst availability and lifetime, and undesirable side reactions. Problems have arisen in thermal decomposition systems due to poor or variable kinetics and volume expansion effects. Reactions which make use of the heat of solution suffer least from materials problems. The major concerns are with the corrosive nature of the chemicals involved. G.R.

A82-10022 Introduction to photovoltaics - Physics, materials and technology. L. Kazmerski (Solar Energy Research Institute, Golden, CO). In: Solar materials science New York, Academic Press, 1980, p. 489-549. 302 refs.

The operational principles and performances of photovoltaic solar cells based on various materials are reviewed. Following a brief introduction to the possible structures and categories of solar cells and the rationale for the development of improved, low-cost variants to the conventional single-crystal Si cell the current-voltage characteristics of a homojunction cell are derived from the materials properties of the device, and the efficiency and equivalent circuits for the device are discussed. The material properties necessary to the functioning of a photovoltaic device are examined, with attention given to the energy gap, absorption coefficient, diffusion length, minority carrier lifetime, doping, surface recombination, and gap state density. Examples of device and materials engineering are presented which illustrate the advancement of solar cell technology. A.L.W.

A82-10023 **Research and device problems in photovoltaics.** L. Kazmerski (Solar Energy Research Institute, Golden, CO). In: Solar materials science. New York, Academic Press, 1980, p. 551-584. 96 refs.

Current problems in photovoltaic device research are reviewed as they relate to intermediate-efficiency thin-film solar cells and high-efficiency concentrator devices. In the area of thin-film solar cells, efforts have been centered on the improvement of materials and device properties for devices based on amorphous silicon, polycrystalline silicon, thin-film GaAs, and CdS, with emphasis on problems associated with the grain boundaries and degradation mechanisms, and on the identification and demonstration of new photovoltaic materials including InP, CdTe, Cu2O, Zn3P2, Cu2Se, ZnSiAs2, CdSiAs2, BAs and polyacetylene. Devices under development for high-efficiency solar concentrators include the multidevice, beam-splitting photovoltaic convertors, monolithic multijunction solar cells, and the edge multiple vertical junction device. A.L.W.

A82-10024 **Heterojunctions for thin film solar cells.** R. H. Bube (Stanford University, Stanford, CA). In: Solar materials science. New York, Academic Press, 1980, p. 585-618. 33 refs. Research supported by the U.S. Department of Energy and Solar Energy Research Institute.

The basic properties of semiconductor heterojunctions and heteroface junctions are discussed in relation to their use in solar cells. The types of measurements that are used in the characterization of an experimental heterojunction cell are considered, including measurements of the bulk properties of the component materials, the crystallographic structure of component materials, the effects of surface treatments on material properties, contact resistivities, dark and light current-voltage characteristics, light diode parameters, the spectral dependence of quantum efficiency, reverse breakdown voltage, the light intensity dependence of cell parameters, junction capacitance, electron-beam induced current, photoluminescence and electroluminescence, chemical composition and interface structure Band diagrams are then presented for heterojunctions composed of a highly conducting p-type optical absorbing window material and a highly conducting n-type window material on a less conducting p-type absorber, which are illustrated by the Cu2S/CdS and CdS/CdTe heterojunctions, respectively. The fabrication and characteristics of CdS/CdTe, CdS/InP, and ZnO/CdTe heterojunctions, MIS and SIS devices, and sputtered ITO/CdTe and ITO/InP buried homojunctions are then examined in detail A.L.W.

A82-10025 **The optimization of solar conversion devices.** D. S. Ginley, M A. Butler, and C. H. Seager (Sandia Laboratories, Albuquerque, NM). In Solar materials science. New York, Academic Press, 1980, p. 619-664. 40 refs. Contract No. DE-AC04-76DP-00789.

The direct and indirect application of simple chemical potential and electronegativity arguments to photoelectrochemical cells (PEC) and thin-film polycrystalline semiconductors - systems seen as having considerable potential for solar energy conversion - is discussed. It is shown how the principal criteria of the cells can be determined. Particular attention is given to the biasing requirements of these cells, and to this end an electronegativity model is presented that can be used to predict biasing requirements on a quantitative basis. Attention is also given to the energy levels in silicon grain boundaries and to the double-depletion-layer, thermal-emission model of conduction over the potential barrier in the boundary. Also discussed are recent results demonstrating that various chemical agents, when appropriately introduced into silicon grain boundaries, are capable of modifying grain boundary potential barriers. C.R.

A82-10026 **Introduction to basic aspects of plasma-deposited amorphous semiconductor alloys in photovoltaic conversion.** R. W. Griffith (Brookhaven National Laboratory, Upton, NY). In Solar materials science. New York, Academic Press, 1980, p. 665-731. 75 refs. Research sponsored by the U.S. Department of Energy

The progress that has been made in advancing an understanding of the materials properties of plasma-deposited a-Si:H alloys is reviewed. The nature of the plasma is discussed, proceeding from preliminary concepts of the RF glow discharge to a more detailed description of the plasma chemistry in the silane glow discharge. Experience gained with plasma etching is briefly reviewed as a paradigm for plasma deposition. Emitting reactive species that are identified in plasma deposition using optical emission spectroscopy are discussed, and electron-impact processes that are pertinent to the silane glow discharge are summarized. In addition, the characterization of plasma-deposited silicon-hydrogen alloys is analyzed. The introduction given to chemical bonding consists of discussions of short-range structural order, the role of hydrogen in the alloy, and the influence of residual gap states upon diode characteristics. C.R.

A82-10331 **Alternative power sources for residential air-conditioning systems.** J. Tiran (Negev, University, Beersheba, Israel). *Applied Energy,* vol 9, Oct. 1981, p. 121-130. 8 refs.

An integrated system which utilizes three sources of energy for the purpose of air-conditioning a residential building is considered. The system includes a control unit which determines (according to a built-in programmed logic) which energy source is to be used The system's three power provisions are: (1) line electricity, (2) electric power generated by an appropriate wind turbine and (3) a hot water system heated by solar collectors. System requirements and operation were simulated by a computer program which calculated the air-conditioning load and the energy provisions throughout a twenty-four hour period. In winter operation, about 68 per cent of the required heating was supplied by solar heating and 32 per cent by wind-generated power and in summer operation, in a typical day, all the required cooling energy was provided by wind-generated power. (Author)

A82-10385 **Prospects for the development of solar energy in the USSR - Production of electric power by thermodynamics methods.** R. R. Aparisi, Iu. N. Malevskii, B. V. Tarnizhevskii, V K. Gusev, and A M Karpenko (Gosudarstvennyi Nauchno-Issledovatel'skii Energeticheskii Institut, Moscow, Teploelektroproekt, Sel'energoproekt, USSR) *(Geliotekhnika,* vol 16, no. 6, 1980, p 3-10) *Applied Solar Energy,* vol 16, no. 6, 1980, p 1-8. 6 refs. Translation.

Tower solar power plants, pumped storage to level off the intermittency of the energy source, and parabolic dish concentrators for low power users in the U S.S.R. are discussed. Capital expenditures and energy efficiency of solar plants are composed with conventionally fueled power plants, deriving baseline economic parameters which justify solar plant construction. Initial plans are presented for the installation of 5 - 10 MW units in rural areas of low generating capacity remote from conventional fuel sources, using mirrors optimized at 25 sq m and equipped with automatic tracking systems. Plants in Kazakhstan are considered for powering deep well irrigation and desalinization of the mineral-rich water. The development of new energy storage capabilities is considered vital to successful introduction of large solar power plant capacities. M S.K.

A82-10386 **Some characteristics of silicon photocells fabricated by planar technology.** C Tkhong, K. A. Tyan, P. V. Khoi, and L. K. Nam (National Center Branch for Scientific Research of Vietnam, Ho Chi Minh City, North Vietnam). *(Geliotekhnika,* vol. 16, no 6, 1980, p 18-21.) *Applied Solar Energy,* vol. 16, no. 6, 1980, p. 15-18. 8 refs. Translation.

It is reported that a method for determining the effective diffusion length on the basis of the spectral distribution curve for the collection coefficient permits a qualitative evaluation of the nonequilibrium distribution of recombination centers in the base layer. (Author)

A82-10387 **Present state of research on selective coatings for solar-energy converters.** M. M Koltun (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Istochnikov Toka, Moscow, USSR). *(Geliotekhnika,* vol 16, no. 6, 1980, p 34-42.) *Applied Solar Energy,* vol. 16, no. 6, 1980, p. 30-38. 42 refs. Translation

Recent developments in selective surface coatings for solar cells, flat plate and tubular collectors, and parabolic concentrators are reviewed Solar cells treated with hydrazine hydrate or alkalies produce a surface with relief, which traps up to 97% of the spectrum. Multilayer cells transparent to the IR are noted for space applications, phosphor coatings to convert ultraviolet radiation to visible light are mentioned for use as light and radiation detectors, expanding the range into the 0.2-0.4 micron wavelengths Coating compounds for cell protection are presented, noting a trend toward

polymer films, silicon varnish, and coatings with microrelief to enhance cell efficiencies. Processes for electrochemical plating of thermal collector surfaces are listed, including black nickel and chrome, as are various reflective coatings for thermal radiators. The development of cermets for high IR transparency is discussed, noting that cermets extend the absorptance/emmissivity ratio to 60-65. Finally, tin oxides employed for solar cell antireflective coatings are observed to reduce surface recombination rates in silicon cells.

M.S.K.

A82-10388 Investigation of abrasive action of atmospheric particles on the reflectance of mirrors. R. A. Zakhidov and A. Ismanzhanov (Akademiia Nauk Uzbekskoi SSR, Tsentral'noe Proektno-Konstruktorskoe Tekhnologicheskoe Biuro Nauchnogo Priborostroeniia, Uzbek SSR) *(Geliotekhnika,* vol. 16, no. 6, 1980, p. 43-47.) *Applied Solar Energy,* vol. 16, no. 6, 1980, p. 39-43. 9 refs. Translation.

Atmospheric dust, its particle sizes, and wind-blown effects on solar power plant mirrors are investigated. Experiments were performed with particles from 5-200 microns at wind tunnel speeds of 2-30 m/s, encountering a protected or uncoated aluminum mirror. Wind speed, mirror angle and dust size and concentration per volume air were varied and mirror reflectance, diffuse reflectance, rear reflection, and light transmission through various protective coatings were measured after 60 hrs bombardment. Damage was related to wind speed, with all dust sizes causing damage when wind exceeded 30 m/s. Mirror angles of 90 and 0 deg relative to the wind eliminated damage up to 30 M/s, and SiO2 coatings were found to offer protection up to a 30 deg angle. The experiments indicate that mountain-valley air circulation presents no danger to mirrors, whereas areas of frequent jet winds and loose soil do. M.S.K.

A82-10389 Experimental investigation of parabolic-cylinder solar concentration with tubular heat receiver. M. A. Markman, N. V. Kolomoets, L. M. Simanovskii, Iu. I. Shmatok, and O. P. Zakharova (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Istochnikov Toka, Moscow, USSR). *(Geliotekhnika,* vol. 16, no. 6, 1980, p. 66-68.) *Applied Solar Energy,* vol. 16, no. 6, 1980, p. 61-63. Translation.

The performance and characteristics of an electroplated anodized aluminum parabolic concentrator with a tubular heat receiver are described. A 2-sq-m sheet of aluminum was elastically deformed into a concentrator with a 400-mm focal length, the heat receiver was a blackened metal tube enclosed in a fluorescent light tube. Focusing errors were determined by use of a collimated light beam shone perpendicular to the receiver window, and optical efficiency and heat receiver losses were calculated and graphed as functions of temperature. The total flux was determined by calorimetry of water flowing through the receiver tube and by measuring the temperature of the heat receiver directly; predicted values for the flux agreed satisfactorily with the experimental findings. M.S.K.

A82-10390 Regime characteristics of a solar thermoelectric generator and comparison of experimental and calculated data. E. A. Movsumov and A. M. Bairamov (Kirovabadskii Pedagogicheskii Institut, Kirovabad, Azerbaidzhan SSR). *(Geliotekhnika,* vol. 16, no. 6, 1980, p. 69, 70.) *Applied Solar Energy,* vol. 16, no. 6, 1980, p. 64-66. 7 refs. Translation.

Experiments undertaken to verify predicted solar thermoelectric generator performance are described. The powder metallurgy process for production of Bi-Te-Se-negative and Bi-Te-Sb positive legs of the thermoelectric generator is reviewed, as is the fabrication of the generator, illuminance, varied according to flux data from the Azerbaidzhan SSR, was provided by a searchlight with a focal-spot maximum heat of 300 C. Volt-ampere characteristics of the thermopiles were determined for various temperature differentials, and the efficiencies were calculated. Both capacity and efficiency were found to rise linearly with increasing temperature. Performances determined from simulation of three actual 12-hour periods agreed well with predicted values. M.S.K.

A82-10391 Electrical characteristics of high-voltage germanium photoconverters under high illumination intensities. D. S. Strebkov, V. A. Tikhomirova, and G. B. Fedosova (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Istochnikov Toka, Moscow, USSR) *(Geliotekhnika,* vol. 16, no. 6, 1980, p. 71-73.) *Applied Solar Energy,* vol. 16, no. 6, 1980, p. 67-69. 6 refs. Translation.

Germanium matrix photoelectric cells were tested in 0.1-5 W/ sq cm illumination to characterize their electric properties. Cell specimens were moved along the optical axis of a Fresnel lens under 600 W illumination to vary the light intensity, and output was compared with a linearly varying short-circuit current of a standard silicon cell. Examination of volt-ampere characteristics revealed that low resistance (0.1 ohm cm) germanium cells displayed a linear photocurrent dependence over the illuminance range explored, while higher resistivity (10 ohm cm) produced nonlinear behavior at around 3 W/sq cm and upward. The behavior is attributed to a voltage drop in the base region of the cell. Efficiency was found to reach a maximum at 1 W/sq cm, falling off thereafter. A 6.5% maximum efficiency was found for 10 ohm cm germanium cells. M.S.K.

A82-10467 Optical properties of selectively absorbing chromium films deposited at oblique angle of incidence. R. T. Kivaisi (Institute of Optical Research, Stockholm, Sweden). *Solar Energy Materials,* vol. 5, Aug. 1981, p. 115-127. 23 refs.

Optical properties of chromium films deposited at oblique angles of incidence are studied, and consideration is given to their being used as selective films in photothermal solar energy conversion. The films were produced on smooth glass substrates by subliming chromium pellets from an electron beam gun in a conventional oil diffusion pumped system in high vacuum. A graphical relationship between film thickness and reflectance was obtained, and coatings with the desired selectivity were produced. Some films were deposited on nickel and aluminum metal backing. A near to zero reflectance (0.9 microns) of a film coated on an aluminum substrate corresponded to a film thickness of 110 nm, the coating having a solar absorptance of about 86%. It is thought that the coating contains a high concentration of metal grains, each surrounded by a very thin film of chromium oxide. It is concluded that the emissivity of the surfaces is primarily determined by the base metal. K.S.

A82-10468 Spectrally selective copper sulphide coatings. S. B. Gadgil, R. Thangaraj, J. V. Iyer, A. K. Sharma, B. K. Gupta, and O. P. Agnihotri (Indian Institute of Technology, New Delhi, India). *Solar Energy Materials,* vol. 5, Aug. 1981, p. 129-140. 9 refs. Research supported by the Tata Energy Research Institute.

Copper sulfide films are chemically deposited on aluminum substrates in ambient air by chemical spray deposition, and their optical properties are studied for their application in solar energy photothermal conversion. The experimental procedure is described, including the deposition technique, structural studies (using an X-ray diffractometer and a transmission electron microscope), stagnation temperature measurements, and aging tests. It is shown that (1) the solar absorptance and solar emittance of the films do not change after cycling between 0 and 200 C, and (2) the films withstand temperatures as high as 200 C for more than 500 h. Solar selectivity with maximum solar absorptance (0.89) and minimum thermal emittance (0.25) is obtained for a film deposited at 250 C with a volume ratio of 1.1 of thiourea and cupric acetate solutions, and a thickness of 1.6 microns. It is concluded that the films provide a low cost ($2.5/sq m) selective coating for photothermal conversion of solar energy. K.S.

A82-10469 Effect of metal base layer on the absorptance and emittance of sputtered graded metal-carbon selective absorbing surfaces. G. L. Harding and S. Craig (Sydney, University, Sydney, Australia). *Solar Energy Materials,* vol. 5, Aug. 1981, p. 149-157. 17 refs. Research supported by the University of Sydney.

Solar absorptance and temperature-dependent emittance is measured for graded metal-carbon films deposited onto smooth aluminum, copper, nickel, and stainless steel base layers, sputter-deposited onto glass tubes at relatively low argon pressure (approximately 0.5 Pa), and deposited onto textured copper using argon pressures 3 to 40 Pa. Absorptance measurements are made on surfaces deposited onto small plane glass slides attached to a glass tube in the coating system, and emittance measurements are made on coated tubes, assembled into glass envelopes. Both the small planar specimens of selective surface and coated tubes were inserted in continuously evacuated glass envelopes and annealed at 500 C for approximately 1 hr. It is shown that solar absorptance varies by only 1-2% for the different base layers, whereas the emittance of surfaces based on nickel and stainless steel is considerably higher than for

surfaces based on copper and aluminum. Small changes occur in absorptances and emittances after annealing It is concluded that the optimum selective surface for evacuated collectors used with mirrors of low concentrations consists of graded metal-carbon overlaid with smooth copper K S.

A82-10471 Production of alloys of bismuth telluride for solar thermoelectric generators. T. Durst, H J. Goldsmid, and L. B. Harris (New South Wales, University, Kensington, Australia). *Solar Energy Materials,* vol. 5, Aug. 1981, p. 181-186. 9 refs

A simple and inexpensive method is described for the preparation of sintered thermoelements for use up to about 200 C, i e., within the temperature range that is accessible using nontracking solar collectors. The method involves selecting the raw materials, weighing the constituents and melting the ingots, grinding and grading the powders, cold-pressing the thermoelements, sintering, and evaluating the thermoelectric properties It is shown that p-type Bi(0 5)Sb(1 5)Te(3) containing 0.05% atomic Pb, and n-type B(2)Te(2 7)Se(0 3) containing 0.2% atomic S are most suitable for operation between 30 and 170 C (i e , at a mean temperature of 100 C). The Seebeck coefficient, electrical conductivity, and figure of merit are measured between 15 and 200 C using apparatus based on Harman's technique (1958), account being taken of radiation losses It is shown that even though the thermoelements are porous, their thermoelectric figures of merit compare well with the values obtained with hot-pressed material of higher density Thermoelements prepared by the method described have been fitted into a solar generator which has been operated for six months without any signs of aging. K S.

A82-10472 Solution grown PbS/CdS multilayer stacks as selective absorbers. G B. Reddy, V Dutta, D. K. Pandya, and K. L. Chopra (Indian Institute of Technology, New Delhi, India) *Solar Energy Materials,* vol 5, Aug. 1981, p 187-197. 16 refs.

Theoretical and experimental studies are reported for the design and fabrication of multilayer stacks for selective solar absorbers (25 x 25 sq cm) of PbS and CdSm made on Ni coated Cu and stainless steel, using a solution grown technique. A mathematical model is formulated using the matrix multiplication method to calculate the reflectance of the absorbers. The preparation technique involves dissociating thiourea in an alkaline solution containing Pb or Cb salts, as reported by Sharma et al. (1976) and Kaur et al (1980) The best values of solar absorptance and thermal emittance obtained are 0.92 and 0.12, respectively, which is in close agreement with the estimated values Coatings with as many as six alternate layers of PbS and CdS have been made. K.S.

A82-10658 Numerical simulation of solar cell open circuit voltage decay. L Castañer, J. Llaberia, J. Garrido, and E Vilamajó (Barcelona, Universidad Politécnica, Barcelona, Spain) *Electronics Letters,* vol 17, Oct. 1, 1981, p. 745-747. 8 refs

A82-10776 Laser bonded n-GaAs/p-GaSb heterojunction intercell Ohmic contact. H T Yang and S W Zehr (Rockwell International Microelectronics Research and Development Center, Thousand Oaks, CA). *Applied Physics Letters,* vol 39, Oct. 15, 1981, p. 634-636 7 refs. Contract No. XS9-8058-2

A method is described for forming an n-GaAs/p-GaSb heterojunction intercell Ohmic contact by a pulsed Nd glass laser (1.06 micron wavelength) bonding procedure. High quality subcell assemblies of appropriate band-gap are fabricated individually and are used to form a metallurgical bond. The method avoids the need of total lattice matching throughout the structure of a stacked multicolor solar converter. K.S.

A82-10810 Boiling flow instability of a fixed mirror distributed focus solar receiver. S M. Cho, L. D Clements, J D Reichert (Texas Tech University, Lubbock, TX), and T T. Kao *(American Institute of Chemical Engineers and American Society of Mechanical Engineers, National Heat Transfer Conference, 20th, Milwaukee, WI, Aug. 2-5, 1981.) AIChE Symposium Series,* vol 77, no. 208, 1981, p. 302-311 10 refs Contract No. EY-76-C-04-3737.

A fixed mirror distributed focus (FMDF) solar thermal electric power plant concept has been developed. The FMDF system consists of fixed spherical mirror arrays (collector), movable receiver (boiler), receiver support and two-axis gimballing mechanisms, auxiliary heat storage system, and turbine-generator equipment. The FMDF concept has been adopted for a five(5)-MWe solar gridiron project for the city of Crosbyton, Texas A review is provided of the basic, steady-state, thermal hydraulic performance characteristics of the FMDF receiver Two types of boiling flow instability are considered, including a static instability and a dynamic instability Approaches for stabilizing unstable boiling flow are also considered, taking into account the use of variable ID tubes and the employment of intermediary plenums in the boiling circuit G R

A82-10836 # Optical degradation of antireflective silica film on solar collector windows. C T Solaga (Commonwealth Scientific and Industrial Research Organization, Div of Mineral Chemistry, Port Melbourne, Victoria, Australia) *Applied Optics,* vol 20, Oct 15, 1981, p. 3464, 3465. 6 refs

It is reported that a sustained accumulation of contaminants on antireflective silica film-coated solar collector glass could lead to increased reflection losses that could be deleterious to collector efficiency, particularly in environments with high atmospheric pollution levels Infrared absorption studies of the eluted material have demonstrated that the change in reflectance of the coated surface is caused, for the most part, by adsorption of airborne contaminants onto the negatively charged, high specific area presented by the close-packed, 10-20 nm diam silica spheres forming the antireflective film O.C

A82-10969 # AAI Corporation receiver design experience in concentrating solar collectors. H A Wilkening, Jr (AAI Corp., Baltimore, MD) *American Society of Mechanical Engineers, Joint Pressure Vessels and Piping, Materials, Nuclear Engineering and Solar Conference, Denver, CO, June 21-25, 1981, Paper 81-Sol-1* 5 p Members, $2.00, nonmembers, $4 00

The design of concentrating solar collectors requires careful attention to the receiver if maximum theoretical efficiencies are to be achieved. Innovative design concepts and detailed analysis are required if the design goals are to be met at a reasonable cost. This paper examines typical design parameters and shows how they relate to actual field tested hardware. Design criteria such as producibility, selective coating, and absorber material, are discussed Several practical applications are then examined in detail. Operational experience of both tracking and fixed receivers is reviewed. The applications discussed are industrial hot water and heating and cooling. The special problems of combined photovoltaic and thermal receivers are included (Author)

A82-10970 # Development of a solar thermal central heat receiver using molten salt. T. R. Tracey (Martin Marietta Aerospace, Denver, CO). *American Society of Mechanical Engineers, Joint Pressure Vessels and Piping, Materials, Nuclear Engineering and Solar Conference, Denver, CO, June 21-25, 1981, Paper 81-Sol-2* 4 p. Members, $2.00, nonmembers, $4.00 Research supported by the U S Department of Energy

The development and test of a 5 MWth solar heat receiver using a molten nitrate salt (60 percent $NaNO_3$, 40 percent $KNaNO_3$) as the heat transfer fluid is described The application of the receiver concept in a central receiver solar power system is explained. The advantages of using molten nitrate salts as the receiver heat transfer fluid and the storage fluid are discussed The problems associated with the receiver development including the need for high temperatures and combinations of creep and fatigue in the receiver tubes are discussed. Our approach to scaling from the 5 MWth test receiver to commercial receivers in the range of 200 MWth to 500 MWth is defined The 5 MWth test system is described including the instrumentation used The test facility which has a 60 m tower and 222 heliostats is described The test results are presented. The receiver was in test for 500 hr at temperature and heat flux levels expected in commercial receiver systems (Author)

A82-10971 # Testing of the U.S. Solar Pilot Plant receiver. G C Coleman (McDonnell Douglas Corp , Huntington Beach, CA) and J M Friefeld (Rockwell International Corp., Canoga Park, CA) *American Society of Mechanical Engineers, Joint Pressure Vessels and Piping, Materials, Nuclear Engineering and Solar Conference,*

Denver, CO, June 21-25, 1981, Paper 81-Sol-3. 4 p Members, $2.00, nonmembers, $4 00

Preconstruction tests were conducted of the external, single-pass-to-superheat water/steam receiver of the U.S. DOE Solar Thermal Pilot Plant at Barstow, CA under actual solar operating conditions in order to validate the design at the earliest possible date. Receiver steady-state and transient operating characteristics and performance were investigated under three different conditions (1) clear day, (2) intermittent cloud, and (3) a simulated emergency situation The testing program was concluded with limited testing of the receiver at flux and power levels above the maximum expected operating conditions. Attention is given to boiler temperature control, lateral flux gradients, panel tube thermodynamics, and dynamic flow stability. O C

A82-10972 # **The development and design of steam/water solar receivers for commercial application.** O. W Durrant, T. J. Capozzi, and R. H Best (Babcock and Wilcox Co , Barberton, OH). *American Society of Mechanical Engineers, Joint Pressure Vessels and Piping, Materials, Nuclear Engineering and Solar Conference, Denver, CO, June 21-25, 1981, Paper 81-Sol-4.* 11 p 7 refs Members, $2.00, nonmembers, $4 00.

A steam/water solar receiver is described which is designed in sectionalized form, with modularized components, so that it may be assembled in various sizes, capacities and geometries to meet the specific requirements of a system and the characteristics of the solar collector field Special design features are incorporated to overcome the lack of balance in north-to-south field flux ratios, the effect of partial and transient cloud patterns, and a large number of thermal cycles A parametric study aimed at the determination of the maximum allowable heat flux on the heat transfer surface components is also described Attention is given to such aspects of the design as the screen tubes, and calculations and analyses are included for pressure and thermal stresses, heat transfer surface structure, acceptance criteria, and the effects of cloud cover O C

A82-10973 # **Conceptual design of an advanced water/steam receiver for a solar thermal central power system.** S F Wu, T V Narayanan (Foster Wheeler Development Corp., Livingston, NJ), and D N. Gorman (ARCO Ventures Co., Denver, CO) *American Society of Mechanical Engineers, Joint Pressure Vessels and Piping, Materials, Nuclear Engineering and Solar Conference, Denver, CO, June 21-25, 1981, Paper 81-Sol-5.* 9 p 5 refs. Members, $2.00, nonmembers, $4 00. Research supported by the U.S. Department of Energy

This paper describes the conceptual design of an advanced water/steam receiver for a commercial-scale solar central receiver thermal power system. The objective was to develop a receiver concept featuring an optimum combination of cost, performance, and reliability While interfaces with other major subsystems of the complete power plant were recognized, emphasis was on the design and performance of the receiver The baseline thermal rating of this receiver was 550 MW, and the steam outlet conditions were 12,860 kPa and 516 C. After technical and economic evaluations, a quad-cavity, natural-circulation concept was selected as the preferred receiver design. It consists of four separate cavities in a single receiver unit, each cavity receiving concentrated solar energy from one quadrant of a surrounding heliostat field (Author)

A82-11185 **Carrier-collection efficiencies in amorphous hydrogenated silicon Schottky-barrier solar cells.** P Viktorovitch, G. Moddel, J. Blake, and W. Paul (Harvard University, Cambridge, MA). *Journal of Applied Physics,* vol 52, Oct. 1981, p. 6203-6207. 28 refs. Contracts No. EG-77-C-01-4042; No. N00014-75-C-0648.

Correlations are studied in the collection efficiency, collection length, depletion width, and midgap density of states and energy-band gaps in sputter and silane-decomposition-produced amorphous hydrogenated silicon Schottky diodes Collection efficiency is controlled by field associated diffusion of carriers and the depletion region, and midgap-state density decreases with preparation-condition variations to produce wider bandgaps. Sputter-produced films have a collection length which is less than the depletion width, and films produced from the plasma decomposition of silane exhibit a smaller-state density for a given bandgap and a collection length equal to the depletion width. In addition, the weak variation of the deduced hole mobility lifetime product with midgap state density and temperature is consistent with holes immobilized before recombing. D.L.G.

A82-11187 **Infrared quenching of photocapacitance in Cu/x/S/CdS solar cells.** T. Suda and R. H. Bube (Stanford University, Stanford, CA). *Journal of Applied Physics,* vol 52, Oct 1981, p. 6218-6223 20 refs. Research supported by the U.S. Department of Energy and Japan International Cooperation Agency.

A technique for infrared quenching of photocapacitance (PHCAP-IR) is used to investigate deep Cu-acceptor levels in Cu(x)S/CdS solar cells prepared by both wet and dry methods on CdS single crystals. A theory is developed which describes a doping profile and PHCAP-IR quenching to obtain energy levels, photoionization cross sections, and concentration profiles of Cu levels in CdS Two transitions of 1 08 and 0.86 eV are measured at room temperature, and the photocapacitance quenching level of 0.86 eV is found to disappear at low temperatures. Spectral distributions of photoionization cross sections are obtained at a peak value of 1 1 x 10 to the -16th sq cm, and the doping profile of Cu indicates that a density of Cu up to one-half of the majority-carrier density diffuses into CdS after heat treatments at 200 C for a few minutes D L.G

A82-11189 **Vertical solar cell and internal electric field.** Y.-T. Tang (National Tsinghua University, Hsinchu, Republic of China) *Journal of Applied Physics,* vol. 52, Oct. 1981, p. 6347-6351. 17 refs.

A method for estimating the pattern of the built-in electric field distribution in a vertical solar cell is developed that relies on the fact that a vertical solar cell responds differently to different monochromatic light. The usefulness of the technique for quality control is discussed. B.J.

A82-11190 **The contoured-oxide monolithic series-array solar battery.** E M. Murray (Hewlett-Packard Laboratories, Palo Alto, CA) and R. M Warner, Jr. (Minnesota, University, Minneapolis, MN) *Journal of Applied Physics,* vol 52, Oct. 1981, p 6352-6356. 7 refs.

The paper presents the monolithic series-array solar battery, which combines integrated circuit and solar battery technology to trade current for voltage and increase the flexibility of the photovoltaic system design. The flexibility holds over a wide range of incident power densities, and the battery offers cost and reliability benefits. The feasibility of the contoured-oxide approach is demonstrated, and power conversion efficiencies of 7 5% are exhibited. The low value is attributed to high series resistance caused by a process omission. Shunting, which is attributable to poor device isolation, is discussed, and corrective modifications are suggested. D L G.

A82-11207 **Simple tracking strategies for solar concentrations.** A. W. G Cope and N Tully (Natal, University, Durban, Republic of South Africa) *Solar Energy,* vol 27, no. 5, 1981, p. 361-365. 6 refs.

Consideration is given to the validity of single axis tracking systems for solar concentrators of low to medium concentration ratios having moderate acceptance angles If the misalignment between the sun and reflector normals is within the acceptance angle perfect tracking can be assumed. Rotation about a fixed polar axis gives a constant misalignment equal to the sun's declination angle on that day. Rotation about a declination axis gives perfect alignment at noon, but increasing misalignment towards each end of the day varying with the time from the equinoxes Data is also given for monthly adjustment of the declination axis All the results are independent of latitude (Author)

A82-11209 **Design and testing of a uniformly illuminating nontracking concentrator.** A. Gupta, S Kumar, Mr Murlidhar, and V K Tewary (Birla Institute of Technology and Science, Pilani, India) *Solar Energy,* vol. 27, no. 5, 1981, p. 387-391. Research supported by the Ministry of Industrial Development

The transverse parabolic shape of the reflecting surface in the Winston nontracking solar concentrator has been modified so that the illumination at the receiver is exactly uniform for certain angles of incidence, and reasonably uniform for other angles. An exact mathematical expression has been derived for the transverse shape of the reflecting surface, which reduces to the Winston parabolic shape in the limit of extreme nonuniformity The performance of the

proposed design has been analysed theoretically as well as tested experimentally Experimental studies show that the illumination at the receiver remains uniform to within 10-12% with no lateral shadows throughout a typical solar day The proposed design should therefore be quite suitable for photovoltaic applications D.L G

A82-11210 Modeling and testing a salt gradient solar pond in northeast Ohio. S A. Shah, T. H Short, and R P Fynn (Ohio Agricultural Research and Development Center, Wooster, OH) *Solar Energy,* vol 27, no 5, 1981, p 393-401 21 refs

A82-11211 Focal plane flux distributions produced by solar concentrating reflectors. J. A Harris and W. S Duff (Colorado State University, Fort Collins, CO). *Solar Energy,* vol 27, no 5, 1981, p 403-411. 5 refs.

A new method is proposed for computing focal plane flux distributions from solar concentrators of parabolic trough, parabolic dish, linear Fresnel, and circular Fresnel geometries The method is based on efficient numerical equations and allows for the reflecting surface quality and concentrator contour accuracy Computer implementation of the proposed flux models makes it possible to use mathematical programming techniques that can search a large parameter space for optimum concentrator/absorber designs. V L.

A82-11212 The effect of inclination on the heat loss from flat-plate solar collectors. P I. Cooper (Commonwealth Scientific and Industrial Research Organization, Div of Mechanical Engineering, Highett, Victoria, Australia) *Solar Energy,* vol. 27, no 5, 1981, p 413-420 9 refs

The top loss coefficient is calculated for single glazed flat-plate collectors as a function of plate temperature, wind speed, ambient temperature, and plate emittance for a typical spacing and an angle of inclination of 45 deg. The sky temperature is assumed to be 12 C below ambient temperature, and an effective sink temperature is defined for top losses from the collector. It is found that the value of the top loss coefficient is insensitive to the effective sink temperature and that the effective temperature is determined solely by the wind speed for a given collector inclination It is also shown that there is a continual reduction in the top loss coefficient up to an inclination of 90 deg. V L.

A82-11213 Performance analysis of d.c.-motor-photovoltaic converter system. II - Series and shunt excited motors. J Appelbaum (Tel Aviv University, Tel Aviv, Israel) *Solar Energy,* vol 27, no 5, 1981, p 421-431

A82-11214 * An experimental study of SO3 dissociation as a mechanism for converting and transporting solar energy. J. H McCrary, G. E McCrary (New Mexico State University, Las Cruces, NM), T A. Chubb (U.S. Navy, Naval Research Laboratory, Washington, DC), and Y S Won (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). *Solar Energy,* vol 27, no. 5, 1981, p 433-440. 6 refs Research supported by the U S. Department of Energy.

The high temperature catalytic dissocation of SO3 is an important chemical process being considered in the development and application of solar-thermal energy conversion, transport, and storage systems A facility for evaluating chemical converter-heat exchangers at temperatures to 1000 C with high flow rates of gaseous SO3 feedstock has been assembled and operated on the NMSU campus Several quartz and metal reactors containing different catalyst configurations have been tested Descriptions of the test facility and of the reactors are given along with a presentation and discussion of experimental results. (Author)

A82-11215 Plutonium thermochemical solar cell. G L. Silver (Monsanto Research Corp., Mound Facility, Miamisburg, OH). *Solar Energy,* vol. 27, no. 5, 1981, p. 443, 444. 9 refs Contract No. DE-AC04-76DP-00053.

An electrical energy producing cycle is proposed which uses aqueous plutonium as its working fluid The principle of the proposed cycle is that more work can be extracted from a process which reduces plutonium at constant acidity form N1 to N2 (N1 is greater than N2) than is required to reoxidize the plutonium from N2 to N1 at some lower value of the acidity. The operation of a cell in which one half is a plutonium solution and the other half is a normal hydrogen electrode is described V L.

A82-11334 Investigations of the OCVD transients in solar cells. L. Castañer, E Vilamajó, J. Llaberia, and J. Garrido (Barcelona, Universidad Politécnica, Barcelona, Spain). *Journal of Physics D - Applied Physics,* vol 14, Oct. 14, 1981, p 1867-1876 12 refs.

A theoretical analysis of the OCVD transients in solar cells has been done taking into account capacitive effects affecting the decay. An experimental method is described which improves the accuracy of measurements. Numerical and experimental verification of the predicted results is also described. (Author)

A82-11343 Stability of n-i-p amorphous silicon solar cells. D. L. Staebler, R S. Crandall, and R. Williams (RCA Laboratories, Princeton, NJ). *Applied Physics Letters,* vol. 39, Nov 1, 1981, p. 733-735. 12 refs Contract No. ET-78-C-03-2219

Unencapsulated, amorphous silicon indium tin oxide/n-i-p/ stainless-steel solar cells were tested for stability All cells have excellent shelf life. Changes occur during exposure to light, but can be controlled by the deposition conditions of the amorphous silicon. The changes are due to trapping and recombination of optically generated carriers in the i layer, and are reversibly annealed out above 175 C Preliminary life tests on two relatively stable cells showed a small initial drop to 5%, followed by a weak logarithmic decay that predicts only about 20% further decrease in efficiency after 20 years in sunlight Work is continuing on improving the efficiency and stability of these cells. (Author)

A82-11344 Efficient Si solar cells by low-temperature solid-phase epitaxy. B -Y Tsaur, G. W. Turner, and J. C. C. Fan (MIT, Lexington, MA). *Applied Physics Letters,* vol 39, Nov. 1, 1981, p. 749-751. USAF-supported research.

Solid-phase epitaxial Si layers of uniform thickness have been grown at 400-500 C by transport of Si atoms from an amorphous Si film through an Al film deposited on 100 line-type single crystal or polycrystalline n-type Si substrates The epitaxial Si layers are strongly p type due to Al doping, and good rectifying junctions are formed between these layers and substrates. Solar cells with conversion efficiences at AM1 of 10.4 and 8.5% have been fabricated on 100 line-type Si and polycrystalline Si substrates, respectively, without the use of an antireflection coating or back-surface field structure (Author)

A82-11386 A novel latent heat storage for solar space heating systems - Refrigerant storage. N R Sheridan (Queensland, University, Brisbane, Australia) and S C. Kaushik *Applied Energy,* vol 9, Nov. 1981, p 165-172. 7 refs Research supported by the Australian Research Grants Committee and University of Queensland

This paper proposes a novel latent heat storage which is applicable to solar space heating systems The device is similar to an absorption refrigerator and stores liquid refrigerant which is subsequently evaporated to release the latent heat It will recover the energy in a heat pump mode for application to solar space heating systems which are seen to be more cost effective - and hence to have a better market potential - than space cooling systems (Author)

A82-11387 Efficiency of Fresnel lenses. P. Kumar Gupta (Indian Institute of Technology, New Delhi, India) *Applied Energy,* vol 9, Nov 1981, p 173-183 5 refs.

The efficiency of Fresnel lenses is discussed with respect to optical (reflection and transmission) losses The efficiencies of lenses of different step widths, i e , 2, 3, 4 and 5 mm, are the same (91 9%) in the case of reflection losses, and the maximum efficiency of a lens of 5 mm step width is 95.8% with respect to transmission losses K S

A82-11390 Geometrical optical performance studies of a composite parabolic trough with a fin receiver. S S Mathur, T. C Kandpal, R N Singh, and A. K. Singhal (Indian Institute of Technology, New Delhi, India). *Applied Energy,* vol 9, Nov 1981, p 223-229

The geometrical optical performance characteristics of a composite parabolic trough (CPT) with a fin receiver have been studied The variation of geometrical concentration ratio with mirror element

size and the rim angle of the parent parabola has been studied and the results are presented graphically The distribution of local concentration ratio over the receiver plane has also been determined for some typical concentrator designs (Author)

A82-11421 Analysis of power, mass, and size parameters of solar vapor-turbine two-circuit systems with organic working bodies. V. A. Grilikhes, M M Grishutin, and V. S. Evseev. *(Geliotekhnika,* no 1, 1981, p. 5-14) *Applied Solar Energy,* vol 17, no. 1, 1981, p 3-11. 11 refs. Translation.

The power efficiency, mass and sizing parameters of two-circuit solar vapor-turbine systems based on an organic working fluid are analyzed Calculations are performed for systems using a diphenyl mixture as the working fluid and incorporating a jet condenser which condenses the flowing vapor and acts as a heat pump with two-stage refrigeration and heat removal by radiation. Expressions for the power efficiency and the specific radiator area (with respect to useful electric power delivered) are derived in terms of radiator emittance and efficiency, mechanical pump power required, pump efficiency, adiabatic temperature drop and the thermal balance equation, and it is shown that these parameters depend on the jet condenser parameters. Estimates of the effects of vapor flow pressure and the temperature of the liquid upon entry to the jet condenser on system efficiency and specific area are then presented, and an alternative to the device considered which overcomes its limitations of high specific radiator area by the division of vapor flow into two parts following first-stage regeneration is presented. Calculations show that the jet condenser is capable of providing the required circulation in both systems. A L W.

A82-11422 Cascade photogenerators based on silicon and germanium matrix photoconverters. D. S Strebkov, V A Tikhomirova, and G B Fedosova (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Istochnikov Toka, Moscow, USSR) *(Geliotekhnika,* no 1, 1981, p 21-23) *Applied Solar Energy,* vol 17, no 1, 1981, p 18-20 Translation

The construction of a cascade solar array based on silicon and germanium matrix-type solar cells is reported Arrays were connected in parallel according to the criterion of equal operating voltages under optimal loads in each stage, and in series according to the criterion of the equality of operating currents, based on measurements of the volt-ampere characteristics of the devices. Measured photocurrents produced under illumination by a tungsten lamp at an irradiance of 0.1 W/sq cm indicate improvements in efficiency relative to the most efficient single material (silicon) amounting to 2% for the germanium irradiated through silicon, and 35-40% for germanium irradiated directly. It is pointed out that the present devices may be useful as photocells with a wide band of spectral sensitivity. A.L.W.

A82-11423 Effect of inhomogeneous flow distribution in a system of heat-generating solar collectors. S I Smirnov, Iu A Konstantinovskii, and A S Torshin (Gosudarstvennyi Nauchno-Issledovatel'skii Energeticheskii Institut, Moscow, USSR) *(Geliotekhnika,* no 1, 1981, p 24-28) *Applied Solar Energy,* vol 17, no 1, 1981, p 21-24 Translation

Consideration is given to the effects of a nonuniform distribution of the heat-carrying fluid flow rates in an array of identical solar collectors connected in parallel on the heat output of the array. An expression is derived for the factor by which total heat output in uniform flow differs from that in nonuniform conditions in terms of water inflow and outflow rates from the separate collectors. Calculations show that for a given flow rate through the array, heat output decreases with increasing flow nonuniformity, however significant decreases in output are only produced at very large flow nonuniformities. Results are presented of experimental measurements of heat output from an array of ten parallel branches containing four collectors each and operating at different flow rates which confirm the theoretical results. A.L.W.

A82-11424 Combined solar-energy converters with selective coatings. M. M. Koltun (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Istochnikov Toka, Moscow, USSR). *(Geliotekhnika,* no 1, 1981, p. 54-60) *Applied Solar Energy,* vol. 17, no. 1, 1981, p 48-54. 25 refs Translation.

The role of selective optical coatings in increasing the efficiency of combined solar energy converters, which may consist of two or more devices operating on the same physical principle in different spectral regions, or two energy conversion devices based on different principles, is discussed. Consideration is given to uses of specially designed selective coatings to improve the efficiencies of cascade solar cells, photovoltaic/thermal solar energy converters, which produce both heat and electricity simultaneously, and thermophotoelectric converters, which transform thermal radiation into electrical energy using narrowband semiconductors. It is concluded that, partly due to the use of selective coatings, combined solar energy converters appear to be the most suitable for future solar energy research. A.L W.

A82-11425 Efficiency of selective surfaces for solar thermal collectors. R A. Zakhidov, A Abdurakhmanov, and Sh. I. Klychev (Akademiia Nauk Uzbekskoi SSR, Spetsial'noe Proektno-Konstruktorskoe Biuro Nauchnogo Priborostroeniia, Uzbek SSR). *(Geliotekhnika,* no. 1, 1981, p. 61-66.) *Applied Solar Energy,* vol. 17, no. 1, 1981, p 55-60 Translation

A82-11541 Solar energy technology - A five-year update. M. K. Simmons (General Electric Co., Schenectady, NY) In: Annual review of energy. Volume 6 Palo Alto, CA, Annual Reviews, Inc., 1981, p. 1-42 143 refs.

Major developments and trends in the field of solar energy in the past five years are reviewed. The tremendous growth in both the intensity and diversity of solar energy research and development projects is illustrated by the growth of government funding in the past decade. Attention is then given to the major directions and objectives of technology advances in the areas of solar and wind resource assessment, low temperature systems including the flat-plate solar collector and storage technology, medium-temperature systems with sunlight concentration for industrial applications, thermal electric and high-temperature systems including the 10 MW(e) pilot plant under construction in Barstow, California, wind energy, biomass production and conversion, photochemical and photovoltaic conversion, ocean thermal energy conversion, and satellite power systems. The rapid, however uneven, growth in the application of solar technology to water and space heating, utilization, and wind and photovoltaics in electricity generation is considered, and future prospects for solar technologies in light of commercial, political, social, and environmental concerns are discussed. A L.W.

A82-11710 * # A solar simulator-pumped gas laser for the direct conversion of solar energy. W R Weaver (NASA, Langley Research Center, Hampton, VA) and J. H Lee (Vanderbilt University, Nashville, TN). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 84-88. 12 refs. Grant No. NCC1-8

Most proposed space power systems are comprised of three general stages, including the collection of the solar radiation, the conversion to a useful form, and the transmission to a receiver. The solar-pumped laser, however, effectively eliminates the middle stage and offers direct photon-to-photon conversion The laser is especially suited for space-to-space power transmission and communication because of minimal beam spread, low power loss over large distances, and extreme energy densities A description is presented of the first gas laser pumped by a solar simulator that is scalable to high power levels The lasant is an iodide C3F7I that as a laser-fusion driver has produced terawatt peak power levels G R

A82-11711 # A spacecraft thermophotovoltaic power source with thermal storage. J G Severns and M H Cobble. In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 89-94 18 refs

A solar fired thermophotovoltaic space power supply with thermal storage is proposed A method is described for estimating component sizes for a given orbit and required load. The well known efficiency enhancement obtainable from a selective radiator is utilized with an Er2O3 radiator used with a germanium photovoltaic.

The possibility of using Yb2O3 with a silicon cell is pointed out, but the high radiator temperatures required make its compatibility with thermal storage doubtful. Temperature difference required to conduct the necessary thermal loads into and through the thermal storage vessel are approximated for two different examples an oxide eutectic, Al2O3-BeO, melting at 2108 K and silicon melting at 1685 K. The highest delta T values needed for a 1 kW rated supply is 166 K. A cassagrain/solar concentrator is described for this application, the major causes of spread of the solar image at the absorbing aperture are discussed and their importance ranked. (Author)

A82-11712 * # **Direct conversion of light to radio frequency energy.** J. W. Freeman and S. Simons (Rice University, Houston, TX). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 95, 96. Research supported by the Brown Foundation of Houston, Grant No NAG3-29.

A description is presented of the test results obtained with the latest models of the phototron The phototron was conceived as a replacement for the high voltage solar cell-high power klystron combination for the solar power satellite concept. Physically, the phototron is a cylindrical evacuated glass tube with a photocathode, two grids, and a reflector electrode in a planar configuration. The phototron can be operated either in a biased mode where a low voltage is used to accelerate the electron beam produced by the photocathode or in an unbiased mode referred to as self-oscillation. The device is easily modulated by light input or voltage to broadcast in AM or FM. The range of operation of the present test model phototrons is from 2 to 200 MHz. G R.

A82-11736 * # **High power solar array switching regulation.** D. K. Decker, J Cassinelli (TRW Defense and Space Systems Group, Redondo Beach, CA), and M. Valgora (NASA, Lewis Research Center, Cleveland, OH) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 224-231

It is pointed out that spacecraft utilization projections for the 1980s and beyond show a trend toward extended lifetimes and larger electric power systems. The need for improved power management and energy transfer arising in connection with this trend has resulted in the conduction of a Solar Array Switching Power Management study A description is presented of initial development work performed in the study, taking into account the characteristics for three mission classes Attention is given to the manned LEO platform (250-kW average load), the unmanned GEO platform (50-kW average load), and an ion propulsion orbit transfer vehicle (50- to 250 kW load). G.R

A82-11738 # **Series vs. shunt regulators for power control in satellite power systems.** J R. Sheie, R. E. Corbett, and M C. Glass (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1.

New York, American Society of Mechanical Engineers, 1981, p. 235-240.

The relative advantages and disadvantages of the series and shunt power-control approaches for various applications are examined, including high and low power and high and low earth orbit. A comparative study of the series and shunt power-control techniques is carried out, with consideration given to solar array sizing, power-control weight, equipment heat dissipation, power availability, and electromagnetic interference characteristics A trade study example is given for specific applications where cost is the evaluation criterion C.R.

A82-11741 * # **Cost and performance projections for SPS photovoltaic blankets.** J. A. Scott-Monck (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1.
New York, American Society of Mechanical Engineers, 1981, p. 255-260 12 refs.

An estimate, based on optimistic projections of current technology, is given for the specific power of photovoltaic blankets which might be achieved if the SPS concept was to be implemented. A simultaneous consideration of cost and technical requirements is used to identify key blanket technologies which must be developed for this reference system. The terrestrial photovoltaic experience coupled with new technology is used to develop cost estimates for the blanket, assuming an annual demand of 5 GW and a manufacturing industry dedicated to blanket production The results indicate that blanket specific power goals may be exceeded, but there is little prospect that the cost goals can be met. This argues for a reconsideration of the photovoltaic option based on more expensive but higher performance blankets. (Author)

A82-11742 # **Satellite power systems /SPS/ energy conversion and power management.** A. A Nussberger (Rockwell International Corp, Space Operations and Satellite Systems Div, Seal Beach, CA) In. Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 1 New York, American Society of Mechanical Engineers, 1981, p. 261-265.

Impacts on the reference concept resulting from alternatives to microwave conversion, photovoltaic techniques, solar concentration ratio and power distribution voltage are discussed Alternatives include solid state RF conversion such as sandwich configurations and end-mounted antenna configurations, and magnetron RF conversion including advanced pivoting panel configurations Mass estimates are compared to a normalized point (2.3 kg/kw), and it is found that the estimates have grown over the past six years by a factor of 2 3 for the reference GaAs concept and 3.5 for the reference silicon concept Mass savings from the use of multi bandgap solar cells is shown at an efficiency of 30%, and it is concluded that the advance magnetron concept incorporating improvements from evolving technology developments can provide a very competitive program. D L.G

A82-11758 * # **High performance silicon solar arrays employing advanced structures.** D E. Rockey (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA), J M. Hedgepeth, and L. Adams (Astro Research Corp., Carpinteria, CA). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 1 New York, American Society of Mechanical Engineers, 1981, p. 374-379. 7 refs. Contract No NAS7-100

Specific design features to reduce cell mass, lower panel operating temperatures, and improve power to mass ratios for silicon solar cell arrays in space applications are presented. Because mass constraints limit payload capacity for launch into GEO, graphite/epoxy structures combined with high performance Si cells are needed to deliver a power/mass ratio of 265 W/kg, notably for Solar Electric Propulsion systems, compared with existing level of 65 W/kg. Shallow diffusion and back surface field cell technology have raised cell efficiencies to 15%, with a back emissivity of 1.64. Structural design requirements comprise Shuttle interface compatibility, full ground test capability, low mass, and high stiffness. Three array alternatives are discussed, and the STACBEAM configuration, which consists of a triangular truss and a piston deployer with folding accomplished on simple hinges, provides 0.2 Hz stiffness and achieves the design power/mass goals. D H.K.

A82-11759 # **Solar panel current degradation factors.** M T Gates (Hughes Aircraft Co., Culver City, CA) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 380-382.

Degradation factors that cause current losses distributed unequally over a string of solar cells in series are discussed A high efficiency solar cell type is used for the investigation with computer simulations to calculate the expected current losses incurred. The study includes analyses of flat panel loss, short circuit current loss in folded cell strings, and folding loss in strings at various operating voltages. Results show that the actual current loss for many conditions is nearly linear with respect to the percent of the string covered, and for voltages at or near the maximum power voltages, and losses are linear even at 5% darkening. D.L.G.

A82-11761 * # **Nonimaging concentrators for photovoltaic arrays in space.** R. Winston, P. Greenman (Chicago, University, Chicago, IL), and D. Rockey (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p 390-392. 8 refs. Research supported by the California Institute of Technology.

Two stage concentrators are studied in order to design an optimum concentrator for photovoltaic arrays in space The study is directed at designs with two-dimensional geometries because they are better suited to moderate concentrations of about 10 X to 50 X, and because the instantaneous flux distribution is more uniform. It is found that with an f/0.5 primary, where f is the focal length of the primary, the flux distribution is very smooth regardless of the angle of incidence of the radiation As the focal ratio is increased, peaks in the distribution begin to appear. The nonuniformities can be reduced by introducing small, closely spaced distortions into the reflecting surfaces, and practical arrays can achieve a concentration of 10 when the acceptance half angle is 4.25 deg or 50 when the acceptance half angle is + or - 1 deg. D.L.G.

A82-11762 * # **High- and low-resistivity silicon solar cells.** A. Meulenberg, Jr. and R A Arndt (COMSAT Laboratories, Clarksburg, MD). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 397-399 13 refs. Research sponsored by the Communications Satellite Corp., Contracts No. NAS3-21280, No. NAS3-22217

Attention is given to recent work at COMSAT Laboratories on improving silicon solar cell efficiencies and open-circuit voltages for both high (more than 1000 ohm-cm) and low (less than 1 ohm-cm) resistivities. It is noted that open-circuit voltages above 650 mV have been obtained for 0 1 ohm-cm cells and that air mass zero efficiencies of 12.5% have been measured from 4-mil 1,250 ohm-cm. C.R.

A82-11763 * # **Solar cell development for the Power Extension Package.** C R Baraona (NASA, Lewis Research Center, Cleveland, OH) and J. L Cioni (NASA, Johnson Space Center, Houston, TX). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 400-403. 6 refs

The Power Extension Package (PEP), a 32-kilowatt, flexible-substrate, retrievable solar array system for use on the Space Shuttle, is described It is noted that solar cell costs will be reduced by increasing cell area and simplifying cell and coverglass fabrication processes and specifications The tests that have been carried out on the cells are described, among them a unique radiation damage test and a side-by-side comparison of candidate cell types with pre- and post-irradiation airplane calibration of outer space short-circuit current C.R.

A82-11764 # **Thin cells - Their present status and future areas of development.** J. H. Wohlgemuth (Solarex Corp., Rockville, MD). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 404-408. 10 refs.

Silicon solar cells as thin as 50 microns are fabricated with AMO efficiencies greater than 15%. A chemical etching method is used on thin regular silicon wafers to reduce them to the required thicknesses. The production of textured thin cells, gridded back contact thin cells, and vertical junction thin cells is reviewed, and future possibilities of enhancing cell performance are discussed. D.L.G.

A82-11765 * # **Gallium arsenide solar cells-status and prospects for use in space.** H. W. Brandhorst, D Flood, and I. Weinberg (NASA, Lewis Research Center, Cleveland, OH). In. Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1 New York, American Society of Mechanical Engineers, 1981, p 409-415 27 refs

Gallium Arsenide solar cells now equal or surpass the ubiquitous silicon solar cells in efficiency, radiation resistance, annealability, and in the capability for producing usable power output at elevated temperatures. NASA has developed a long-range research and development program to capitalize on these manifold advantages. In this paper we review the current state and future prospects for R&D in this promising solar cell material, and indicate the progress being made toward development of GaAs cells suitable for a variety of space missions Results are presented from studies which demonstrate conclusively that GaAs cells can provide a net mission cost and weight savings for certain important mission classes. (Author)

A82-11766 # **GaAs solar cells for space application.** G. S. Kamath (Hughes Research Laboratories, Malibu, CA). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1
New York, American Society of Mechanical Engineers, 1981, p. 416-421

It is noted that the status of GaAs solar cells for space power applications has been greatly enhanced by recent developments. Techniques for the large-scale development of space-qualified cells have been perfected at Hughes Research Laboratories using liquid phase epitaxial methods GaAs cells have been produced with large areas (2 x 4 sq cm) and with reduced thickness (less than 2 mils), the power capacity of these cells is fully equal to the conventional 2 cm x 2 cm cell previously produced. It is noted that in addition to the higher efficiency of the GaAs cells in comparison with silicon, they also have increased radiation hardness to most radiation. It is pointed out that the cost of Ga has come down from $3/g in 1960 to $0.50 in 1980. It is concluded that GaAs is a viable candidate for solar cell application in space power systems and that the advances to date justify their use for specific missions, even at today's cost. C.R.

A82-11767 * # **High efficiency thin-film GaAs solar cells.** S. Zwerdling, K. L. Wang, and Y C M. Yeh (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1.
New York, American Society of Mechanical Engineers, 1981, p. 422-427. Research sponsored by the U.S. Department of Energy, U.S. Air Force, and NASA.

The paper demonstrates the feasibility of producing high-efficiency GaAs solar cells with high power-to-weight ratios by organic metallic chemical vapor deposition (OM-CVD) growth of thin epi-layers on suitable substrates. An AM1 conversion efficiency of 18% (14% AM0), or 17% (13% AM0) with a 5% grid coverage is achieved for a single-crystal GaAs n(+)/p cell grown by OM-CVD on a Ge wafer. Thin GaAs epi-layers OM-CVD grown can be fabricated with good crystallographic quality using a Si-substrate on which a thin Ge epi-interlayer is first deposited by CVD from GeH4 and processed for improved surface morphology. D.L.G.

A82-11769 * # **Power management of multi-hundred kilowatt spacecraft power systems.** D. K. Decker, G. W Fleck (TRW Defense and Space Systems Group, Redondo Beach, CA), and J. Graves (NASA, Marshall Space Flight Center, Huntsville, AL). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1.
New York, American Society of Mechanical Engineers, 1981, p. 434-439.

A NASA-sponsored study of space power distribution system technology is in progress to develop an Autonomously Managed Power System (AMPS) for large space power platforms The conceptual design of a 250 kW photovoltaic power system, including the power management subsystem (PMS), is presented. A PMS concept is derived based on the need to accommodate the increased complexity of a utility-type power system, and to minimize Shuttle resupply and ground station operational costs. The main PMS functions are discussed along with the control strategies of the autonomously managed power system (Author)

A82-11772 # **The evaluation of four solar-array-powered multi-kW power conditioners for Space Shuttle Orbiter application.** M. C. Wright (Lockheed Engineering and Management Services Co., Houston, TX). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings.

Volume 1. New York, American Society of Mechanical Engineers, 1981, p 451-456. 6 refs.

The performance of solar-array-powered multikilowatt power conditioners for application on the Space Shuttle Orbiter Power Extension Package (PEP) is evaluated. The application, application requirements, and performance test results are discussed. The PEP goals and requirements are thought to be attainable by utilizing existing power conditioning technology. C.R

A82-11773 # . **The Texas Instruments Solar Energy System development.** E. L. Johnson (Texas Instruments, Inc., Dallas, TX). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1 New York, American Society of Mechanical Engineers, 1981, p. 798-804. Contract No. DE-AC01-79ER-10000

The system is described, showing that energy conversion and storage functions are combined in a novel way. Here, small silicon solar cells are immersed in an electrolyte and the current generated by the cells is used directly to electrolyze a halogen acid, for example, HBr. The hydrogen and bromine produced can be stored separately until needed and then recombined in a fuel cell to give electrical energy on demand. The fuel cell HBr product is returned to the solar chemical convertor, thus completing the closed loop energy cycle In summarizing the achievements to date, it is noted that feasibility demonstration of a 13% array electrical efficiency prepared by a laboratory process and 10% array efficiencies have been obtained from potentially scalable solar cell and array processes C.R.

A82-11778 # **Small sodium sulfur battery for solar and wind energy systems.** H. J. Haskins and A. G. Domaszewicz (Ford Aerospace and Communications Corp., Aeronutronic Div., Newport Beach, CA). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 836-840. Contract No DE-AM02-79CH-10012.

A conceptual design of a 1 MWh sodium-sulfur storage battery is given. The battery is to be used in small (15 kW), stand-alone solar or wind electrical power systems. The design uses approximately 1,400 sodium-sulfur cells of a new, high energy capacity configuration. The cells are connected in a parallel/series network to give a discharge voltage of 120 VDC minimum, and with sufficient cell redundancy for a 10 year battery life. A description is given of the battery structure, thermal enclosure, and controls. Battery performance estimates are given, including the effect of thermal losses. It is concluded that sodium-sulfur batteries hold promise for good performance and reliability in small, stand-alone power systems. C.R.

A82-11780 # **Molten salt thermal energy storage subsystem for Solar Thermal Central Receiver plants.** P. B. Wells (Martin Marietta Aerospace, Denver, CO) and G. P. Nassopoulos (American Technigaz, Inc., Hingham, MA) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 925-930. Research supported by the U.S. Department of Energy.

The development of a low-cost thermal energy storage subsystem for large solar plants is analyzed. Molten nitrate salt is used as both the plant's working fluid and as the storage medium. The storage system comprises a specially designed hot tank to hold salt at a storage temperature of 839 K (1050 F) and a separate carbon steel cold tank to hold the salt after its thermal energy has been extracted to generate steam. The hot tank is lined with insulating firebrick to lower the shell temperature to 561 K (550 F) so that a low-cost carbon steel shell can be used. A preliminary design is described for a large commercial-size plant (1200 MWht). Also described are a laboratory test program for the critical components and the design, construction, and test of a small-scale research experiment at the Central Receiver Test Facility in Albuquerque, New Mexico. C.R.

A82-11781 # **Ground-mounted thermal storage for the parabolic dish solar collector/Stirling engine system.** R. J. Copeland, J. Ullman (Solar Energy Research Institute, Golden, CO), and J. W. Leach (North Carolina State University, Raleigh, NC) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1 New York, American Society of Mechanical Engineers, 1981, p. 935-940 5 refs

Several types of pumped-fluid thermal energy transport and phase-change thermal storage systems are examined. The pumped fluid circulates through a symmetrically arranged group of collectors within a large collector field and transports thermal energy to the engine/thermal storage subsystem near the center of the connected cluster. Cost analyses are made on the basis of variations in the designs of the major components Pressurized liquid transport fluids and saturated liquids that boil in the solar receiver to return as vapors are investigated A number of liquid metals are considered for each type of thermal energy transport Conventional insulation and vacuum-jacketed multilayer foil type insulation designs are assessed. Also investigated are tube-intensive and direct-contact type heat exchangers C.R.

A82-11793 # **Advances in photovoltaics R&D - An overview.** L. L. Kazmerski (Solar Energy Research Institute, Golden, CO). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2.

New York, American Society of Mechanical Engineers, 1981, p. 1637-1641. 35 refs.

Solar cells based upon polycrystalline and amorphous Si, CdS, GaAs, and emerging materials are covered for thin film applications. In the context of the discussion, a thin-film solar cell is one whose active layer is near the minimum required for adequate current collection. Therefore, 50-100 micrometers of polycrystalline Si can be defined as thin film, in contrast to 1-10 micrometers of amorphous Si. A description is provided of highly efficient, nonconventional approaches to concentrator cell applications, taking into account developments in the cell fabrication and module demonstration areas. G.R.

A82-11794 # **The development of high efficiency cascade solar cells - An overview.** M. L. Timmons, J A. Hutchby, S. M. Bedair, and M. Simons (Research Triangle Institute, Research Triangle Park, NC). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2. New York, American Society of Mechanical Engineers, 1981, p 1642-1644. 9 refs. Research supported by the Solar Energy Research Institute and U.S Air Force.

Multiple junction solar cells offer potential efficiencies much higher than single junction cells. These high efficiencies are achieved by minimizing the heat losses. Two approaches of utilizing multiple junctions have been demonstrated experimentally The two approaches are related to spectral splitting and the tandem cell concept. The limiting factor of spectrum splitting is the cost of the reflective filter. The tandem cell technology is new, and device areas are still quite small. G.R.

A82-11795 # **Research activities of solar cells in ROC.** H. L. Hwang (National Tsinghua University, Hsinchu, Republic of China) and C. Y. Sun (Industrial Technology Research Institute, Hsinchu, Republic of China). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2. New York, American Society of Mechanical Engineers, 1981, p. 1645-1648. 24 refs.

Silicon solar cell research is considered, taking into account the preparation of a Schottky-barrier silicon solar cell with the aid of an electroless plating process, silicon epitaxial layers grown by chemical vapor deposition (CVD), and ion-implantation techniques employed to fabricate silicon grating-type solar cells. Research on alternative solar cells is also reported. Organometallic CVD has been used in the fabrication of a Cu2S/CdS solar cell. Investigations regarding CuInS2 as a new photovoltaic material are discussed. G.R.

A82-11796 * # **Multijunction high voltage concentrator solar cells.** G. J. Valco, V. J. Kapoor (Case Western Reserve University, Cleveland, OH), J. C. Evans, and A.-T Chai (NASA, Lewis Research Center, Cleveland, OH). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2. New York, American Society of Mechanical Engineers, 1981, p. 1649-1653. NASA-supported research.

The standard integrated circuit technology has been developed to design and fabricate new innovative planar multi-junction solar cell chips for concentrated sunlight applications This 1 cm x 1 cm cell consisted of several voltage generating regions called unit cells which were internally connected in series within a single chip resulting in high open circuit voltages Typical open-circuit voltages of 3 6 V and short-circuit currents of 90 ma were obtained at 80 AM1 suns A dramatic increase in both short circuit current and open circuit voltage with increased light levels was observed (Author)

A82-11797 # **A central tower solar test facility /RM/CTSTF/.** S. Bevilacqua and R Gislon (Comitato Nazionale per l'Energia Nucleare, Rome, Italy). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 2. New York, American Society of Mechanical Engineers, 1981, p. 1742-1745. 9 refs.

The considered facility is intended for the conduction of test work in connection with studies of receivers, thermodynamic cycles, heliostats, components, and subassemblies. Major components of the test facility include a mirror field with a reflecting surface of 800 sq m, a 40 m tower, an electronic control system, a data-acquisition system, and a meteorological station. A preliminary experimental program is discussed, taking into account investigations related to facility characterization, an evaluation of advanced low-cost heliostats, materials and components tests, high-concentration photovoltaic experiments, and a study of advanced solar thermal cycles. G.R.

A82-11798 * # **Secondary concentrators for parabolic dish solar thermal power systems.** L D. Jaffe and P. T Poon (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2. New York, American Society of Mechanical Engineers, 1981, p. 1752-1758. 18 refs. Research sponsored by the U.S. Department of Energy and NASA.

A variety of different concepts are currently being studied with the objective to lower the cost of parabolic mirrors and to provide alternatives. One of the considered approaches involves the use of compound concentrators. A compound solar concentrator is a concentrator in which the sunlight is reflected or refracted more than once. It consists of a primary mirror or lens, whose aperture determines the amount of sunlight gathered, and a smaller secondary mirror or lens. Additional small optical elements may also be incorporated. The possibilities and problems regarding a use of compound concentrators in parabolic dish systems are discussed. Attention is given to concentrating secondary lenses, secondary imaging and concentrating mirrors, conical secondary mirrors, compound elliptic secondary concentrating mirrors, and hyperbolic trumpet secondary concentrating mirrors. G.R.

A82-11799 * # **The effect of concentrator field layout on the EE-1 small community solar power system.** R. L. Pons and R. E. Irwin (Ford Aerospace and Communications Corp., Aeronutronic Div., Newport Beach, CA). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2. New York, American Society of Mechanical Engineers, 1981, p 1759-1763. 6 refs. Contract No. JPL-955637

The point-focusing distributed receiver (PFDR) concept is employed by a number of solar thermal power systems currently under development. One type of PFDR system which shows particular promise incorporates distributed energy generation. According to this concept each parabolic dish collector is a self-contained power generation module, and a conventional electrical system is used to interconnect the modules. The concept is thus modular, and any number of power modules can be combined to achieve the required plant size. Given the benefits of mass production, it appears that this type of system can produce electricity at lower cost than is projected for conventional (fossil) power systems over the next decade. An employment of organic Rankine cycle heat engines is considered. G.R.

A82-11800 * # **Development of a solar receiver for an organic Rankine cycle engine.** H J. Haskins, R. M. Taylor, and D. B Osborn (Ford Aerospace and Communications Corp., Aeronutronic Div., Newport Beach, CA). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 2. New York, American Society of Mechanical Engineers, 1981, p. 1764-1769. Contract No. JPL-955637.

A prototype power conversion assembly (PCA) developed by an American aerospace company is considered. The PCA will be mounted at the focal point of a 12 meter parabolic dish and will produce approximately 20 kW of 3 kHz ac power to a ground-mounted rectifier. The PCA includes a cavity receiver coupled to an organic Rankine cycle engine. The engine working fluid is toluene. The performance goals of the receiver design are to maximize both the thermal efficiency and the heat capacity of the core. The latter goal is desired for stabilizing the PCA operation during intermittent cloud cover The receiver design is based upon the utilization of a direct-heated copper shell. It was necessary to develop a feasible manufacturing process for assuring a good braze joint between the stainless steel, containing the toluene, and the copper shell. G R.

A82-11801 * # **Control system development for a 1 MW/e/ solar thermal power plant.** E. R. Daubert, F. M. Bergthold, Jr , and D. G Fulton (Ford Aerospace and Communications Corp., Aeronutronic Div., Newport Beach, CA). In. Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2. New York, American Society of Mechanical Engineers, 1981, p. 1770-1775. Contract No. JPL-955115.

The point-focusing distributed receiver power plant considered consists of a number of power modules delivering power to a central collection point. Each power module contains a parabolic dish concentrator with a closed-cycle receiver/turbine/alternator assembly. Currently, a single-module prototype plant is under construction. The major control system tasks required are related to concentrator pointing control, receiver temperature control, and turbine speed control. Attention is given to operational control details, control hardware and software, and aspects of CRT output display. G R.

A82-11802 # **Dynamic performance analysis for the solar hybrid repowering of the El Paso Electric Company Newman Unit No. 1.** D. A. Hofer and B. L. Pierce (Westinghouse Electric Corp., Advanced Energy Systems Div., Pittsburgh, PA). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2. New York, American Society of Mechanical Engineers, 1981, p. 1776-1781. Contract No. DE-AC03-79SF-10740.

Newman Unit No. 1 has an 82 MWe tandem-compound, double-flow, reheat steam turbine. It was built in 1960 for baseload duty using natural gas as the primary fuel. The solar repowered configuration utilizes water/steam central receiver technology to provide main steam to the high pressure stage and reheat steam to the intermediate stage of the turbine-generator. Fossil energy is used to supplement solar generated steam for intermittent cloudy day operation and for economic dispatch when solar energy is not available. To aid in the feasibility study for the solar repowering of the unit, a digital simulation model was developed. The results obtained with the model indicate that the system is able to handle average velocity clouds with little degradation of the quality of electric power output. Approaches for improvements are also discussed. G.R.

A82-11803 # **An evaluation of alternate system configurations for solar repowering electric power plants.** L E. Van Bibber and W. G. Parker (Westinghouse Electric Corp., Advanced Energy Systems Div., Pittsburgh, PA). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 2. New York, American Society of Mechanical Engineers, 1981, p. 1782-1786. Contract No. DE-AC03-79SF-10740.

The results of studies to determine the feasibility of using a solar tower power plant to repower an existing oil and gas fired electricity plant in El Paso, TX are presented The existence of 3,500 acres of open land on site, lack of major environmental or legal constraints, increasing costs of conventional fuels, and the remaining economic life of an 82 MWe reheat steam turbine for which a pilot study could

effectively be made encouraged the study. One basic configuration was chosen and four others rejected Heliostats with 57 sq m surfaces and a recirculative concept receiver tower were selected as items which would be commercially available in the near term; additional design considerations were concerned with several solar thermal/ fossil fuel steam generator systems interfaces The fossil fuel reheat boilers were considered as back-up for cloudy days, as storage showed no economic advantage Economic projections indicate that production of standardized units would make the solar system economically competitive. M.S.K.

A82-11804 # **Photovoltaic system studies and developments.** D. G. Schueler (Sandia Laboratories, Albuquerque, NM). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2.
New York, American Society of Mechanical Engineers, 1981, p 1832-1834. 17 refs Research supported by the U.S Department of Energy.

Photovoltaic technology has the potential of reducing dependence on conventional energy sources, if the cost of photovoltaic systems can be brought down in the range of $2 per peak Watt. The major potential applications for photovoltaic technology have been extensively analyzed with regard to their economics, market potential, and system performance requirements These include residential, commercial and industrial, and utility central generation applications This paper reviews the essential features of these various applications and outlines ongoing development activities. (Author)

A82-11830 # **Utilization of wind/solar energy in generating electricity in Saudi Arabia.** A. E. M Nasser (Riyadh, University, Riyadh, Saudi Arabia). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2. New York, American Society of Mechanical Engineers, 1981, p. 2060-2063.

Solar and wind data averages gathered for five years and plans for a 1.2-1.4 kW solar wind energy plant at Riyadh, Saudi Arabia are presented. Wind speeds were gathered at 2 m height averaging 3.9 m/sec, and extrapolated to 22 m and 5.45 m/sec, average solar intensity was found to be 600 W/sq m between 6 a.m and 6 p m. The generator system comprises a 5.5 m diameter multiblade windpowered turbine on a 10 meter tower and photovoltaic modules generating 500 W The NACA 0018 blade tips will be enclosed within a conical duct, augmenting the wind velocity by an expected 10%. Lead-acid batteries will be used for storage, initial applications of the system are targeted for remote villages and military outposts. M.S K.

A82-11839 # **Advanced Satellite Power System /SPS/ concept.** W V McRae and G M. Hanley (Rockwell International Corp , Space Operations and Satellite Systems Div , Seal Beach, CA). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 3
New York, American Society of Mechanical Engineers, 1981, p. 2115-2118

Evolution in design, improvements in economics, and reductions in material and space requirements for the Satellite Power System (SPS) are reviewed Selection of GaAs solar cells over silicon wafers has been made for reasons of self-annealing and better performance at higher temperatures, in addition to the fact that GaAs cells are the base configuration for multibandgap cells These cells, when used with 6 1 reflectors, reduce satellite mass by 18%, with a corresponding reduction in satellite area of 75% The SPS can then be sun-oriented, eliminating tilt control, employment of magnetrons instead of less efficient klystrons eliminates 15% of transmitter weight New evidence for ionospheric power density tolerance indicates higher permissible power levels, thus allowing larger and fewer (20 instead of 60) satellites delivering 7 57 GW per rectenna site, and capital costs are reduced 40%. Finally, open wire, parabolic rectennas will require 50% less in capital construction costs than former flat designs The timetable for operational capability is now targeted for the year 2000 M S K.

A82-11842 # **'Thin foil cells - A challenge for space array designers'.** P A. Iles and F. Ho (Applied Solar Energy Corp , City of Industry, CA) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 3 New York, American Society of Mechanical Engineers, 1981, p 2126-2128. 10 refs

The present status of manufacturing, power output, and life expectancy of thin foil silicon cells (less than 50 micron thickness) is reviewed Properties such as 14-15% efficiency, flexibility, light weight, radiation resistance, controllable absorptance, and area ranging from 4-25 sq cm are noted as favorable features, while the need for extra care in preparation, easy loss of a greater number of cells due to random cracking, and additional fabrication steps all add to costs. Lighter weight is a significant advantage in considerations for higher orbital placement, with present blanket thin cell packaging yielding from 50-330 W/lb Further testing is necessary to show operational durability in thermal cycling and LEO radiation, and for radiation hardness against diffusion length degradation or resistivity changes in the semiconductor Additional testing is also needed to verify successful deployment of the blanket arrays. Progress toward thinner cells (25 micron) with slightly less efficiency and toward dendritic web production are mentioned as showing promise for further cost reductions M S.K

A82-11855 # **Progress in large area photovoltaic devices based on amorphous silicon alloys.** J. P. deNeufville, M. Izu, and S. R. Ovshinsky (Energy Conversion Devices, Inc., Troy, MI). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 3.
New York, American Society of Mechanical Engineers, 1981, p. 2217-2220. 17 refs.

Photovoltaic cells using light absorbing thin amorphous films based on silicon appear to have properties suitable for the conversion of sunlight into electricity with a near-term efficiency in the range of 7-10% and at a cost in the range of 35-50 cents per peak watt. To meet these objectives, prototype 1-sq ft cells have been constructed and tested. The excellent yields obtained for such cells permitted the construction of a 24-sq ft array which produces useful power under exposure to both direct and diffuse natural illumination. Cost analyses and preliminary tests indicate that the deposition of electrodes and absorber in a continuous automated method of manufacturing will provide sufficient production throughput and device performance to meet the cost goals required for heat-to-head competition between a-Si alloy photovoltaics and conventional sources of electrical power in the U S. (Author)

A82-11858 # **A thermoelectric refrigerator powered by photovoltaic solar collectors.** H. Sofrata. In. Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 3. New York, American Society of Mechanical Engineers, 1981, p. 2239-2242. 5 refs

A82-12269 # **The effect of variable fluid properties on scale modeling.** J. S. Kraabel (Sandia Laboratories, Livermore, CA) In Momentum and heat transfer processes in recirculating flows, Proceedings of the Winter Annual Meeting, Chicago, IL, November 16-21, 1980. New York, American Society of Mechanical Engineers, 1980, p.103-110 5 refs Research supported by the U S Department of Energy

The heat transfer to the air about a solar central receiver may be described as high Reynolds number (about 10,000,000), high Grashof number (about 10 to the 13th) mixed orthogonal convection Although it is a low Mach number flow, it is highly compressible because of the large surface to free-stream temperature differences (500 to 1000 C) One approach to scale model testing that simultaneously achieves large values of Re and Gr in a mixed convection regime uses low temperature (80K) nitrogen The present study examines the effects of temperature dependent variable fluid properties on stagnation line heat transfer Although applicable only in the region of the stagnation line, and only for forced convection, the solution is suitable for this initial investigation because it is relatively easy to determine and because it may be used as the initial condition for the remainder of the flow A comparison is made between solutions simulating scale model testing in low temperature nitrogen and solutions for ambient temperature air with wall temperatures equal to those of central receivers The heat transfer coefficient described by Nu/square root of Re is found to be nearly constant for all circumstances studied. (Author)

A82-12501 **International Scientific Conference on Space, 21st, Rome, Italy, March 25, 26, 1981, Proceedings (Convegno Internazionale Scientifico sullo Spazio, 21st, Rome, Italy, March 25, 26, 1981, Atti).** Conference sponsored by the Ministero degli Affari Esteri, Ministero della Difesa, CNR, et al. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1981. 200 p. In Italian and English.

Papers are presented on solar power satellites and Spacelab technology. Topics covered include conversion and transmission techniques, safety problems, and structures and positioning in orbit. Attention is also given to cost considerations and energy balances for the SPS. Aspects of the first flight of Spacelab which were considered comprised scientific and technological experiments, material and life sciences, astronomy, plasma physics, and earth observations, experiment operation, and payload specialist training. M.S.K.

A82-12502 # **Market potential and problems for SSPS.** M. J. Claverie and A. P. Dupas (CNRS, Paris, France). In: International Scientific Conference on Space, 21st, Rome, Italy, March 25, 26, 1981, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1981, p. 17-25.

The paper examines the SSPS (satellite solar power station) as an energy system on a worldwide basis and assesses the possible limitations of the worldwide use of the SSPS It is suggested that the SSPS is a very promising concept for the United States, but its use in many parts of the world may be severely hampered by its large power output and its large land requirements. Such a situation may jeopardize the international acceptance of the project. Thus, the study of alternative concepts allowing smaller receivers on the ground and smaller minimum power of the receivers seems advisable in order to reach an acceptable concept of a worldwide SSPS system. B.J.

A82-12506 # **Methods and problems of industrial-scale electric power generation from solar energy (Metodi e problemi per ricavare energia elettrica su scala industriale dalla solare).** P. L. Finocchi (Consorzio per Sistemi di Telecomunicazioni via Satelliti S.p.A., Milan, Italy). In: International Scientific Conference on Space, 21st, Rome, Italy, March 25, 26, 1981, Proceedings Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1981, p. 53-67. 10 refs. In Italian.

Ground-based and space-based methods of electric power generation from solar energy are considered, with attention given to both technical and economic factors. Two systems are discussed in particular: solar cells and thermoelectric generators, and attention is given to the technical and economic aspects of the construction and operation of satellite solar power stations. B.J.

A82-12507 # **Transportation systems and cost comparison for launching an SPS into geosynch. orbit.** D. E. Koelle (Messerschmitt-Bolkow-Blohm GmbH, Ottobrunn, West Germany). In International Scientific Conference on Space, 21st, Rome, Italy, March 25, 26, 1981, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1981, p. 81-89. 6 refs.

Total mass requirements and costs are compared for Shuttle and orbital transfer as opposed to single vehicle to GEO and ballistic missiles plus orbital transfer to GEO for launch of an SPS. Noting that Shuttle delivery for one SPS would cost 5 billion dollars and require over 200 flights, three different ballistic missile delivery systems are analyzed. Use of a 500 megagram vehicle to LEO followed by orbital transfer to GEO is projected to be 3.6-4.8 billion dollars per SPS. A flyback capability is observed to be the most preferable solution, and calculations show that an equatorial launch can save 500-800 million dollars per SPS. Criteria for minimum costs are given as fully reusable system, unmanned vehicle, minimum stages, technical simplicity, operational simplicity, large size, minimal ground and orbital operations, and the equatorial launch site. M.S.K.

A82-12509 # **Solar power satellite system energy balance.** A. Buratti (Compagnia Nazionale Satelliti per Telecomunicazione S.p.A., Rome, Italy). In International Scientific Conference on Space, 21st, Rome, Italy, March 25, 26, 1981, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1981, p. 99-103. 22 refs.

A literature review which concludes that the Shuttle is the basic launch system to LEO, in addition to an IUS, until the year 2000 is presented. Propellant to payload mass ratios are analyzed briefly to show that Shuttle launch can deliver only four tons to GEO, the prime site for the SPS. The energy requirements for propellant and solar array manufacture, and energy consumed in placing an SPS in GEO are calculated to be 5000 kWh/kg, while power delivered by an SPS is given as 700 kWh/kg. The results indicate that an improvement of one to two orders of magnitude is necessary for the SPS to satisfy the requirement that the energy it produces exceeds the power consumed in gaining operational status. M.S.K.

A82-12532 **Photovoltaics, the solar electric solution.** C. D Beach and A. H. Litka (Florida Solar Energy Center, Cape Canaveral, FL). In The year of the Shuttle, Proceedings of the Eighteenth Space Congress, Cocoa Beach, FL, April 29-May 1, 1981. Cocoa Beach, FL, Canaveral Council of Technical Societies, 1981, p. 3-36 to 3-41. 6 refs.

Direct conversion of solar energy to electricity by photovoltaic devices (solar cells) may be the most promising solution to the current energy problem. Photovoltaic energy systems provide a clean, simple method of energy conversion, and are reliable, safe, and flexible with respect to size (modular). The federal government is trying to commercialize photovoltaics by funding research on new materials and manufacturing processes. Earliest commercialization will be in residential systems, where the power grid back-up provides for a reliable electrical system without storage costs. The Florida Solar Energy Center has been operating a 5 kW experimental residential facility since 1980. The facility showed an average solar irradiance in the 62.5 sq m panels of 264 kw-hours/day from December 1980 through February 1981. The overall system efficiency was 7%, and the inverter operated with an ac output/dc input efficiency of 85-90%, depending on input levels J F

A82-12812 **Theoretical analysis of the performance of a gravity-controlled solar concentrator.** L Papa, G. A Rottigni (Genova, Università, Genoa, Italy), and C Ceccherini. *Nuovo Cimento C, Serie 1,* vol 4C, May-June 1981, p 284-294. 5 refs. Research supported by the Consiglio Nazionale delle Ricerche

Numerical calculations are presented of the performance of a solar concentrator with cylindrical parabolic symmetry, fixed focal axis, and a variable density reflector, the curvature of which is determined by gravity and the density distribution The actual performance of the concentrator is deduced from measurements of total and diffuse solar radiation taken from 1964 to 1973 at Genoa, a city characterized by a typically maritime climate. The quantity of energy gathered by the solar collector is shown to be highly variable due to fluctuations in solar input, averaging 990 thermal kWh/sq m per year and in reasonable agreement with predictions based on a hypothesis of one clear day followed by one completely overcast day. Comparison of the geometrical concentration factors of purely gravity controlled solar concentrators with those of variable-density gravity controlled concentrators also demonstrates the advantages of the variable-density devices, which outweigh the supplementary costs associated with the provision for variable density by the suspension of chains under the reflecting surface A.L W

A82-12817 **A numerical model of a graded band gap CdS/x/Te/1-x/ solar cell.** R. Radojcic, A. E. Hill, and M. J. Hampshire (Salford, University, Salford, England). *Solar Cells,* vol. 4, Sept. 1981, p. 109-120. 14 refs.

A numerical model of a graded bandgap CdS-CdTe solar cell is developed and used to optimize the design of an n-CdS(x)Te(1-x) - p-CdS(0.5)Te(0.5) thin film cell. The advantage of using a bandgap graded in the direction of thickness is the elimination of surface recombination losses by use of the window effect. The CdS-CdTe system was chosen because of the potential for thin film processing. The assumptions underlying the understanding of the CdS(x)Te(1-x) - CdS(0.5)Te(0.5) cell structure are given and a theoretical analysis is included. The photon flux is included as a function of photon energy by representing the solar spectrum as 100 discrete monoenergetic beams which are represented as numerical information in a computer. The energies are absorbed at some point within the graded bandgap layer, and an analytic description is furnished to describe

the distribution of photogenerated carriers in a graded layer. Thickness can be optimized by varying it proportionally with the bandgap; an optimal value of the base layer bandgap was found to be 1.35 eV. It is concluded that a graded bandgap device can be 1.8 times as efficient as a nongraded structure due to the lower reverse leakage current and greater fill factor in the graded device. M.S.K.

A82-12818 Preparation and properties of graded band gap CdS/x/Te/1-x/ thin film solar cells. R. Radojcic, A. E. Hill, and M. J. Hampshire (Salford, University, Salford, England). *Solar Cells,* vol. 4, Sept. 1981, p. 121-126. 9 refs.

The manufacture and experimental investigation of the properties of a thin film graded CdS(x)Te(1-x) solar cell are described. Graded CdS(x)Te(1-x) layers were vacuum co-deposited at a fixed rate of 20 A/sec by a shuttered method, in alternating layers of CdS and CdTe, to form an interdiffuse homogeneous CdS(x)Te(1-x) layer. Indium was added as a dopant to control the impurity concentration. Optical transmission of the films verified that the built-in field was stable, and a p-n barrier was found to exist. Photovoltages were measured to be 300 mV, but a SnO2 coating caused a resistance high enough to preclude measurement of the photocurrent. A combination of the window effect and a built-in field was observed, and the wide spectral response, particularly in the blue wavelengths, confirmed the theoretical predictions. Finally, copper was rejected as a contact electrode because of the tendency of its atoms to migrate along the grain boundaries and form trapping states and resistive paths. M.S.K.

A82-12819 Series resistance effects in 20 sq cm indium tin oxide-polycrystalline silicon solar cells. A. P. Genis, C. Osterwald, J. E. Mahan, and J. B. Dubow (Colorado State University, Fort Collins, CO). *Solar Cells,* vol 4, Sept. 1981, p. 127-133. 17 refs.

Indium tin oxide-Si solar cells of 20 8 sq cm area and 9.2% total area efficiency were fabricated on polycrystalline substrates. The cell fabrication sequence is described, with particular attention to the formation of an adherent low resistance front-contact grid based on a solder-dipping process. A detailed series resistance analysis of the structure is given, the sheet resistance of the indium tin oxide layer is measured by a voltage-probing technique and is found to be the dominant series resistance component for the specific grid pattern used. (Author)

A82-12820 Effect of annealing CdS on a sintered CdS/Cu2S solar cell. K. Mukhopadhyay and H. Saha (Kalyani, University, Kalyani, India). *Solar Cells,* vol. 4, Sept. 1981, p. 135-146. 16 refs. Research supported by the Indian National Science Academy.

The effects of varying different parameters of formation on the performance and degradation of sintered CdS/Cu2S solar cells is described. CdS layers of 15 mm diameter and 0.8 mm thickness were formed after sintering at 800 C for 3 hr in an inert atmosphere, and then etching with HCl H2O. Four equal pieces were cut with three sintered at 200 C, one in vacuum, one in argon, and one in air; the fourth was not annealed. The CdS layers were studied by scanning electron microscopy, and the resistivity and mobility by a perpendicular four-probe arrangement. Cells were formed and capacitance-voltage measurements taken at room temperature. Annealing in argon and air was found to decrease the resistivity and increase the mobility, whereas annealing in vacuum increased both the short-circuit current and open-circuit voltage, and increased the fill factor by a factor of about 1.74. Also, vacuum annealing decreased Cu diffusion to a minimum, leading to an almost complete elimination of degradation. M.S.K.

A82-12821 ZnO - p-InP heterojunction solar cells. K. P. Pande and C. N. Manikopoulos (Rutgers University, Piscataway, NJ). *Solar Cells,* vol. 4, Sept. 1981, p. 147-152. 9 refs.

The formation of ZnO-p-InP heterojunctions by means of a reactive evaporation technique for the deposition of ZnO is reported. ZnO is highly regarded as a window layer because of its low sheet resistivity, high transparency, and large energy gap (3.2 eV). The p-InP fabrication is described, and the Zn layer was formed by pumping the chamber pressure down to one-millionth torr, bleeding in oxygen at 10 mtorr, evaporating Zn in a crucible by resistive heating, and activating a glow discharge to form a ZnO layer on the InP substrate. Annealing took place at 250 C for 2 min in an argon atmosphere, yielding a ZnO layer with a conductivity of 72 ohm/cm and more than 85% transparency. I-V curves are plotted, capacitance-voltage data are reported, and photovoltaic properties are graphed and discussed, noting that recombination centers are expected to be eliminated with further optimization of the ZnO layer. The cells had a 6.6% efficiency and series resistance of 30 ohms. M.S.K.

A82-12822 Photoelectrochemical behaviour of CdS/ NaI.3.3NH3 /liquid sodium iodide ammoniate/ junctions - Utilization in solar energy conversion. D. Guyomard, M. Herlem (Paris, Ecole Supérieure de Physique et de Chimie Industrielles, Paris, France), R. Heindl (CNRS, Laboratoire d'Etude des Matériaux par des Techniques Avancées, Meudon, Hauts-de-Seine, France), and J.-L. Sculfort (CNRS, Laboratoire d'Electrochimie Interfaciale, Meudon, Hauts-de-Seine, France). *Solar Cells,* vol 4, Sept 1981, p. 157-167. 26 refs. Direction des Recherches, Etudes et Techniques Contract No 79-1210.

A liquid NaI.3.3NH3 solution was used as the medium in a photoelectrochemical cell to stabilize the working of CdS photoanodes and results are reported The reference voltage of in situ Ag-Ag(plus) electrodes in the NaI.3 3NH3 solution is 0.27 V. The CdS samples were polished with diamond paste, rinsed in distilled water, and etched with HCl; ohmic contacts were formed on the backs with an evaporated gold and indium coating. Cyclic voltammetry was used to measure the electroactivity range, and a depletion layer was determined to exist in the space charge layer when an anodic current was found with reverse bias. High sensitivity to daylight was found, and this is attributed to the etching treatment and reactions to bulk energy levels. The addition of iodine to the solution was found to stabilize the photocurrent with a simultaneous rise in acidity, the iodine eventually vanishes unless the NH4(plus) is above 0.5 M or when the pH is near zero. An overall efficiency of 2 percent is noted, and the stabilization due to iodine presence resulted in cell operation for over a month. M S.K.

A82-12823 A practical method of analysis of the current-voltage characteristics of solar cells. J. P. Charles (Tunis, Ecole Nationale d'Ingénieurs, Tunis, Tunisia), M. Abdelkrim, Y. H. Muoy (Faculté des Sciences, Tunis, Tunisia), and P. Mialhe (Ecole Normale Supérieure, Dakar, Senegal). *Solar Cells,* vol. 4, Sept. 1981, p. 169-178. 15 refs.

A numerical method suitable for use with a programmable calculator is developed for determining the current-voltage (I-V) equation parameters of a solar cell driven as a generator only. The exact magnitude of the photocurrent is found and the fill factor is deduced. High and low quality Si solar cells were studied under illumination from a 12 V lamp in AM1 conditions. I-V curves are plotted for varying diode quality factors and the fill factors were analytically examined. Series resistance, shunt resistance, photocurrent, series current, and diode quality factors were calculated from the experimental data of the fourth quadrant characteristic for an ideal cell and results are diagrammed with performance data from the test cells. A flow chart is provided for the operations of the program. The quality factor is found to be dominant, unless significant output losses are encountered, and then series and shunt resistances gain effect. M.S.K.

A82-12824 V2O5-Si photovoltaic cells. J. Gobrecht, R. Nottenburg, K. Chewey, and S. Wagner (Solar Energy Research Institute, Golden, CO). *Solar Cells,* vol. 4, Sept. 1981, p. 179-186. 13 refs.

The results of experimentation of the preparation of V2O5 films for solar cells is presented. The V2O5 films were prepared in three ways (1) a powder was annealed directly on a Si wafer; (2) 0.02 M solutions of V2O5 in 5N HCl were applied directly with a dropper; and (3) the solution was misted on substrates heated to about 200 C. I-V characteristics, film resistivities, and C-V measurements were made under AM1 conditions, and the use of a forming gas was found to decrease the sheet resistivity. Evidence was found for an interfacial barrier and Auger electron spectroscopy indicated the presence of a silicon rich oxide layer, but the thickness was not determined. A reaction of V2O5 with Si was demonstrated at different formation temperatures. Adding a dopant such as H2 annealing at 600 C lowered the interface resistance from 1 k-ohm/cm to 2 ohm/cm; however, increasing the barrier conductance did not

increase either the short circuit current or open circuit voltage, factors which yet preclude practical use of the V2O5-Si cell. M.S.K.

A82-12825 Temperature dependence of the short-circuit current in MIS solar cells. S. K. Krawczyk, A. Jakubowski, and M. Zurawska (Warszawa, Politechnika, Warsaw, Poland). *Solar Cells,* vol. 4, Sept. 1981, p. 187-194. 14 refs.

A theoretical study of the temperature dependence of the short-circuit current (Isc) in MIS solar cells, particularly Al-SiO2 - p-Si, is presented. A current flow model is developed, assuming a small potential drop across the dielectric layer, no fast surface states at the Si-SiO2 interface, and device thickness much larger than the minority carrier diffusion length Negligible series resistance and shunt conductance, and no temperature dependence by either the energy gaps in Si or SiO2, or the minority carrier lifetime, or the absorption coefficient were also assumed The behavior of Isc as a function of temperature is explained by a displacement of the quasi-Fermi levels at the semiconductor surface, and changes in Isc are caused by increase in the recombination and diffusion currents with increasing temperature. Fabrication procedures for the MIS cells are provided. It is noted that the effective dielectric thickness is different from the measured dielectric thickness, and further work is indicated to determine the effect of oxidation conditions on this thickness. M.S.K.

A82-12949 High-temperature solar central receivers. A. C. Skinrood (Sandia National Laboratory, Livermore, CA). *Sunworld,* vol. 5, July 1981, p. 97-104.

Designs and concepts for solar central receiver thermal power plants are reviewed. Concentrations of over 1,000 suns are now possible, and seven prototype plants, producing from 1-10 MWe, are close to completion, employing cavity and external receiver configurations. Heat transfer fluids are discussed, noting that the water/steam cycle is emerging as the dominant mode, liquid sodium is benefitting from extensive testing for nuclear power plants, molten salt provides thermal storage at $10-30/kWt-hr; high temperature gas systems (815 C) can be applied for gypsum board drying and NH3 production. Heliostats are all of a steel/glass configuration and require mass production to become economical. Thermal storage systems, applications for repowering in conjunction with conventional power plants, and cogeneration for electricity/process heat are examined, and power costs are projected to match those of coal if the central receiver construction costs can be halved. D.H.K.

A82-12950 Solar perspectives - Israel, solar pond innovator. S. Winsberg. *Sunworld,* vol 5, July 1981, p 122-125

Existing and planned solar pond electricity producing power plants in Israel and California are discussed. Salt ponds, with salinity increasing with depth, are coupled with low temperature, organic working fluid Rankine cycle engines to form self-storage, nonpolluting, electric plants. Average pond thermal gradients range from 25 C surface to 90 C at the bottom; 160 GW of potential power have been projected as currently available from existing natural solar ponds from a partial survey of 14 countries The largest installation to date has a 220 kW output, and a 5 MW plant is scheduled for completion in 1983. Efficiencies of 10% and a cost of $2,000/kW for a 40 MW plant are projected, a cost which is comparable to that of conventional plants. The 40 MW plant is an optimized design, allowing for modular plant additions to increase capacity. D.H.K.

A82-13083 The effect of non-Markovian cloud patterns on the design of a regulator for a solar-powered boiler. D D. Sworder (California, University, La Jolla, CA) and K. L. Zondervan (Aerospace Corp., Guidance and Control Div., El Segundo, CA). In: Joint Automatic Control Conference, Charlottesville, VA, June 17-19, 1981, Proceedings. Volume 1. New York, American Institute of Chemical Engineers, 1981. 2 p. (WA-3F). NSF Grant No. ECS-80-80-03547, Contract No. DE-AC03-78ET-20517.

This paper provides the regulator synthesis equations for the steam temperature regulator in a solar-powered boiler. The primary source of disturbance is produced by the motion of clouds across the field of mirrors which focus solar energy on the boilers. To permit flexibility in describing a variety of cloud conditions, the cloud model is non-Markov. (Author)

A82-13199 Oxide optimization at the p-Si/aqueous electrolyte interface. H. J. Lewerenz, M. Lübke (Max-Planck-Gesellschaft zur Förderung der Wissenschaften, Fritz-Haber-Institut, Berlin, West Germany), K. J. Bachmann (North Carolina State University, Raleigh, NC), and S. Menezes (Bell Telephone Laboratories, Inc., Murray Hill, NJ). *Applied Physics Letters,* vol. 39, Nov. 15, 1981, p. 798-800. 22 refs.

A combination of surface chemical and voltammetric treatments have been used to optimize the stability and performance of p-Si/v(2+)-v(3+)4MHCl/C solar cells. B-doped Si electrodes exposing a (100) face to the electrolyte, a spectroscopically pure C counter-electrode and a saturated calomel electrode were used in a 3-electrode potentiostatic arrangement A power conversion efficiency of 6.1% under 60-mW/cm sq illumination was recorded S.C.S.

A82-13200 Thin-film gallium arsenide homojunction solar cells. S. S Chu, T. L. Chu, F. S. Zhang, L. Book, and J. M. Yu (Southern Methodist University, Dallas, TX). *Applied Physics Letters,* vol. 39, Nov. 15, 1981, p. 803-805. 5 refs. Contract No. X50-9002-3.

Thin film homojunction GaAs solar cells of p(+)/n/n(+) configuration were deposited on tungsten-coated graphic substrates by the reaction of gallium, hydrogen chloride, and arsine containing approriate dopants Solar cells with an area of 8 cm sq and an AM1 efficiency of about 7% were produced. The observed low fill factor is caused by grain boundary shunting and high series resistance. The cells are characterized by dark and illuminated current voltage and quantum efficiency measurements. S.C.S.

A82-13284 Chromatic aberration effect on solar energy systems using Fresnel lenses. E Lorenzo (Madrid, Universidad Politécnica, Madrid, Spain) *Applied Optics,* vol 20, Nov 1, 1981, p. 3729-3732 12 refs

A82-13285 Luminescent solar concentrators. II - Experimental and theoretical analysis of their possible efficiencies. J S. Batchelder, T. Cole (California Institute of Technology, Pasadena, CA), and A H. Zewail. *Applied Optics,* vol 20, Nov. 1, 1981, p. 3733-3754. 12 refs. Research supported by the U.S. Department of Energy and ARCO Solar, Inc

Experimental techniques are developed to determine the applicability of a particular luminescing center for use in a luminescent solar concentrator (LSC). The relevant steady-state characteristics of eighteen common organic laser dyes are given. The relative spectral homogeneity of such dyes are shown to depend upon the surrounding material using narrowband laser excitation. Three independent techniques for measuring self-absorption rates were developed, these are time-resolved emission, steady-state polarization anisotropy, and spectral convolution. Preliminary dye degradation and prototype efficiency measurements are included. Finally, simple relationships are given relating the efficiency and gain of an LSC to key spectroscopic parameters of its constituents (Author)

A82-13713 † Investigation of the possibility of using inexpensive concentrating systems in the modules of a photoelectric station (K issledovaniiu vozmozhnosti ispol'zovaniia deshevykh kontsentriruiushchikh sistem v moduliakh fotoelektricheskoi stantsii). F. A. Akhmedov, Sh. Z. Mirtursunov, and R. A. Muminov (Akademiia Nauk Uzbekskoi SSR, Fiziko-Tekhnicheskii Institut, Tashkent, Uzbek SSR). *Geliotekhnika,* no. 4, 1981, p. 10-13. In Russian.

The use of various types of inexpensive concentrators in a solar power station with GaAs-Al(x)Ga(1-x)As cells and single-axis sun tracking is discussed. An analysis is presented of the dependence of the total efficiency of a module on the level of concentration, and of the distribution of radiation intensity in the focal plane for various types of concentration. B.J.

A82-13715 † Analysis of the optical characteristics of solar collectors (Analiz opticheskikh kharakteristik solnechnogo kollektora). O. S. Popel', S. E. Frid, and E. E. Shpil'rain (Akademiia Nauk SSSR, Institut Vysokikh Temperatur, Moscow, USSR). *Geliotekhnika,* no. 4, 1981, p. 27-32. 5 refs. In Russian.

The influence of the optical characteristics of a collector on its efficiency is investigated. It is shown that the optical thickness of the transparent coating has the determining influence on the maximum

efficiency of the collector. The effects of solar-radiation incidence angle, dust contamination, and shadowing on the efficiency of the collector are also examined. B.J.

A82-13716 † Production and certain properties of photoelectric cells based on silicon epitaxial structures (Poluchenie i nekotorye svoistva fotoelektricheskikh preobrazovatelei na osnove epitaksial'nykh struktur kremniia). M. S. Saidov, B. M. Abdurakhmanov, R. Aliev, and V. P. Chirva (Akademiia Nauk Uzbekskoi SSR, Institut Elektroniki, Tashkent, Uzbek SSR). *Geliotekhnika,* no. 4, 1981, p. 33-38. 8 refs. In Russian.

The feasibility of using silicon epitaxial structures of p(+)-n, n(+)-p, and p-p(+) types as photoelectric-cell materials is evaluated. The basic characteristics of such cells are investigated, including volt-ampere, load, and spectral characteristics, and the dependence of these characteristics on temperature and illumination intensity. It is concluded that such epitaxial structures can be successfully used as solar-cell materials. B.J.

A82-13717 † System of tolerances for a solar-tower power station (Sistema dopuskov dlia SES bashennogo tipa). R. R. Aparisi and D. I. Tepliakov (Gosudarstvennyi Nauchno-Issledovatel'skii Energeticheskii Institut, Moscow, USSR) *Geliotekhnika,* no. 4, 1981, p 39-44. 8 refs. In Russian.

The principles underlying the establishment of a system of tolerances for a solar-tower station are presented. Attention is given to static and dynamic tolerances and deviations for a single heliostat, and geometrical tolerances for a field of heliostats. B.J.

A82-13718 † Mathematical simulation model for the operation of the optical system of a solar power station (Matematicheskaia imitatsionnaia model' raboty opticheskoi sistemy SES). I. V Baum (Akademiia Nauk Turkmenskoi SSR, Institut Ispol'zovaniia Solnechnoi Energii, Turkmen SSR). *Geliotekhnika,* no. 4, 1981, p. 45-52. In Russian.

A82-13737 Amorphous silicon bibliography - Introduction. A. H. Mahan and J. L. Stone (Solar Energy Research Institute, Golden, CO). *Solar Cells,* vol 4, Oct. 1981, p. 205, 207-267, 269-291 (50 ff.). 1964 refs.

A bibliography of works about amorphous silicon is presented. It includes works published during the 1977-1980 period Among the topics covered in the papers are (1) photoelectrochemistry of hydrogenated amorphous silicon, (2) laser annealing of hydrogenated amorphous silicon, (3) electronic hopping transport in disordered materials, (4) tunneling in hydrogenated amorphous silicon, and (5) the frequency-dependent dielectric behavior of amorphous silicon thin films. S.C S.

A82-13803 A new low temperature III-V multilayer growth technique - Vacuum metalorganic chemical vapor deposition. L. M Fraas (Chevron Research Co , Richmond, CA). *Journal of Applied Physics,* vol 52, Nov 1981, p. 6939-6943 11 refs.

A new technique for multilayer growth by metalorganic chemical vapor deposition is described. The vacuum metalorganic chemical vapor deposition technique combines the low-temperature growth capability of molecular beam epitaxy with the source handling system of chemical vapor deposition. The viability of the new technique is demonstrated by the growth of high-mobility layers of GaAs, GaAs(1-x)P(x), and Ga(1-x)In(x)As at 570 C. Room-temperature mobilities of GaAs films as high as 4990 sq cm/V s are obtained. Doping of both p-type and n-type films is demonstrated. GaAs shallow homojunction solar cells fabricated with this technique are described. Active-area solar cell efficiencies as high as 19.6% are obtained with 6 'suns' AM2 concentrated light. This multilayer growth technique is particulary suited to the fabrication of multicolor solar cells. (Author)

A82-13804 Dependence of minority carrier diffusion length on illumination level and temperature in single crystal and polycrystalline Si solar cells. P. C. Mathur, R. P. Sharma, P. Saxena (Delhi, University, Delhi, India), and J. D. Arora (Delhi, University, Delhi; Hindu College, Moradabad, India). *Journal of Applied Physics,* vol. 52, Nov. 1981, p. 6949-6953. 29 refs.

A82-13805 Investigation of the performance of an MoS2/I-/I2/C electrochemical solar cell. R. Audas and J C. Irwin (Simon Fraser University, Burnaby, British Columbia, Canada). *Journal of Applied Physics,* vol. 52, Nov. 1981, p. 6954-6960. 19 refs Research supported by the British Columbia Science Council.

The performance of an electrochemical solar cell with a single crystal of MoS2 in an I(-)/I2 electrolyte has been investigated. An efficiency greater than 5% has been obtained by carefully cleaving the crystal to ensure a good quality surface, and by optimizing the electrolyte concentration. The cell performance has been compared to the predictions of a phenomenological model that incorporates a term representing a diffusion overvoltage. Excellent agreement with the experimental results has been obtained with two free parameters, representing the shunt and series resistance of the cell. (Author)

A82-13806 Low frequency capacitance characterizations on indium/x-phase of metal free phthalocyanine solar cells. Y. H Shing and R. O. Loutfy (Xerox Research Center of Canada, Mississauga, Ontario, Canada). *Journal of Applied Physics,* vol. 52, Nov. 1981, p. 6961-6964. 11 refs. Research supported by the National Research Council of Canada.

A82-14001 * # Dish concentrators for solar thermal energy - Status and technology development. L D Jaffe (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2530.* 11 p. 8 refs

Comparisons are presented of point-focusing, or 'dish' solar concentrator system features, development status, and performance levels demonstrated to date. In addition to the requirements of good optical efficiency and high geometric concentration ratios, the most important future consideration in solar thermal energy dish concentrator design will be the reduction of installed and lifetime costs, as well as the materials and labor costs of production. It is determined that technology development initiatives are needed in such areas as optical materials, design wind speeds and wind loads, structural configuration and materials resistance to prolonged exposure, and the maintenance of optical surfaces. The testing of complete concentrator systems, with energy-converting receivers and controls, is also necessary. Both reflector and Fresnel lens concentrator systems are considered. O.C.

A82-14002 * # Buffer thermal energy storage for a solar Brayton engine. H J. Strumpf and K P. Barr (AiResearch Manufacturing Company of California, Torrance, CA) *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2531.* 10 p. Contracts No NAS7-100; No. JPL-955136.

A study has been completed on the application of latent-heat buffer thermal energy storage to a point-focusing solar receiver equipped with an air Brayton engine. To aid in the study, a computer program was written for complete transient/stead-state Brayton cycle performance. The results indicated that thermal storage can afford a significant decrease in the number of engine shutdowns as compared to operating without thermal storage. However, the number of shutdowns does not continuously decrease as the storage material weight increases. In fact, there appears to be an optimum weight for minimizing the number of shutdowns. (Author)

A82-14003 * # Development, solar test, and evaluation of a high-temperature air receiver for point-focusing parabolic dish applications. E. J Hanseth (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2532.* 8 p. 5 refs.

A high temperature solar receiver was fabricated and tested in excess of 1370 C on an 11-meter-diameter test bed concentrator at the Jet Propulsion Laboratory Parabolic Dish Test Site, Edwards, California. The 60-kilowatt thermal receiver design utilizes state-of-the-art silicon carbide honeycomb matrix panels to receive and transfer the solar energy and mullite elements for thermal buffer storage. Solar tests were conducted with indicated air exit temperatures ranging from 885 C (1625 F) to 1427 C (2600 F), mass flow rates of 75 to 105 g/sec (0.16 to 0.23 lbm/sec), and pressures up to

265 kPa absolute (38 4 psia) Estimates of efficiency are 59.7% at 1120 C (2048 F) to 80.6% at 885 C (1625 F) when aperture spillage losses are considered separately. Results are presented which demonstrate the feasibility of this innovative receiver concept for point-focusing parabolic dish applications over a wide temperature range. (Author)

A82-14004 : **Feasibility of solar assisted ethanol production.** M L. Holden, A N. Shekar, and T. F. Smith (Iowa, University, Iowa City, IA). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec 1-3, 1981, Paper 81-2533.* 9 p 15 refs. Research supported by the Iowa Energy Policy Council and U.S. Department of Energy.

Interest in alternative liquid fuels is growing due to the increasing scarcity and cost of conventional fuels. One such alternative is ethanol fuel. A positive energy balance associated with production of ethanol fuel, however, has been a point of concern. Utilizing 'free' solar process energy can displace non-renewable fuels and produce a more favorable energy balance. The purpose of this study is to ascertain the feasibility of a solar assisted ethanol fuel production system utilizing a simulation model. System sensitivity to collector area, configuration, and type along with ethanol fuel production rate, distillation pressure and temperature, and thermal energy storage size are examined. (Author)

A82-14005 * # **Solar concentrator panel and gore testing in the JPL 25-foot space simulator.** E W Dennison and M. J. Argoud (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2534.* 7 p

The optical imaging characteristics of parabolic solar concentrator panels (or gores) have been measured using the optical beam of the JPL 25-foot space simulator. The simulator optical beam has been characterized, and the virtual source position and size have been determined. These data were used to define the optical test geometry. The point source image size and focal length have been determined for several panels. A flux distribution of a typical solar concentrator has been estimated from these data Aperture photographs of the panels were used to determine the magnitude and characteristics of the reflecting surface errors. This measurement technique has proven to be highly successful at determining the optical characteristics of solar concentrator panels. (Author)

A82-14013 # **Solar thermal cost goals - Implementing a methodology for assessing break-even value and market potential.** W. E. Fraize and J. Gordon (Mitre Corp., McLean, VA). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2550.* 10 p. 5 refs. Contract No. DE-AC01-79ET-21047.

Cost goals for solar thermal technologies are being reviewed and updated by the U.S. Department of Energy. This paper describes a methodology for determining cost goals for electric utility and industrial applications. The methodology consists of. (1) estimating break-even capital or delivered energy cost to the users; (2) incorporating the economic and financial analysis that may be employed by the potential user, and (3) relating break-even costs to potential market size as a basis for setting cost goals. The approach to cost goals presented here is not technology dependent. As a result, it can be applied to any emerging technology and can be used to develop consistent cost targets across a number of diverse technologies. (Author)

A82-14014 # **A method for preliminary evaluation and sizing of solar thermal cogeneration system applications.** J. T. Ator (Aerospace Corp., Energy and Resources Div., El Segundo, CA) *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2551* 14 p. 20 refs.

A simplified system model has been found helpful in evaluating proposed solar cogeneration applications. The necessary data base includes mean daily insolation and average daily loads for each month. A combination of direct and stored solar thermal energy, purchased power, and heat energy derived from organic fuels is included in the modeling to ensure 24-hour effectiveness in meeting all thermal and electrical loads The effect of varying collector field size on total annual displacement of fossil energy is determined without the complexity of hour-by-hour simulation. An application to a hypothetical large military base is presented to illustrate the method. (Author)

A82-14015 * # **Use of ceramics in point-focus solar receivers.** R. H. Smoak and A. A. Kudirka (California Institute of Technology, Jet Propulsion Laboratory, Applied Mechanics Div., Pasadena, CA). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2552.* 10 p. 16 refs. Research sponsored by the U.S. Department of Energy and NASA.

One of the research and development efforts in the Solar Thermal Energy Systems Project at the Jet Propulsion Laboratory has been focused on application of ceramic components for advanced point-focus solar receivers. The impetus for this effort is a need for high efficiency, low cost solar receivers which operate in a temperature regime where use of metal components is impractical. The current status of the work on evaluation of ceramic components at JPL and elsewhere is outlined and areas where lack of knowledge is currently slowing application of ceramics are discussed. Future developments of ceramic processing technology and reliability assurance methodology should open up applications for the point-focus solar concentrator system in fuels and chemicals production, in thermochemical energy transport and storage, in detoxification of hazardous materials and in high temperature process heat as well as for electric power generation. (Author)

A82-14405 **A simplified method for direct calculation of the annual load fraction of solar systems for space heating.** M. M. Hawas and M. R Abou-Zeid (Garyounis, University, Benghazi, Libya). *Energy* (UK), vol. 6, Sept. 1981, p. 933-943 11 refs.

A82-14406 **Thermal analysis of three zone solar pond.** M. S. Sodha, N. D. Kaushik, and S. K. Rao (Indian Institute of Technology, New Delhi, India). *International Journal of Energy Research,* vol. 5, Oct.-Dec. 1981, p. 321-340. 20 refs.

A periodic analysis of a three zone solar pond as a solar collector and a heat storage medium is presented. The pond is modelled as having an upper convective zone, a middle nonconvective layer, and a lower convective zone. The walls are insulated, and the bottom is blackened, and salt concentrates in the middle zone, with increasing density downwards. Solar short wave radiation passes through to the bottom and is absorbed, while IR rays penetrate only a few cm. Six harmonics are used as a representation of the periodic variation of atmospheric temperature and solar intensity. The Fourier heat conduction equation for the nonconvective region is solved explicitly, and the convective heat and mass flux through the pond is accounted for. Reflective losses and radiation attenuation with depth are approximated by use of an effective extinction coefficient. Numerical results are obtained which indicate an increase of efficiency with temperature, leveling off at 5% at a collection temperature of 90 C. M.S.K.

A82-14445 **Contributions of space reflector technology to food production, local weather manipulation and energy supply, 1985-2020.** K. A. Ehricke (Space Global Co., La Jolla, CA). *British Interplanetary Society, Journal (Space Technology),* vol. 34, Dec. 1981, p. 511-518.

The parameters and uses of orbital space reflectors to redirect measured amounts of solar radiation to selected areas of the earth are discussed. Two systems, Lunetta - night illumination, and Soletta - solar level irradiation, are considered, noting that solar level reflectance is over a thousand times brighter than moonlight. Optimized orbits, reflective angles, and mirrored surfaces are explored for controlling the image size and location. Soletta applications are envisioned for weather modification, as a source of night time power for electrical generation, and to enhance biomass growth; Lunetta reflectors may be used for urban, polar, and rural illumination, and as a light source for disaster and rescue operations. A prototype Lunetta would have a 1,860 sq km area, with full scale models ranging from 18 to 50 times larger. D.H.K.

A82-14446 A technological approach towards future large solar arrays. B. Goergens (Space and New Technologies, Wedel, West Germany). *British Interplanetary Society, Journal (Space Technology),* vol 34, Dec. 1981, p. 519-526. 5 refs.

Developmental strategies for large solar arrays for future space missions are described, noting that enlargements for the near term will be dependent on the ability to interface with the Shuttle. Spacelab missions, currently scheduled for seven days duration, could be extended to 30-90 days if power was available. Higher cell efficiencies, deployable blanket technology, space based mass production of solar cells, and capabilities to handle high voltages are listed as priorities for solar cell development. A comparison is made between technologies for solar and terrestrial solar cells, and mention is made of 100 micron thick cells, 5 x 5 sq cm cells, back field cells, and back reflective surface cells for space applications. A 50 kW array with foldable deployment, high voltage technology, and the success of welded cells are outlined. D.H.K.

A82-14667 Gallium-arsenic-antimony heterojunction photocells. V. M. Andreev, N. S. Zimogorova, O. O. Ivent'eva, V. I. Myrzin, and S. P. Troshkov. *(Pis'ma v Zhurnal Tekhnicheskoi Fiziki,* vol. 7, Feb. 12, 1981, p. 132-135.) *Soviet Technical Physics Letters,* vol 7, Feb. 1981, p. 56, 57 8 refs. Translation.

A study of heterojunction solar cells with a narrow-gap GaAs(1-x)Sb(x) layer and a wide-gap GaAs window is reported. Photocurrent spectra of these heterojunction structures is presented. The attainment of reverse breakdown voltages of 25-30 V in the diodes shows that it is possible to produce structures in which the lattice mismatch of the substrate and the narrow-gap layer will have a minimal effect on the properties of the p-n junction. B.J.

A82-14846 # Optimization of flow passage geometry for air-heating, plate-type solar collectors. K. G. T. Hollands and E. C. Shewen (Waterloo, University, Waterloo, Ontario, Canada). *ASME, Transactions, Journal of Solar Energy Engineering,* vol. 103, Nov. 1981, p. 323-330. 11 refs. National Research Council of Canada Contract No. 125Q31155-7-4409.

Rectangular and triangular duct air flow solar collectors are analyzed to determine the optimum configuration for the flow passages. The pressure drop and mass flow rates are assumed to be specified values, and a uniform heat flux boundary condition is used to define the upper surface. A model for heat transfer in a flow in an infinite passage is considered, and it is shown that once the channel length is chosen, all other terms become fixed. The forced convective heat transfer is found to depend on the length of the channel in the collector. A design for a short-path collector is presented, where manifolds constrain air flow to half of the collector width in any one passage, and a lower limit to passage width is obtained as 2 mm. The V-groove collector offers higher efficiencies than the flat plate-type by 7-12% m and the optimal flow length is found at 0.5 m minimum. D H.K.

A82-14847 # Material property data and their use in design and analysis for an elevated temperature solar code. I. Berman (Foster Wheeler Development Corp., Livingston, NJ). *ASME, Transactions, Journal of Solar Energy Engineering,* vol. 103, Nov. 1981, p. 345-350. 20 refs.

Specific properties of the materials, temperatures, and operating parameters for elevated temperature solar thermal power plants are considered as a basis for developing standards of implementation. Physical and mechanical properties such as thermal conductivity, elastic modulus, expansion, strength, and creep are discussed and recommendations for ASME Code I and III materials are cited where feasible. Inelastic behavior tests involving beam bending, pipe ratcheting, torsion-torsion tests, and axial cyclic tests of various stainless steel specimens and Incoloy 800 material are reported. Peculiarities of problems for solar applications are noted to be a lack of information of basic material behavior due to the low amount of actual operational experience, a large number of transient temperature cycles, and primary creep. D.H.K.

A82-15006 # Silicon and gallium arsenide photovoltaic cells - Models for the functioning, experimentation, and application to concentrating collectors (Les cellules photovoltaiques au silicium et à l'arseniure de gallium - Modèles de fonctionnement, experimentation et application aux générateurs sous concentration). F. Therez. Toulouse III, Université, Docteur d' Etat Thesis, 1980. 198 p. 68 refs. In French.

Theoretical and experimental studies are reported for the use of Si and GaAs monocrystalline solar cells in concentrator configurations. Behavior of the cells' structures are examined, and homojunction (HJ) and heterojunction (HTJ) cells are explored for the effects on the electrical properties caused by larger sizing. Analytical models are developed to show that diffusion and conduction are the pertinent mechanisms for current-voltage characteristics of HJ and HTJ cells, and concepts of Auger recombination and reduction of the width of the forbidden band are introduced. A numerical model is presented for optimization of nonconcentrating systems, and a two-dimensional study is made of concentrating systems to establish a design for the cover of the concentrator. Finally, bicolor cells involving the bonding of Si and GaAs cells are considered, with efficiencies provided based on relations to monolithic and multispectral cells. M.S.K.

A82-15111 Sputtered thin film electrodes for photoelectrochemical cells. A. A. Soliman and H. J. J. Seguin (Alberta, University, Edmonton, Canada). *Canadian Journal of Physics,* vol. 59, Nov. 1981, p. 1674-1679. 14 refs. Research supported by the Natural Sciences and Engineering Research Council of Canada and Imperial Oil Corp.

Semiconducting TiO2 film photoelectrodes were prepared by dc sputtering from a simple hot pressed TiO2 powder target. To make the target semiconducting, it was first heated in a hydrogen atmosphere. Films so produced on heated glass substrates were polycrystalline and strongly adhered to the substrates. When tested for photoelectrolysis, these films were chemically stable and did not exhibit any photodecomposition. The spectral response was investigated and a main absorption edge at about 400 nm was obtained. The technique appears attractive for inexpensive large scale production of photoelectrodes for solar-hydrogen conversion. (Author)

A82-15112 Current-voltage characteristics of semiconductor-electrolyte junction solar cells. F. El Guibaly and K. Colbow (Simon Fraser University, Vancouver, Canada). *Canadian Journal of Physics,* vol. 59, Nov. 1981, p. 1682-1685. 15 refs.

An improved model for the semiconductor-electrolyte solar cell is discussed. Charge transfer kinetics, surface recombination, recombination in the quasi neutral region and in the depletion region, as well as the series and shunt resistance of the cell are included in the model. It is shown that the surface transfer velocity of minority carriers across the semiconductor-electrolyte interface affects primarily the open circuit voltage, the fill factor and power conversion efficiency, and only to a lesser degree the short circuit current. As is the case with nonelectrolyte solid state cells, the series resistance of the electrochemical cell reduces the fill factor and the conversion efficiency, while the shunt resistance reduces the open circuit voltage of the cell in addition to reducing the fill factor and the power conversion efficiency. (Author)

A82-15439 Colloidally deposited high-temperature solar selective surfaces. J. J. Zybert and D. R. McKenzie (Sydney, University, Sydney, Australia). *Applied Optics,* vol. 20, Dec. 1, 1981, p. 4051-4053. 11 refs.

Thin, colloidally deposited coatings with uniform thickness for solar selective surfaces are described. A 200 nm Cu film was deposited on glass by vacuum evaporation in an electron beam coating chamber. A second layer of colloidally suspended Si and C was deposited by slowly withdrawing the copper-coated substrate from the colloidal dispersion; uniform thicknesses of 200 and 480 nm were obtained. Reflectance was in the 1-1.5 micron region and emittance (highest for thickest coatings) levelled off after baking at 400 C. The film withstood 600 C temperatures for 200 with no loss in absorptance, compared to a 2% loss after 500 C for 100 hr for both vacuum evaporated cermets and sputter deposited titanium silicide coatings. Further improvements are predicted by the use of colloids with higher volume fractions of silica and lower concentrations of carbon. M.S.K.

A82-15441 An analytical model for high-low-emitter /HLE/ solar cells in concentrated sunlight. W.-Z. Shen and C.-Y. Wu (National Chiao Tung University, Hsinchu, Republic of China).

Solid-State Electronics, vol. 24, Nov. 1981, p. 1025-1037. 21 refs. Research supported by the National Science Council of the Republic of China.

A current-voltage characteristic is derived for the high-low emitter solar cell in concentrated sunlight. For high-level injection, the ambipolar approach is used to yield the complete information of the low emitter concentration region, including the ohmic drop, the Dember voltage, the minority carrier current density, the minority-carrier distribution, and the electric field distribution. High doping effects including Auger recombination and bandgap narrowing are considered. The dependences of short-circuit current, open-circuit voltage, fill factor, and conversion efficiency on the variations of the geometrical dimensions and material parameters are discussed in detail for silicon single crystal materials. It is shown that the maximum conversion efficiency of 22% at 100 suns (AMO) can be obtained for silicon high-low emitter solar cell. (Author)

A82-15442 A pinhole model for metal-insulator-semiconductor solar cells. A. Rothwarf (Drexel University, Philadelphia, PA) and I. Pereyra (Delaware, University, Newark, DE). *Solid-State Electronics,* vol. 24, Nov. 1981, p. 1067-1070. 22 refs. Contract No. DE-AC01-79ET-23107-01.

Based upon a consideration of the standard theory of MIS solar cells and the experimental results on such devices, the concept of tunneling through the thin insulating layer as the controlling mechanism is rejected. In place of the tunneling mechanism the concept of parallel Schottky diodes through pinholes in the insulator is proposed. The mathematical formulation fits this proposal. The characteristics and limits of efficiency expected for such a pinhole MIS are explored and found to be in good accord with existing results on experimental diodes. The equations needed to specify the density and size of the pinholes needed for optimal efficiency are formulated but not solved. A suggestion to test the hypothesis by artificially producing pinhole devices is proposed. (Author)

A82-15444 Effect of junction depth on the performance of a diffused n/+/p silicon solar cell. P. C. Dhanasekaran and B. S. V. Gopalam (Indian Institute of Technology, Madras, India). *Solid-State Electronics,* vol. 24, Dec. 1981, p. 1077-1080. 17 refs.

A82-15447 Theory of back surface field silicon solar cells. S R. Dhariwal (Government College, Ajmer, India) and A. P. Kulshreshtha (Indian Space Research Organization, Satellite Centre, Bangalore, India). *Solid-State Electronics,* vol 24, Dec 1981, p. 1161-1165. 12 refs. Research supported by the Department of Space and Space Commission.

A theory has been developed which explains the behavior of back surface field (BSF) silicon solar cells with n+pp+ or p+nn+ structure. The theory is based on the calculation of the open circuit voltage of a BSF cell by considering the charge neutrality condition with drift of both the majority and minority carriers, whereas previous theories have emphasized the flow of minority carriers alone. It is shown that the open circuit voltage of a BSF cell is almost independent of the base layer resistivity at high levels of injection. It is also shown that the enhancement of the open circuit voltage of a high resistivity cell is more apparent in n+pp+ than in p+nn+ structure, because the former gives lower voltages in the non-BSF structure. V.L.

A82-15607 Bounds and exact theories for the transport properties of inhomogeneous media. R. C. McPhedran and G. W. Milton (Sydney, University, Sydney, Australia). *Applied Physics A - Solids and Surfaces,* vol. A 26, Dec. 1981, p. 207-220. 39 refs. Research supported by the Science Foundation for Physics.

The reported investigation is concerned with the transport properties of an inhomogeneous substance composed of two different materials, the composite being macroscopically homogeneous. The problem arises in connection with the calculation of the optical properties of cermets for solar energy applications. It is also important in mechanical engineering for the study of the properties of composites. Subclasses of the problem include the scalar and the vector case. The investigation is mainly concerned with scalar problems, taking into account rigorous methods. Attention is given to two approaches. One approach is concerned with the calculation of bounds regarding the transport properties. The second approach involves a consideration of specific periodic structures and the exact solution of the transport problem. It is the principal aim of the investigation to demonstrate the unity of these two approaches. G.R.

A82-15642 † Method for calculating the unsteady temperature conditions of the generator in a solar refrigeration system (Metod rascheta nestatsionarnogo temperaturnogo rezhima generatora solnechnoi kholodil'noi ustanovki). B. M. Achilov, V. V. Chugunkov, and R. M. Mirzakhodzhaev (Bukharskii Gosudarstvennyi Pedagogicheskii Institut, Bukhara, Uzbek SSR). *Akademiia Nauk Uzbekskoi SSR, Doklady,* no. 8, 1981, p. 32-34. In Russian.

A82-15653 Calculation of the top loss coefficient by the network method and applications to solar collectors. T Muneer and M. Hawas (University of Garyounis, Benghazi, Libya). *Energy* (UK), vol. 6, Oct. 1981, p 971-981. 10 refs.

A technique for the analysis of radiation exchange between two parallel planes with an intervening transmitting-absorbing-reflecting medium is extended to include convective heat transfer in the case of flat-plate solar collectors. The radiation exchange between the absorber plate of the collector and the sky is analyzed by a network method. Two network elements represent the surface and space resistances, which model the exchange of radiant energy between any two surfaces The heat flow in each branch of the network is determined by application of Kirchhoff's Law to the circuit with the algebraic sum of the currents at each node set at zero A flow chart is provided for the solution of the network, and radiosities and emissive powers are found for various plastic and glass covers including all paths of heat transfer loss. Top loss coefficients are derived and the method is proved reliable for calculation of the temperature of any cover and the heat exchange between two surfaces. M.S.K

A82-15660 Introduction of solar energy in Saudi Arabia - A case study. A. I. El-Sharkawy (King Abdulaziz University, Jeddah, Saudi Arabia), A. A. Husseiny, and R. Kenarangui (Iowa State University of Science and Technology, Ames, IA) *Journal of Engineering and Applied Sciences,* vol. 1, no. 1, 1981, p. 41-55. 5 refs.

Policies for the introduction of solar energy in Saudi Arabia are examined. Differentiation is made between areas of low density (nomadic) and high density (urban) population. Five strategies are considered which encompass the evolution from overall dependence on fossil fuel to a total energy system solely based on solar energy. Use is made of the multiattribute utility theory in the decision analysis of the various strategies. (Author)

A82-15666 A solar heating system with annual storage. F. Lazzari and G. Raffellini (Bologna, Università, Bologna, Italy). *International Journal of Ambient Energy,* vol 2, July 1981, p. 141-149.

A solar heated house with long term storage capability, built in Trento, Italy, is described. The one story house was built from modular components and has a total heated volume of 1130 cu m. Flat plate solar collectors with a water-antifreeze medium are located beneath the lawn, and six cylindrical underground tanks holding 130 cu m of water heated by thermal energy from the collectors are situated under the garden. The house walls have an 8 cm cavity filled with 5 cm of formaldehyde foam, yielding a heat transmission (U) of 0 37 W/sq m/deg C. The roof and ceilings are insulated with fiberglass and concrete, producing U-values of 0.46 W/sq m/deg C and 0.57 W/sq m/deg C, respectively. Heat pumps using 6 kW move thermal energy between the house and the tanks. Direct hot water heating occurs in the summer, and direct home heating when the stored water temperature exceeds 32 C. A computer model was developed which traces the annual heat flow and it is shown that the system supplies all heating requirements for the house, with electrical requirements equal to 20 percent of the annual house needs. M.S.K

A82-15903 * Towards a high-temperature solar electric converter. G. J. Dunning and A. J. Palmer (Hughes Research Laboratories, Malibu, CA). *Journal of Applied Physics,* vol. 52, Dec. 1981, p. 7086-7091. 10 refs. Contract No. NAS2-10001.

The concept of an ultrahigh-temperature solar electric heat-engine converter is examined in which an alkali plasma would serve

as both the high-temperature collector of solar radiation and as the working fluid for a high-temperature working cycle. The working cycle would be a simple magnetohydrodynamic Rankine cycle. Theoretical and experimental results obtained to date are summarized. These include (1) an experimental confirmation of the theoretical prediction that a plasma temperature of about 2800 K can be reached through heating cesium vapor by sunlight concentrated to approximately 300 W per sq cm, and (2) the establishment of a theoretical model of the complete solar heated plasma magnetohydrodynamic cycle. V.L.

A82-15911 A new structure for a semiconductor-insulator-semiconductor solar cell. K. Sen and R. S. Srivastava (D. B. S. College, Dehradun, India). *Journal of Applied Physics,* vol. 52, Dec. 1981, p. 7309-7312. 7 refs.

The open circuit voltage and short circuit current characteristics of S(p + n)IS, a new structure proposed for semiconductor-insulator-semiconductor solar cells, are calculated and compared with those of the S(n+)IS type solar cells. It is found that the theoretical conversion efficiency of the new structure with polycrystalline base is about 30% and its open circuit voltage is of the order of 1.3 V, which is much higher than for a polycrystalline S(n+)IS solar cell. V.L.

A82-16051 Grain size dependence of the photovoltaic properties of solar grade polysilicon. S Kumari, N. K. Arora, and G. C. Jain (National Physical Laboratory of India, New Delhi, India). *Solar Energy Materials,* vol. 5, Oct. 1981, p. 383-390. 20 refs.

The effect of grain size on the various photovoltaic and diode parameters of polycrystalline silicon solar cells is investigated. The grain size ranged from 0.3-3 mm, and the solar cells were fabricated on 22 mm diameter and 300 micron thick polycrystalline Si wafers with a resistivity of about 10 ohm cm. The solar grade polysilicon has an impurity concentration as high as 10 to the 16th - 10 to the 17th/cu cm, with iron as the major impurity. The variation of efficiency and diffusion length with grain size was found to shift to higher grain size ranges in solar cells made out of solar grade poly-Si. This is a result of the increased detrimental effects of grain boundaries in solar grade poly-Si, since the excess impurities segregate at the grain boundaries. A study of dark I-V characteristics shows that the grain boundaries do not appreciably affect bulk recombination, but do enhance the contribution of the space charge recombination J.F.

A82-16053 Photoelectrochemical cells using polycrystalline and thin film MoS2 electrodes. G. Djemal, U. Lachish, D. Cahen (Weizmann Institute of Science, Rehovot, Israel), and N Muller *Solar Energy Materials,* vol 5, Oct 1981, p 403-416 21 refs Research supported by the European Communities Energy Research and Development Program and U.S.-Israel Binational Science Foundation

The preparation and preliminary characterization of a variety of photoactive polycrystalline MoS2 electrodes in polyiodide aqueous electrolyte are reported. The best photoresponse results were obtained when multicrystalline lumps were affixed to metal substrates, pressed pellets reached about 30% of the output of these electrodes. Thin polycrystalline films were prepared by flux annealing of pasted films, these showed some photoresponse, which was improved by more than an order of magnitude if an organic polymer binder was used in the preparation and retained by low temperature annealing. These electrodes reached 50% of the output of pressed pellets The effect of the polymer is due to (1) orientation of the crystallites, and (2) shielding of some of the exposed edges from the solution. Prolonged use of these photoelectrodes or short use at higher temperatures will decrease their output, but the original activity can be restored by renewed low temperature annealing The wavelength dependence of the photoresponse of these electrodes shows that those using a polymer matrix approach the performance of single crystals most closely J.F

A82-16054 A study of the purification process during the elaboration by electron bombardment of polysilicon ribbons designed for photovoltaic conversion. D. Casenave, R Gauthier, and P. Pinard (Lyon, Institut National des Sciences Appliquées, Villeurbanne, Rhône, France). *Solar Energy Materials,* vol 5, Oct. 1981, p. 417-423 10 refs Research supported by the Centre National de la Recherche Scientifique and Agence Nationale de Valorisation de la Recherche

A method of elaboration of polysilicon ribbons for solar energy conversion has been developed, which uses powder as a starting material The method is characterized by its low energy costs, its high pulling rates, and its elimination of substrate contamination. Ribbons with small grains (of the order of 100 microns) are obtained in the first melting process from the powder. The ribbons are then recrystallized under an electron beam, giving elaborated polycrystalline samples with a columnar structure and an average thickness of 400 microns. Electron irradiation at low pressure leads to two simultaneous processes of purification, one resulting from the displacement of the molten zone produced on the sample by the electron beam, the other operating by evaporation of impurities in vacuum. J.F.

A82-16055 Solar selective properties and high temperature stability of CVD ZrB2. E. Randich and R. B Pettit (Sandia National Laboratory, Albuquerque, NM) *Solar Energy Materials,* vol. 5, Oct. 1981, p. 425-435 16 refs. Contract No DE-AC-04-76DP-00789

The aging at temperatures of 400, 500, and 600 C in air is examined for chemical vapor deposited (CVD) zirconium diboride (ZrB2) and zirconium diboride coatings overcoated with silicon nitride (Si3N4) The solar absorptance and emittance properties of polished CVD ZrB2 on high-density, hot-pressed ZrB2 are also reported Antireflection coatings of Si3N4 increased the solar absorption of CVD ZrB2 from initial values of 0.46-0 77 to 0 88-0.93, while only increasing the emittance from 0 08 to 0 10. Aging tests show the Si3N4/ZrB2 combination, both free standing and on Kovar substrates, to be stable in air at 500 C for greater than 1000 h, but at 600 C, the emittance increased after 300 h exposure. This slow degradation at 600 C appears to result from oxidation of the Si3N4 antireflection layer. J.F

A82-16056 Photocorrosion of strontium titanate photoanodes. C W de Kreuk, J L B. de Groot (Centrale Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Centraal Laboratorium TNO, Delft, Netherlands), and A Mackor (Centrale Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Organisch Chemisch Instituut TNO, Utrecht, Netherlands) *Solar Energy Materials,* vol 5, Oct 1981, p 437-444 13 refs Research supported by VEG-Gasinstituut.

The photocorrosion of a strontium titanate photoanode was studied under acidic (0.5 M H2SO4), neutral (0 5 M Na2SO4), and alkaline (1 0 M NaOH) conditions It was found that in the 0.5 M H2SO4 acid medium, SrTiO3 corrodes very rapidly upon band-gap irradiation (at a potential of 1 V) with an external bias Assuming the photocorrosion to be a two-hole process releasing strontium ions, the corrosion corresponded to 10% of the photocurrent No substantial corrosion was found in the dark or under open-circuit conditions In the neutral medium the corrosion was less severe, chipping of the crystal surface was observed (thickness of about 0 2-0 4 microns), due to the loss of strontium No substantial corrosion was found under alkaline conditions. J.F.

A82-16057 Sputter etched metal solar selective absorbing surfaces for high temperature thermal collectors. G L. Harding and M R Lake (Sydney, University, Sydney, Australia). *Solar Energy Materials,* vol 5, Oct. 1981, p. 445-464 31 refs. Research supported by the University of Sydney.

Magnetron sputter etching was used to successfully texture copper, stainless steel, and nickel in the form of sheets (280 mm x 50 mm) and tube (280 mm in length). The various surfaces exhibited absorptances in the range of 0.90 to 0.95 and emittances in the range of 0.10 to 0 25 at 300 K In the case of copper surface morphologies and solar selectivity varied with sputter etching parameters, allowing tailoring of selective properties Surfaces produced on stainless steel and nickel were less dependent on sputtering conditions. Sputter-etched copper surfaces were stable in vacuum at 400 C, sputter-etched stainless steel surfaces were stable at 500 C and deteriorated slowly in air at 400 C, surfaces based on nickel deteriorated slowly in air even at 300 C Measurements of the dependence of absorptance on angle of incidence show that textured specimens produced by

sputter etching behave similarly to a highly specular sputtered selective surface The magnetron sputtering techniques can also be extrapolated to produce solar absorbers having an axial length of about 2 m. J.F.

A82-16124 Solar chemistry of metal complexes. H. B. Gray (California Institute of Technology, Pasadena, CA) and A. W. Maverick (Washington University, St. Louis, MO). *Science,* vol. 214, Dec. 11, 1981, p 1201-1205. 41 refs.

Electronic excited states of certain transition metal complexes undergo oxidation-reduction reactions that store chemical energy. Such reactions have been extensively explored for mononuclear complexes. Two classes of polynuclear species exhibit similar properties, and these complexes are now being studied as possible homogeneous sensitizer-catalysts for hydrogen production from aqueous solutions. (Author)

A82-16127 High efficiency inversion layer solar cells on polycrystalline silicon by the application of silicon nitride. R. Schorner and R. Hezel (Erlangen-Nürnberg, Universitat, Erlangen, West Germany) *IEEE Transactions on Electron Devices,* vol. ED-28, Dec. 1981, p. 1466-1469. 15 refs.

A82-16131 A method for experimental assessment of the shifting approximation, with application to polysilicon solar cells. J. A. Mazer (Harris Semiconductor, Inc., Palm Bay, FL), A. Neugroschel, and F. A. Lindholm (Florida, University, Gainesville, FL). *IEEE Transactions on Electron Devices,* vol ED-28, Dec. 1981, p. 1530-1534. 6 refs. Contract No. XS-9-8275-1

The method makes use of the fact that, in a solar cell for which the shifting approximation is valid, a constant series resistance, independent of illumination, will cause the light and dark I-V curves to be symmetrically displaced with respect to the I sub SC-V sub OC curve. This symmetry is analyzed in detail The experimental data are seen as suggesting that the shifting approximation is valid and that the series resistance is independent of illumination up to at least one-sun intensity for a variety of polysilicon solar cells in which the intragrain-base minority carrier diffusion length is less than or equal to the average grain diameter C R.

A82-16132 K/u/-band flat-profile Si-IMPATT diodes with 10-percent efficiency. D. Leistner and J Freyer (Munchen, Technische Universitat, Munich, West Germany). *IEEE Transactions on Electron Devices,* vol ED-28, Dec 1981, p 1553, 1554. 8 refs. Research supported by the Fraunhofer Gesellschaft zur Förderung der angewandten Forschung.

A82-16133 Influence of the junction area to edge area ratio on the open-circuit voltage of silicon solar cells. A Cuevas, J Eguren, E Sanchez, and M Cid (Madrid, Universidad Politécnica, Madrid, Spain) *IEEE Transactions on Electron Devices,* vol. ED-28, Dec 1981, p 1554, 1555. 5 refs.

A82-16229 # Thermal performance of a solar still. M. S Sodha, J. K. Nayak, G. N. Tiwari (Indian Institute of Technology, New Delhi, India), and U. Singh. *Journal of Energy,* vol 5, Nov.-Dec. 1981, p. 331-336. 19 refs.

A simple periodic analysis of a basin-type solar still (both single as well as double), mounted on a stand, has been presented. The effect of dye injected into the water of a single-basin still has been explained. Numerical calculations have been carried out using parameters corresponding to stills with which experiments have been carried out at the Indian Institute of Technology, Delhi. It is found that the present theory quite satisfactorily explains the thermal performance of basin-type solar stills. (Author)

A82-16247 An integrating sphere based on absolute method for measuring solar absorptance. X. Ge (China University of Science and Technology, Hefei, People's Republic of China) and Y. Peng (Chinese Academy of Sciences, Shanghai Institute of Ceramics, Shanghai, People's Republic of China) *Engineering Thermophysics in China,* vol. 1, Oct.-Dec. 1981, p. 347-366. 32 refs. Translation.

In this paper, an integrating sphere for measuring solar absorptance is described. Its characteristics are (1) it is an absolute method, (2) it can be used to measure the directional-hemispherical reflectance for various incidence angles; (3) the samples to be measured may be specular, diffuse or specular-diffuse reflecting surfaces. Theoretical analyses are carried out for this integrating sphere and the measured data of reflectance of the MgO, vacuum-vaporized aluminum mirror film and other surfaces are presented. (Author)

A82-16249 Natural convection in air layers at various aspect ratios and angles of inclination. D Luo and L. Han (Qinghua University, Beijing, People's Republic of China). *Engineering Thermophysics in China,* vol. 1, Oct.-Dec. 1981, p. 385-397. 17 refs. Translation.

The results of an experimental investigation of natural convection in air layers at various aspect ratios and angles are presented. The Rayleigh numbers range from subcritical to 1,000,000; the angle of inclination, measured from the horizontal, ranges from 0 to 90 deg. From an analysis of the physical model and the experimental measurements, several experimental nondimensional formulas are proposed. Special attention is given to the influence of the aspect ratio on heat transfer. The influence is found to differ with the range of the aspect ratio, being more pronounced in the range of low aspect ratios. The applicability of the recommended relationships to the design of solar collectors is stressed. C.R.

A82-16469 Effects of heat treatment on epitaxial silicon solar cells on metallurgical silicon substrates. T L Chu, S. S. Chu (Southern Methodist University, Dallas, TX), L. L. Kazmerski, R Whitney (Solar Energy Research Institute, Golden, CO), C. L Lin, and R. M. Davis (Poly Solar, Inc., Garland, TX). *Solar Cells,* vol. 5, Dec. 1981, p. 29-38. 7 refs Contract No. XZ-0-9192-1.

A preparation of acid extracted metallurgical grade silicon as a large-grain substrate for solar cells is described. Metallic impurities which normally accumulate on the grain boundaries of pulverized Si were removed by 400 hr of aqua regia refluxing Secondary ion mass spectrometry (SIMS) revealed that aluminum and iron concentrations were significantly reduced, and the Si was made into sheets by unidirectional solidification on an RF-heated graphite plate. Solidification at 1-2 cm/min yielded a (110) crystallite orientation, SIMS determined that remaining impurities were uniformly diffuse, and heat treatment in He at 700 C resulted in precipitation of metallic impurities onto the grain boundaries. Trichlorosilane was thermally reduced to form an epitaxial film on the Si substrate, and 37 sq cm cells were fabricated with an efficiency of 8.95%. M.S.K.

A82-16471 n-/indium tin oxide//p-InP solar cells. L. Gouskov, H. Luquet, J. Esta, and C. Gril (Montpellier II, Université, Montpellier, France). *Solar Cells,* vol. 5, Dec. 1981, p. 51-66. 17 refs.

n-(indium tin oxide)/p-InP solar cells of 11 percent efficiency were fabricated using the spray method to deposit indium tin oxide onto single-crystal p-type InP. For the atomic ratio Sn:In of 1:10, the optimized spray temperature is 450 C. The various characterizations made on this type of device give results which are in good agreement with a buried homojunction model. (Author)

A82-16472 Effects of double-exponential current-voltage characteristics on the performance of solar cells. A. H M. Shousha (United Arab Emirates University, Al Ain, United Arab Emirates). *Solar Cells,* vol. 5, Dec. 1981, p. 67-73. 10 refs

The effects of double-exponential dark current-voltage characteristics on the open-circuit voltage, fill factor and conversion efficiency of solar cells were investigated with reference to MIS solar cells. The results presented show various types of cell performance depending on the relative contributions of the postulated current transport mechanisms. (Author)

A82-16474 Effects of processing parameters on thick film inks used for solar cell front metallization. K. Firor and S. Hogan (Solar Energy Research Institute, Golden, CO). *Solar Cells,* vol. 5, Dec. 1981, p. 87-100. 9 refs.

A study is described of commercially available thick film conductor inks to determine their suitability for use as solar cell front electrical contacts. By varying processing parameters such as firing profile and length of HF etch, most of the silver-based inks were found to form good electrical contacts. Irrespective of ink

composition, adjustment of processing parameters is necessary to optimize the performance of a thick film solar cell contact. The base metal conductor inks tested were found to be unsuitable for solar cell front metallization. The two major problems encountered were high diffusivities in silicon and high series resistances introduced by the base metal contacts. (Author)

A82-16598 A seasonally adjusted concentrator with modifications of absorber shape. S. C. Mullick and S. K Nanda (Indian Institute of Technology, New Delhi, India) *Applied Energy,* vol 9, Dec 1981, p 257-266. 14 refs

A design procedure for a solar collector absorber is described, which avoids the optical losses which occur through the air gap A comparison of the performance results of this modified absorber with those of a plane tubular absorber shows an improvement in the intercept factor from 0.8 to 0.92. The surface area of the modified absorber is about 9% larger than the surface of the plane tubular absorber, but the shape is such that the overall heat loss factor is much lower: the total heat loss for the modified absorber at 100 C above ambient is only 0.2% higher than that of the plane tubular one. Performance curves of both absorbers are given, demonstrating the improved efficiency of the modified absorber. J.F.

A82-16599 Theoretical analysis of the Fresnel lens as a function of design parameters. P. K Gupta (Indian Institute of Technology, New Delhi, India). *Applied Energy,* vol. 9, Dec. 1981, p. 301-310. 7 refs.

The theoretical performance of the Fresnel lens was studied as a function of the design parameters - i.e., the radius to the center of the steps, the focal distance from the back of the lens to the plane of the image with the object (i.e., the sun) at infinity, the thickness of the lens plate, the step width and the refractive index of the material (with respect to air) - used in its fabrication. Numerical calculations have also been carried out for a Fresnel lens of perspex sheet. (Author)

A82-16742 Photoanode on the base of pheophytin-sensitized reactions. E Iu. Kats, Iu. N. Kozlov, and B A. Kiselev (Academy of Sciences, Institute of Photosynthesis, Pushchino, USSR). *Energy Conversion and Management,* vol. 21, no 3, 1981, p 171-174. 18 refs.

A model of a photoelectrochemical fuel element for photoionized reduction of methylviologen is presented, along with experimental results. The photoanode is described on a basis of pheophytin-sensitized oxidation of manganese ions, with tetranitromethane used as an irreversible electron acceptor Use of a platinum electrode and preparation of the chemical redox agents is described, and a polarographic cell at 20 C illuminated by a 750 W iodine lamp was investigated. The addition of water or Mn ions to the solution in the photogalvanic cell led to total tetranitromethane reduction. The pheophytin-sensitized reduction of MN ions permitted an open current voltage of 750 mV and a short circuit photocurrent of 100 micro-A/sq cm. The recombination of reaction products is inhibited by the irreversible tetranitromethane reduction, which is a drawback for use of the system. M S K

A82-16744 Optimization of heat losses in normal and reverse flat-plate collector configurations - Analysis and performance. M. Madhusudan, G N Tiwari, D. S. Hrishikeshan, and H K. Sehgal (Indian Institute of Technology, New Delhi, India). *Energy Conversion and Management,* vol 21, no. 3, 1981, p. 191-198 6 refs

A82-16745 Nickel sulphide-lead sulphide and nickel sulphide-cadmium sulphide selective coatings for solar thermal conversion. M. Madhusudan and H. K. Sehgal (Indian Institute of Technology, New Delhi, India). *Energy Conversion and Management,* vol. 21, no. 3, 1981, p. 199-204. 6 refs.

A82-17098 * Low cost silicon-on-ceramic photovoltaic solar cells. B G. Koepke, J. D. Heaps, B. L. Grung, J. D. Zook (Honeywell Corporate Material Sciences Center, Bloomington, MN), J. D. Sibold (Coors Porcelain Co., Golden, CO), and M. H Leipold (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). In Energy and ceramics. Amsterdam, Elsevier Scientific Publishing Co., 1980, p. 1146-1158. 23 refs. Research sponsored by the U.S. Department of Energy and NASA

A technique has been developed for coating low-cost mullite-based refractory substrates with thin layers of solar cell quality silicon. The technique involves first carbonizing one surface of the ceramic and then contacting it with molten silicon. The silicon wets the carbonized surface and, under the proper thermal conditions, solidifies as a large-grained sheet. Solar cells produced from this composite silicon-on-ceramic material have exhibited total area conversion efficiencies of ten percent. (Author)

A82-17099 The use of semiconducting oxide ceramics in solar energy conversion. I. R Bedwell and E. R. McCartney (New South Wales, University, Kensington, Australia). In Energy and ceramics. Amsterdam, Elsevier Scientific Publishing Co., 1980, p. 1159-1172. 18 refs.

N-type oxide semiconductors in such forms as single-crystal slices and sintered compacts of rutile and hematite are studied, with a view to their use as photo-anodes in photogalvanic and photoelectrolytic solar cells. Slices of single-crystal hematite displayed anisotropic behavior in the photogalvanic mode, with higher currents obtained by an (012) slice than those having other orientations. Photoresponse variations were also found in hematite compacts, depending on the origin of the iron oxide used, and quantum efficiencies in the 1-5% range were measured. Other aspects of the research reported are: (1) AC and DC conductivity, (2) the effect of ohmic constant, (3) photocurrent as a function of bias voltage, and (4) long-term stability. O.C.

A82-17126 The design of a sodium-cooled 2.7 MW receiver for a solar power plant (Auslegung eines natriumgekuhlten 2,7 MW-receivers für ein Sonnenkraftwerk). D. Stahl, H. Weizenkamp (Interatom Internationale Atomreaktorbau GmbH, Bensberg, West Germany), and H. Fricker (Gebruder Sulzer AG, Winterthur, Switzerland). *Brennstoff-Warme-Kraft,* vol. 33, Nov. 1981, p 451-454 In German.

The design of the sodium-cooled 2.7 MW receiver, installed at the solar power plant in Almeria, Spain, is described. Particular attention is given to the receiver requirements, its construction, and its thermodynamic and dynamic response to solar radiation. The receiver has a thermal output of 2.7 MW, maximum and minimal sodium flow rates of 7.34 kg/sec and 0 734 kg/sec, respectively, and sodium inlet and outlet temperatures of 270 C and 530 C, respectively The geometry of the receiver includes an active thermally conducting wall, formed from a 120 deg portion of a vertical cylinder with a radius of 2.25 m and a height of 3.61 m, the maximum heat flux reaches a value of about 62 W/sq cm, the average being about 16 W/sq cm. The total thermal efficiency at 100% load is 88.3%, this efficiency decreases steadily, due to the constant sodium outlet temperature and the constant radiation, convection, and line losses. Out of sunlight, the receiver cools down from radiation losses of about 320 kW, the maximum temperature transient is about 2 k/sec. J F.

A82-17128 Solar-thermal experimental projects on the Spanish Plataforma Solar (Solarthermische Versuchsvorhaben auf der spanischen Plataforma Solar). W. Grasse (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Cologne, West Germany). *DFVLR-Nachrichten,* Nov. 1981, p. 6-10. In German.

The Plataforma Solar with an area of 1,000,000 sq m is located in Spain at a distance of approximately 50 km from the Mediterranean. In May 1979, nine members of the International Energy Agency (IEA) decided to support the construction of Small Solar Power Systems (SSPS). The countries involved include West Germany, the U.S., Spain, and Italy. The SSPS are to demonstrate the operational feasibility of solar technologies which have been mainly developed in Germany and the U.S. In addition, data are to be obtained regarding the relative competitive position of two different operational concepts for SSPS. The concepts are related to the central receiver system (solar tower) and the distributed collector system. Attention is also given to the Spanish solar power station CESA-1 and the German-Spanish technology program GAST, which is to explore the technological limits of solar-energy systems. G.R.

A82-17252 Metallurgical analysis and high temperature degradation of the black chrome solar selective absorber. C. M. Lampert (California, University, Berkeley, CA). *(Thin Solid Films,* vol. 72, 1980, p. 73-81.) In Metallurgical coatings 1980, Proceedings of the Seventh International Conference, San Diego, CA, April 21-25, 1980. Volume 1 Lausanne, Elsevier Sequoia, S A , 1980, p 73-81 13 refs. Contract No W-7405-eng-48.

A commercially produced coating is used in scrutinizing the properties and degradation modes of black chrome that is exposed to high temperatures. Both asplated and annealed microstructural models are studied In the microstructural characterization, the technical means comprise scanning electron microscopy, transmission electron microscopy, Auger depth profiling, hemispherical reflectance measurements, and energy-dispersive X-ray analysis. From these results, a physical metallurgical model for the wavelength-selective properties of the coating is developed. It is found that black chrome degrades as Cr2O3 oxide particles grow and the chromium is depleted. The effect is pronounced in air, less noticeable in a medium vacuum. It is noted that oxidation by preferential diffusion and outgassing which causes structural changes may take place. C R.

A82-17253 Sputter-deposited Al2O3/Mo/Al2O3 selective absorber coatings. J. A Thornton, A. S Penfold, and J L. Lamb (Telic Corp , Santa Monica, CA) *(Thin Solid Films,* vol. 72, 1980, p. 101-109.) In Metallurgical coatings 1980, Proceedings of the Seventh International Conference, San Diego, CA, April 21-25, 1980. Volume 1 Lausanne, Elsevier Sequoia, S.A , 1980, p. 101-109 16 refs Research supported by the U.S. Department of Energy

An investigation of Al2O3/Mo/Al2O3 (AMA) interference-type selective absorber coatings deposited by cylindrical magnetron sputtering onto low emittance molybdenum-coated glass and stainless steel substrates is presented Both post- and hollow-cathode magnetrons were used The Al2O3 layers were formed by reactive sputtering from aluminum and by RF sputtering from alumina targets The semitransparent molybdenum intermediate layers were deposited with and without oxygen injection. The optical constants for the individual sputtered layers were determined from transmission and reflectance measurements, and were used to calculate the influence of these layers on the solar absorptance of the complete AMA coating The optical properties of the sputtered AMA layers were in reasonable agreement with theory, yielding hemispherical solar absorptances of 0 92-0.95 with total hemispherical emittances of 0 06-0 10 at 20 C The highest absorptances and the lowest emittances were obtained for coatings in which the center molybdenum layer had been deposited with oxygen addition. The thermal stabilities of coatings with RF-sputtered Al2O3 were superior to those with reactively sputtered Al2O3. AMA coatings on stainless steel with an Al2O3 diffusion barrier were stable (less than 2% loss in absorptances) at 700 C in vacuum and at 550 C in air. These coatings are therefore attractive for a range of selective absorber applications, including high temperature collectors for use between 300 and 600 C (Author)

A82-17254 Characterization of selective solar absorber microstructures - Electron microscope studies. L. E. Murr, O. T. Inal, and M. Valayapetre (New Mexico Institute of Mining and Technology, Socorro, NM). *(Thin Solid Films,* vol. 72, 1980, p. 111-120.) In: Metallurgical coatings 1980, Proceedings of the Seventh International Conference, San Diego, CA, April 21-25, 1980. Volume 1. Lausanne, Elsevier Sequoia, S.A., 1980, p. 111-120. 8 refs. Contract No. ER-78-84-4266.

A82-17255 Oxidation of electrodeposited black chrome selective solar absorber films. P. H Holloway, K. Shanker (Florida, University, Gainesville, FL), R. B Pettit, and R R. Sowell (Sandia National Laboratory, Albuquerque, NM). *(Thin Solid Films,* vol. 72, 1980, p 121-128.) In Metallurgical coatings 1980, Proceedings of the Seventh International Conference, San Diego, CA, April 21-25, 1980. Volume 1. Lausanne, Elsevier Sequoia, S A , 1980, p. 121-128. 15 refs Contracts No. DE-AC04-76DP-00789, No. DE-FG02-79ER-10541

A82-17293 Aplanatic double reflection system for thermophotovoltaic applications - Design. F. Demichelis, E. Minetti-Mezzetti (Torino, Politecnico, Turin, Italy), and G. Ferrari (Fiat S.p.A., Centro Ricerche, Turin, Italy). *Applied Optics,* vol 20, Dec. 15, 1981, p. 4190-4192.

An aplanatic double-reflection concentrator which is relatively inexpensive and provides a highly concentrated output beam has been developed for applications in thermophotovoltaic solar energy systems. The configuration consists of a spherical primary reflector and a field of Fresnel mirror secondary reflectors deployed on a spherical surface so that the Abbe sine condition is satisfied, eliminating both spherical aberration and coma. Optical analysis of such a system has resulted in the design of a solar collector for a thermophotovoltaic converter which concentrates a power of 1000 W on the absorber through an aperture of 0 01 m, and has demonstrated its suitability for high-temperature solar systems. A.L W

A82-17294 Finite Lambertian source analysis of concentrators - Application to solar reflectors. A. Luque and J. M. Gómez (Madrid, Universidad Politécnica, Madrid, Spain). *Applied Optics,* vol. 20, Dec. 15, 1981, p. 4193-4200. 6 refs

The Lambertian source characteristics of solar reflectors operating in concentrating collectors are considered. The figures of merit of a given concentrator are analyzed with respect to its behavior in casting the incident power into the collector (intercept factor) and its ability to illuminate the collector as a Lambertian source (shape quality factor), and it is shown that the maximum power is cast on the collector when the concentrator is seen as a Lambertian source. The intercept factor of ideal mirrors, defined as those mirrors casting all received rays onto the receiver, are examined in the case of inaccuracies in concentrator shape, and it is found that all outlines become Lambertian when the tracking error is high enough. A method for cost analysis is presented which leads to the conclusion that mirrors with quality factors close to the Lambertian should be used for high-cost collectors, while mirrors with intercept factors close to those of the ideal should be used if the concentrator cost is high. A.L.W.

A82-17649 A comparison of p-i-n and Schottky barrier hydrogenated amorphous silicon, a-Si:H, solar cells. R. S. Crandall (RCA Laboratories, Princeton, NJ). *RCA Review,* vol. 42, Sept. 1981, p. 441-457. 16 refs. Research supported by RCA; Contract No. XG-0-9372-1.

Measurements of the photoconductive response of Schottky barrier and p-i-n solar cell structures made from hydrogenated amorphous silicon are presented to compare the properties that determine their efficiency. It is demonstrated that the photoconductivity determines the fill factor rather than the dark current, as in crystalline silicon cells. Analysis of the current voltage curves of the p-i-n cells are used to show that the electron and hole drift lengths are of the same order in the i layer of the cell. (Author)

A82-17650 Field nonuniformity due to photogenerated carriers in a p-i-n solar cell. R. S. Crandall (RCA Laboratories, Princeton, NJ). *RCA Review,* vol. 42, Sept. 1981, p. 458-462. 10 refs. Research supported by RCA; Contract No. XG-0-9372-1.

The changes in the electric field due to the free-carrier space charge in a p-i-n solar cell are calculated. A criterion for significant field reduction caused by space charge is presented. It is suggested that there will be significant electric field lowering for hydrogenated amorphous silicon, a-Si:H, solar cells much thicker than 1 micron under 1 sun illumination. (Author)

A82-17761 # The El Paso electric 20-kilowatt photovoltaic system. V. V. Risser and S. Durand (New Mexico Solar Energy Institute, Las Cruces, NM). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 20th, Orlando, FL, Jan. 11-14, 1982, Paper 82-0064.* 8 p.

Features and operational characteristics of a 20 kW flat plate photovoltaic power system are described. The system powers computers which control a combined cycle 190 MW power plant. Performance has been an average of 93 kWh/day, 6.05% efficiency, and at an average cell temperature of 22 C from Dec. 1980 to Sept. 1981. The array comprises 279 sq m area, 64 panels, 6 subarrays for subsystem shorting if necessary, and fuses set at 250 V with a reaction time of 10 microsec. Testing procedures are outlined,

including data acquisition, weather monitoring, operation in cloudy periods, and fault isolation modes. Maintenance has been dominated by upkeep of the data acquisition system, and it is noted that significant reductions in all maintenance would have results in only minor reductions in overall system performance. M.S.K.

A82-17762 # **The Mt. Laguna photovoltaic project.** L. R. Suelzle (Helionetics, Inc., Irvine, CA) and D. E. Haskins (Sandia National Laboratory, Albuquerque, NM). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 20th, Orlando, FL, Jan. 11-14, 1982, Paper 82-0065*. 7 p. 6 refs.

The Mt. Laguna 60 kW photovoltaic project was completed and placed in operation in June of 1979. During the first two years of operation the photovoltaic system has met or exceeded most of the technical requirements originally established with virtually no problems. The electrical output from the photovoltaic array however, has suffered a slow but consistent decline during the 2-year operational period. Fortunately, the load on the grid has declined at a still greater rate so that the percentage of the load carried by the photovoltaic system has increased from 10% to about 20%. This paper addresses the 2 years of operations and analyzes the overall performance and effectiveness of the system during that time. (Author)

A82-17764 # **The Lea county electric 100-kilowatt grid-connected photovoltaic system.** V. V. Risser and P. Hutchinson (New Mexico Solar Energy Institute, Las Cruces, NM). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 20th, Orlando, FL, Jan. 11-14, 1982, Paper 82-0067*. 7 p.

A 100-kilowatt flat-plate grid-connected photovoltaic system, funded by the Department of Energy, was installed in Lovington, New Mexico. The system is composed of two 50-kilowatt subfields, each with a dedicated power conditioning unit. A subfield contains 21 subarrays, 80 modules each. Oriented due south, the total panel area of 1,685 square meters may be adjusted manually to 10, 30, or 40 degrees from horizontal. System performance and weather information is collected and analyzed by New Mexico Solar Energy Institute. Performance data is checked daily and fault detection techniques are used if string current degradation is noted. The system has operated automatically since March 17, 1981. Reliability of prime system components has been high. This paper reviews results to date and examines system performance from a user's viewpoint. (Author)

A82-17765 # **Startup experience with a concentrating photovoltaic power system.** S. I. Kaplan (Oak Ridge National Laboratory, Oak Ridge, TN). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 20th, Orlando, FL, Jan. 11-14, 1982, Paper 82-0068*. 5 p. Contract No. W-7405-eng-26.

Physical features and startup characteristics of a 240 kW parabolic trough photovoltaic power system are described. The Mississippi County Community College array (Blytheville, AR) comprises 45 rows of linear parabolic troughs oriented N-S, which track E-W by means of a hydraulically driven actuator. The solar input is focussed onto 50/50 water-glycol cooled receiver bars on which Si solar cells are mounted. Nominal operating temperature for the cells is 50 C, with the heat transferred to the building heat supply in the winter. The output is routed through a power conditioning unit for inversion to 480 V ac power, for use by the school or, when the demand is exceeded, for direct transmission into the utility grid. Problems during startup have included misalignment, due to gravitational torquing and twisting, standoff insulation, and tracking during cloudy periods. Output has been 45% of design during the autumn of 1981. M.S.K.

A82-18025 **Electric utility modeling extensions to evaluate solar plants.** J. T. Day and M. J. Malone (Westinghouse Electric Corp., Pittsburgh, PA). *IEEE Transactions on Power Apparatus and Systems*, vol. PAS-101, Jan. 1982, p. 120-124; Discussion, p. 125, 126. 12 refs.

It is pointed out that solar concepts, such as solar thermal electric and photovoltaic conversion plants, which use direct sunshine, have operating characteristics that cannot be adequately handled with conventional generation planning models. The simulation methodology employed considers a separate detailed solar operation model which is interfaced with conventional utility generating planning models to determine the operating and reliability impact of solar plants on a utility system. Attention is also given to optimal utility expansion extensions. The operation of a 100 MWe central receiver solar-thermal power plant on a synthetic utility system representative of the southwest U.S. is considered. G.R.

A82-18222 * # **High performance solar Stirling system.** J. W. Stearns (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) and R. Haglund (Advanco Corp., El Segundo, CA). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2554*. 6 p. 10 refs. NASA-supported research.

A full-scale Dish-Stirling system experiment, at a power level of 25 kWe, has been tested during 1981 on the Test Bed Concentrator No. 2 at the Parabolic Dish Test Site, Edwards, CA. Test components, designed and developed primarily by industrial contractors for the Department of Energy, include an advanced Stirling engine driving an induction alternator, a directly-coupled solar receiver with a natural gas combustor for hybrid operation and a breadboard control system based on a programmable controller and standard utility substation components. The experiment demonstrated practicality of the solar Stirling application and high system performance into a utility grid. This paper describes the design and its functions, and the test results obtained. (Author)

A82-18223 * # **Configuration selection study for isolated loads using parabolic dish modules.** W. Revere, J. Bowyer, T. Fujita, and H. Awaya (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2549*. 11 p. 10 refs. Research sponsored by the U.S. Department of Energy and NASA.

A configuration tradeoff study has been conducted to determine optimum solar thermal parabolic dish power systems for isolated load applications. The specific application of an essentially constant power demand as required for MX missile shelters is treated. Supplying a continuous level of power with high reliability is shown to require a power system comprising modular parabolic dish power units where the heat engines of the modular power units can be driven by fossil fuels as well as solar-derived heat. Since constraints on reliability result in the provision of a power generating capability that exceeds the constant demand level, efficient utilization of the power system requires battery storage. Tradeoffs regarding the optimum size of storage are investigated as a function of the number of power modules and the cost of the fossil fuel which is used to meet the demand when insolation is unavailable and storage is depleted. (Author)

A82-18232 **Theoretical and numerical resolution of a mathematical model of the release of solar energy from storage (Résolution théorique et numérique d'un modèle mathématique de déstockage de l'énergie solaire).** H. Ghidouche, F. Lavainne, and N. Point (Paris XIII, Université, Villetaneuse, Seine-Saint-Denis, France). In: Numerical methods for engineering; Proceedings of the Second International Congress, Paris, France, December 1-5, 1980. Volume 1. Paris, Dunod, 1980, p. 369-382. In French.

Solutions of a mathematical model describing the recovery of solar energy stored as heat in a pebble bed are presented in the one- and two-dimensional cases. Fluid and pebble temperatures, and fluid pressure, velocity and density are obtained as functions of time and position for a pebble bed storage unit heated to a temperature of 70 C and releasing its heat to air at 20 C over the course of 6 months. The problem is treated numerically using different time scales for the pebbles and the fluid. In the one-dimensional case, the advancement of the energy release front is found to correspond to experimental observations. A.L.W.

A82-18287 * **Effects of low temperature periodic annealing on the deep-level defects in 200 keV proton irradiated AlGaAs-GaAs solar cells.** S. S. Li, T. T. Chiu (Florida, University, Gainesville, FL), and R. Y. Loo (Hughes Research Laboratories, Malibu, CA). *IEEE,*

U.S. Defense Nuclear Agency, NASA, and DOE, Annual Conference on Nuclear and Space Radiation Effects, 18th, Seattle, WA, July 21-24, 1981.) IEEE Transactions on Nuclear Science, vol. NS-28, Dec. 1981, p. 4113-4118. 15 refs. Grant No. NsG-1425.

The GaAs solar cell has shown good potential for space applications. However, degradation in performance occurred when the cells were irradiated by high energy electrons and protons in the space environment. The considered investigation is concerned with the effect of periodic thermal annealing on the deep-level defects induced by the 200 keV protons in the AlGaAs-GaAs solar cells. Protons at a fluence of 10 to the 11th P/sq cm were used in the irradiation cycle, while annealing temperatures of 200 C (for 24 hours), 300 C (six hours), and 400 C (six hours) were employed. The most likely candidate for the E(c) -0.71 eV electron trap observed in the 200 keV proton irradiated samples may be due to GaAs antisite, while the observed E(v) +0.18 eV hole trap has been attributed to the gallium vacancy related defect. The obtained results show that periodic annealing in the considered case does not offer any advantages over the one time annealing process. G.R.

A82-18471 **Model based studies of some optical and electronic properties of narrow and wide gap materials.** N. M. Ravindra, K. S. Kumar, V. K. Srivastava (Roorkee, University, Roorkee, India), and R. P. Bhardwaj. *Infrared Physics*, vol. 21, Nov. 1981, p. 369-381. 26 refs. Research supported by the Council of Scientific and Industrial Research and University Grants Commission of India.

Studies are reported concerning the optical and electronic properties of narrow and wide gap materials in the groups IV, V, VI, III-V, II-VI, I-VII, IV-VI, and IV-IV, with emphasis on the high-frequency dielectric constant and its related properties. The relevance of this work to solar cells is discussed, and a comparative assessment of the models proposed by Penn (1962), Van Vechten (1969), Breckenridge et al. (1974) and Grimes and Cowley (1975) is presented. It is found that, although all of the models give adequate estimates of the Penn gap, none of them are universally applicable. In addition, studies are presented of the temperature and pressure dependence of the Penn and energy gaps and the high frequency dielectric constant, followed by an evaluation of the electron-phonon contribution to the total temperature dependence of the energy gap and the refractive index. The inverse square law governing the variation of deformation potential with the lattice parameter is found to be valid for a large number of semiconductors. O.C.

A82-18645 # **Application of solar power satellites to India's energy needs - A macroengineering solution to a macroproblem.** J. P. Vajk (Science Applications, Inc., Pleasanton, CA). In: Macroengineering: The rich potential; Proceedings of the Third Symposium, San Francisco, CA, January 6, 1980. (A82-18643 06-99) New York, American Institute of Aeronautics and Astronautics, 1981, p. 97-109. 12 refs.

It is proposed that Solar Power Satellites (SPSs) be used as the primary energy source for the synthesis of methanol, which is easily transported, and may be derived from water and from carbon dioxide extracted from the air. In order to meet the household energy needs of India in this way at the turn of the century, 200 SPSs of 5 GW capacity each would be required. The construction and operation of the 2000 synthesis plants to which the SPS power would be transmitted by laser or microwave beam would (1) alleviate India's rural unemployment, (2) stimulate the development of economic infrastructures and a skilled labor force in rural areas, (3) reduce family energy expenditures, and (4) decrease pressures on the natural environment by providing a cheaper substitute for firewood and dried animal manures. O.C.

A82-18697 † **The universal plane method for calculating the dimensions of heliostats (Metod universal'noi ploskosti dlia rascheta gabaritov geliostatov).** L. B. Perres and I. V. Baum (Akademiia Nauk Turkmenskoi SSR, Institut Solnechnoi Energii, Turkmen SSR). *Akademiia Nauk Turkmenskoi SSR, Izvestiia, Seriia Fiziko-Tekhnicheskikh, Khimicheskikh i Geologicheskikh Nauk*, no. 5, 1981, p. 57-61. In Russian.

It is pointed out that heliostat dimensions are crucial in ensuring that sunlight is properly reflected during the day in solar furnaces and solar power stations. In determining these dimensions, allowance must be made for changes in the sun's position during the day, changes which depend on the latitude of the installation. To construct unique algorithms for calculating the dimensions, a procedure involving general concepts must be formulated and this formulation introduces a universal frame of reference. An example of this which has attracted considerable interest involves a flat round receiver that is parallel either to the horizontal plane or to the universal plane considered here. C.R.

A82-18698 † **Thermal deformation of concentrators in an antisymmetric temperature field (Termodeformatsii kontsentratorov v antisimmetrichnom temperaturnom pole).** R. Bairamov, V. M. Korolev, Iu. I. Machuev, A. Nazarov, E. V. Sokolov, and V. G. Fokin (Akademiia Nauk Turkmenskoi SSR, Fiziko-Tekhnicheskii Institut, Ashkhabad, Turkmen SSR). *Akademiia Nauk Turkmenskoi SSR, Izvestiia, Seriia Fiziko-Tekhnicheskikh, Khimicheskikh i Geologicheskikh Nauk*, no. 5, 1981, p. 67-72. 5 refs. In Russian.

Attention is given to skew-symmetric temperature deformations. It is noted that deformations of this type occur when the temperature of the middle surface of the mirror and when the temperature gradient of the thickness vary according to a certain law, which is given. Such a temperature distribution arises when the optical axis of the mirror does not coincide with the direction of the radiant heat flux. Expressions are given which make it possible to determine the deviations of points on the reflecting surface from the theoretical profile. The deformed surface obtained can be approximated by a paraboloid having parameters (focus distance and the direction of the optical axis) which differ from the original values. C.R.

A82-18816 **A simplified model of the thermohydraulic behaviour of a linear collector network for the conversion of the solar energy.** C. Bellecci, M. Camarca, M. Conti, L. La Rotonda, S. Natoli, G. Piccini, and R. Visentin (Calabria, Università, Cosenza, Italy). *Nuovo Cimento C, Serie 1*, vol. 4C, July-Aug. 1981, p. 385-396. 6 refs.

A model has been set up to describe the thermohydraulic behavior of a solar power plant in a quasi-steady-state approach; the simplifying assumptions have been proved to be correct. The model has been solved to determine the optimum sizes of the thermal accumulator. (Author)

N82-10276# Mid-American Solar Energy Complex, Minneapolis, Minn
QUARTERLY REPORT OF SOLAR FEDERAL BUILDINGS PROGRAM IN THE MASEC REGION
Jun. 1981 20 p
(Contract DE-AC02-79CS-30150)
(DE81-027968, MASEC-R-81-059/1) Avail NTIS HC A02/MF A01

Solar Federal Buildings Program (SFBP) projects within the 12-state MASEC region are listed The states involved are Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin The SFBP agencies projects are briefly described DOE

N82-10490 Southern Methodist Univ., Dallas, Tex
THIN-FILM POLYCRYSTALLINE CADMIUM TELLURIDE SOLAR CELLS AND LARGE-AREA POLYCRYSTALLINE SILICON SOLAR CELLS Ph.D. Thesis
Roshdy Abolazayem Abderrassoul 1981 139 p
Avail. Univ Microfilms Order No. 8117882

Device quality polycrystalline films were deposited on a tungsten-coated graphite substrate by chemical vapor deposition An in-situ indium layer was deposited prior to CdTe deposition to reduce the back resistance Indium and iodine were used for n-type doping, and arsenic and phosphorus were used for p-type doping. The structural and electronic properties of the films were evaluated Post-deposition heat treatment in a cadmium overpressure reduced the electrical resistivity by a factor of 2-3. Large-area purified metallurgical silicon substrates on graphite were prepared by unidirectional solidification. The moving-coil zone-melting technique was used. The pulverized metallurgicalsilicon was acid-treated and phosphoruspentoxide gettered prior to recrystallization, in order to reduce the content of harmful

metallic impurities, especially Al and Fe A spectrophotometric technique was used to determine the iron content in the acid-treated silicon Dissert. Abstr

N82-10491 *Southern Methodist Univ., Dallas, Tex*
THIN FILM PHOTOVOLTAIC DEVICES Ph.D. Thesis
Ching-Long Lin 1981 117 p
Avail Univ Microfilms Order No 8117881

The deposition of a silicon film containing a p-n junction on a metallurgical silicon substrate was used for the preparation of thin-film silicon solar cells The substrate was prepared by the unidirectional solidification of the purified metallurgical silicon on a graphite plate, and the silicon film was deposited by the thermal reduction of trichlorosilane with hydrogen containing appropriate dopants Indium phosphide films were deposited on foreign substrates by the reaction of indium, hydrogen chloride, and phosphine Their structural and electrical properties were studied Schottky barriers prepared from indium phosphide films were found to have low rectification ratios, high dark currents, and poor photovoltaic response due to grain boundary effects The effects of grain boundaries were partially reduced by thermal oxidation, ruthenium (III) treatment, and nitridation, thus improving the photovoltaic characteristics of thin-film indium phosphide solar cells Dissert Abstr

N82-10496*# National Aeronautics and Space Administration Pasadena Office, Calif
SOLAR ENERGY MODULATOR Patent Application
Allan R McDougal (JPL, California Inst of Tech., Pasadena) and Robert R Hale, inventors (to NASA) (JPL, California Inst of Tech., Pasadena) Filed 17 Jul 1981 14 p
(Contract NAS7-100)
(NASA-Case-NPO-15388-1, US-Patent-Appl-SN-284286) Avail NTIS HC A02/MF A01 CSCL 10A

A module is described with a receiver having a solar energy acceptance opening and supported by a mounting ring along the optic axis of a parabolic mirror in coaxial alignment for receiving solar energy from the mirror, and a solar flux modulator plate for varying the quantity of solar energy flux received by the acceptance opening of the module The modulator plate is characterized by an annular, plate-like body, the internal diameter of which is equal to or slightly greater than the diameter of the solar energy acceptance opening of the receiver Slave cylinders are connected to the modulator plate for supporting the plate for axial displacement along the axis of the mirror thereby shading the opening with respect to solar energy flux reflected from the surface of the mirror to the solar energy acceptance opening T M

N82-10500*# Optical Coating Lab., Inc., City of Industry, Calif Photoelectronics Div
SILICON SOLAR CELL PROCESS DEVELOPMENT, FABRICATION AND ANALYSIS Annual Report, 1 Jul. 1980 - 30 Jun. 1981
H I Yoo, P A Iles, and D C Leung 31 Jun 1981 100 p refs Sponsored in part by DOE
(Contract JPL-955089)
(NASA-CR-163787, DOE/JPL-955089-81/12, JPL-9950-597) Avail NTIS HC A05/MF A01 CSCL 10A

Solar cells were fabricated from EFG ribbons dendritic webs, cast ingots by heat exchanger method, and cast ingots by ubiquitous crystallization process Baseline and other process variations were applied to fabricate solar cells EFG ribbons grown in a carbon-containing gas atmosphere showed significant improvement in silicon quality Baseline solar cells from dendritic webs of various runs indicated that the quality of the webs under investigation was not as good as the conventional CZ silicon showing an average minority carrier diffusion length of about 60 um versus 120 um of CZ wafers Detail evaluation of large cast ingots by HEM showed ingot reproducibility problems from run to run and uniformity problems of sheet quality within an ingot Initial evaluation of the wafers prepared from the cast polycrystalline ingots by UCP suggested that the quality of the wafers from this process is considerably lower than the conventional CZ wafers Overall performance was relatively uniform except for a few cells which showed shunting problems caused by inclusions T M

N82-10501*# Wyle Labs., Inc., Huntsville, Ala
AN ANALYTICAL COMPARISON OF THE EFFICIENCY OF SOLAR THERMAL COLLECTOR ARRAYS WITH AND WITHOUT EXTERNAL MANIFOLDS Final Report
Sep 1981 30 p
(Contract DEN8-000006)
(NASA-CR-161852) Avail NTIS HC A03/MF A01 CSCL 10A

An analytical comparison of the efficiency of solar thermal collector arrays with and without external manifolds is reported A FORTRAN computer program was written for the computation of the thermal performance of solar thermal collector arrays with and without external manifolds Arrays constructed from two example solar thermal collectors are computated Typical external manifold sizes and thermal insulations are presented graphically and are compared with the thermal performance of the collector alone E A K

N82-10502*# Wyle Labs., Inc., Huntsville, Ala
PERFORMANCE EVALUATION OF THE SOLAR KINETICS T-700 LINE CONCENTRATING SOLAR COLLECTOR Final Report
Sep 1981 49 p
(Contract DEN8-000006)
(NASA-CR-161856) Avail. NTIS HC A03/MF A01 CSCL 10A

A performance evaluation of the solar kinetics T-700 line concentrating solar collector is reported Collector descriptions, summary, test conditions, test equipment, test requirements and procedures, and an analysis of the various tests performed are described E A K.

N82-10504*# Wyle Labs., Inc., Huntsville, Ala.
EVALUATION OF ALL-DAY-EFFICIENCY FOR SELECTED FLAT PLATE AND EVACUATED TUBE COLLECTORS Final Contractor Report
Sep 1981 158 p
(Contract DEN8-000006)
(NASA-CR-161866) Avail. NTIS HC A08/MF A01 CSCL 10A

An evaluation of all day efficiency for selected flat plate and evacuated tube collectors is presented Computations are based on a modified version of the NBSIR 78-1305A procedure for all day efficiency The ASHMET and NOAA data bases for solar insolation are discussed Details of the algorithm used to convert total (global) horizontal radiation to the collector tilt plane of the selected sites are given along with tables and graphs which show the results of the tests performed during this evaluation J M S

N82-10507# Harvard Univ., Cambridge, Mass
OPTIMIZATION OF TRANSPARENT ELECTRODE FOR SOLAR CELLS Technical Progress Report, 15 Dec. 1980 - 15 Jun. 1981
Roy G Gordon 1981 5 p Prepared for Midwest Research Inst., Golden, Colo
(Contract DE-AC02-77CH-00178)
(DE81-023359, SERI/PR-9318-1-T2) Avail NTIS HC A02/MF A01

Fluorine-doped tin oxide films prepared from highly purified tetramethyl tin (TMT) were compared with films prepared under identical conditions using less pure TMT No effects due to impurities were found The use of thermocouples to measure the temperature of glass surfaces is unsatisfactory The use of an infrared emission thermometer is recommended DOE

N82-10509# Boeing Co., Seattle, Wash
SOLAR PROJECT DESCRIPTION FOR PUBLIC SERVICE COMPANY OF NEW MEXICO (LOT 7) SINGLE FAMILY RESIDENCE, RIO RANCHO, NEW MEXICO
6 Aug 1981 58 p
(Contracts DE-AB01-76CS-31020, HUD-H-2372)
(DE81-027853, SOLAR/1084-81/50) Avail NTIS HC A04/MF A01

A solar space heating/domestic hot water system employing 150 square feet air flat plate collectors and 20,000 pounds of rock for storage is described The collector, storage, energy to load, and auxiliary heat subsystems and five modes of operation are described Auxiliary space heating is provided by an electric strip heater in the air ducts The hot water system consists of an 80 gallon solar preheating tank which supplies a 40 gallon conventional tank An electric heating element provides auxiliary heating in the preheat tank DOE

N82-10510# Boeing Co., Seattle, Wash
SOLAR PROJECT DESCRIPTION FOR COLORADO SUN-WORKS: SINGLE FAMILY
1981 74 p
(Contracts DE-AB01-76CS-31020, HUD-H-2372)
(DE81-028054, SOLAR/1051-81/50) Avail NTIS HC A04/MF A01

A passive solar energy system for both space heating and domestic hot water preheating is described The passive space heating system consists of a drum wall and direct gain system Heat losses are reduced by a Beadwall movable insulation The vertically stacked drums near the south wall form a drumwell chimney where heated air rises through ceiling vents above the drums into an open plenum area between the roof and the ceiling of the rooms Additional vents from this plenum on the north side of the house provide a path for the warm air into the room Earth berms on the north, east, and west sides of the house, a one foot covering of earth on the roof, and an entry vestibule are used Cooling is enhanced by night ventilation The hot water system consists of two 30 gallon tanks painted black and positioned next to the south wall Original cost estimates for provisioning and installation of the solar system are given DOE

N82-10511# Department of Housing and Urban Development, Washington, D C
SOLAR PROJECT DESCRIPTION FOR LIVING SYSTEMS SINGLE FAMILY RESIDENCE, DAVIS, CALIFORNIA
Oak Ridge, Tenn DOE 31 Aug 1981 75 p Prepared in cooperation with Boeing Co., Seattle
(Contract DE-AB01-76CS-31020)
(DE81-029743, SOLAR/1046-81/50) Avail NTIS HC A04/MF A01

Two independent systems are described - a direct gain passive solar space heating system and an active domestic hot water preheating system Large south-facing windows and a clerestory skylight permit direct winter Sun to enter the house Solar energy thermal storage is provided by both water filled tubes and the concrete slab floor Movable shutters and insulating curtains provide capability to reduce night heat losses Summer overheat protection is provided by roof overhangs and by natural ventilation The collector, storage, heating load, and auxiliary loads subsystems and modes of operation are described for both systems The house is instrumented for thermal performance evaluation Original cost estimates for provisioning and installation of the solar system are given DOE

N82-10512# Midwest Research Inst., Kansas City, Mo Solar Energy Research Inst
ENERGY END-USE REQUIREMENTS IN MANUFACTURING, VOLUME 1
Dilip R Limaye (Synergic Resources Corp.), Steven Isser (Synergic Resources Corp.), Roy Beatty (Synergic Resources Corp.), Glenn Colville (Synergic Resources Corp.), Karen Lang (Synergic Resources Corp.), and Frank Krawiec Jul 1981 233 p refs
(Contracts DE-AC02-77CH-00178, EG-77-C-01-4042)
(DE81-028975, SERI/TR-733-790R-Vol-1) Avail NTIS HC A11/MF A01

A review and evaluation of existing industrial energy data bases were undertaken to assess their potential for supporting SERI research to analyze technical and economic feasibility of solar technologies, and to establish multilayer R and D programs for solar thermal industrial electric power systems and solar IPH systems In the review of existing industrial energy data bases, the level of detail, disaggregation, and primary sources of information were examined The focus was on fuels and electric energy used for heat and power purchased by the manufacturing subsector and listed by 2-, 3-, and 4-digit SIC, primary fuel, and end use DOE

N82-10513# Sandia Labs., Albuquerque, N Mex
FREQUENCY RESPONSE ANALYSIS OF FLUID CONTROL SYSTEMS FOR PARABOLIC-TROUGH SOLAR COLLECTORS
R Schindwolf Jul 1981 29 p refs
(Contract DE-AC04-76DP-00789)
(DE81-029293, SAND-80-0385) Avail NTIS HC A03/MF A01

A linearized steady-state frequency response is derived for parabolic-trough collectors and for connecting piping that can be used in standard gain-phase analyses to evaluate system stability and closed-loop frequency response The frequency-response characteristics of a typical collector string and piping are used in a gain-phase analysis to get some insight into the effect on system stability of various system parameters such as controller gain, sensor and controller-time constants, and sensor location DOE

N82-10515# Science Applications, Inc., McLean, Va Electro-Optics Technology Div
TECHNICAL AND ECONOMIC ASSESSMENT OF SOLAR THERMOPHOTOVOLTAIC CONVERSION Final Report, Jul. 1981
W Koechner, H R Verdun, and N C Wyeth Jul 1981 190 p refs Sponsored by Electric Power Research Inst
(EPRI Proj 1415-1)
(DE81-803762, EPRI-AP-1940) Avail NTIS HC A09/MF A01

The solar thermophotovoltaic (STPV) conversion concept is aimed at large-scale electric utility applications After consideration of several options, a conceptual system arrangement was chosen an analyzed to provide calculations for STPV system configuration, size, performance, and cost Baseline designs were selected fo the optical and converter subsystems, and a detailed analysis of the performance of these subsystems was made using mathematical models an computer codes The various subsystems operating parameters were related to overall sytem performance and cost, and a minimum cost/power output point was found for the conceptual system DOE

N82-10516# Veda, Inc., Camarillo, Calif
ECONOMIC ANALYSIS OF THE UNIFIED HELIOSTAT ARRAY
7 Nov 1980 395 p refs
(Contract DE-AC03-80SF-10802)
(DE81-026698, DOE/SF-10802/T4, VEDA-43905-80U/P0069) Avail NTIS HC A17/MF A01

The array (UHA) is comprised of conventional two-axis heliostats mounted on a terraced south-facing wall of a single structure The arrangement of heliostats on the array is chosen to eliminate or control the degree of inter-heliostat shading and blocking The UHA was investigated as to cost and optical performance Two heliostats, the Veda Industrial Heliostat (VIH) and the Repowering Helistat were investigated in conjunction with the UHA The UHA is found to be a viable candidate for solar thermal central receiver applications The UHA-VIH combination was shown to provide very high flux densities and to be suitable for high temperature applications in the 1000 K to 2000 K range These temperatures were shown to be achieve even with very small (1 MWt) collector fields. DOE

N82-10519# Lincoln Lab., Mass Inst of Tech., Lexington
PERFORMANCE OF TERRESTRIAL PHOTOVOLTAIC MODULES AT MIT LINCOLN LABORATORY EXPERIMENTAL PHOTOVOLTAIC SYSTEMS
S E Forman 30 Apr 1981 19 p refs
(Contract DE-AC02-76ET-20279)
(DE81-029995, DOE/ET-20279/140) Avail NTIS HC A02/MF A01

Through a program of periodic surveillance, measurements and inspections, over 250 electrically failed modules were located, removed and analyzed during a four-year period The principal causes of failure were cells cracked due to weathering or internal module stresses, failed solder joints; interconnects not soldered to rear sides of cells at assembly, cells or interconnects electrically shorted to metallic substrates, and broken or split interconnects Details and photographs of many of the different typs of failures are presented In addition, some of the analysis techniques used to locate the failures are described DOE

N82-10521# Chicago Univ., Ill Enrico Fermi Inst
INTEGRATED FUNCTION NONIMAGING CONCENTRATING COLLECTOR TUBES FOR SOLAR THERMAL ENERGY Technical Progress Report
Roland Winston and Joseph J OGallagher 25 Aug 1981 21 p refs
(Contract DE-AC02-80ER-10558)
(DE81-029677, DOE/ER-10558/2) Avail NTIS HC A02/MF A01

A substantial improvement in optical efficiency over contemporary external reflector evacuated tube collectors was achieved by integrating the reflector surface into the outer glass envelope The design, fabrication and preliminary test results are described

for a prototype collector based on this concept Efficiencies above 40% up to nearly 300 C may be achieved DOE

N82-10534# Midwest Research Inst, Golden, Colo Solar Energy Research Inst
STANDARDS APPLICATION AND DEVELOPMENT PLAN FOR SOLAR THERMAL TECHNOLOGIES
H R W Cobb Jul 1981 218 p refs
(Contracts DE-AC02-77CH-00178, EG-77-C-01-4042)
(DE81-030310, SERI/TR-742-885) Avail NTIS HC A10/MF A01

Functional and standards matrices, developed from input from ST users and from the industry that will be continually reviewed and updated as commercial aspects develop are presented The matrices highlight codes, standards, test methods, functions and definitions that need to be developed They will be submitted through ANSI for development by national consensus bodies. A contingency action is proposed for standards development if specific input is lacking at the committee level or if early development of a standard would hasten commercialization or gain needed jurisdictional acceptance T M

N82-10537# Los Alamos Scientific Lab, N Mex
STATE OF THE ART IN PASSIVE SOLAR HEATING
J Douglas Balcomb 1981 4 p Presented at the Passive and Hybrid Solar Energy Program Update Meeting, Washington, D C, 9-12 Aug 1981
(Contract W-7405-eng-36)
(LA-UR-81-2185, CONF-810832-1) Avail NTIS HC A02/MF A01

The state of the art is outlined according to four major categories passive, solar practice, evaluation, design, and products and materials Needed future research activities and point industry/government activities are listed DOE

N82-10538# Los Alamos Scientific Lab, N Mex
LOS ALAMOS NATIONAL LABORATORY PASSIVE SOLAR PROGRAM
Donald A Neeper 1981 12 p refs Presented at the Passive and Hybrid Solar Energy Program Update Meeting, Washington, D C, 9-12 Aug 1981
(Contract W-7405-eng-36)
(DE81-028778, LA-UR-81-2162, CONF-810832-2) Avail NTIS HC A02/MF A01

Progress in passive solar tasks performed for FY-81 is documented Twenty-eight configurations of sunspaces were studied using the solar load ratio method of predicting performance, the configuration showing best performance is discussed The minimum level of insulation needed to generate convective flow in the thermosphon test rig is noted and measured Information is also included on test room performance, off speak auxiliary electric heating for a passive home, free convection experiment, monitored building, and technical support to the US Department of Energy DOE

N82-10539# Midwest Research Inst, Kansas City, Mo Solar Energy Research Inst
INVESTIGATION OF PHOTOVOLTAIC MECHANISMS IN POLYCRYSTALLINE THIN-FILM SOLAR CELLS Quarterly Report, 1 Aug. - 31 Oct. 1980
T A Temofonte 3 Apr 1981 18 p refs
(Contract DE-AC02-77CH-00178)
(DE81-027272, SERI/PR-9233-1-T1, QR-1) Avail NTIS HC A02/MF A01

Initial efforts focused on exploring the role of atomic hydrogen on silicon surfaces The atomic hydrogen was generated using an inductively coupled plasma Comparisons using Auger sputter profiling were made of hydrogenated silicon surfaces, deliberately oxidized silicon surfaces and silicon surfaces having a native oxide The auger spectrum of a hydrogenated silicon surface is initially qualitatively similar to that for an oxidized surface Distinct differences emerge as a function of sputtering depth, ziv, the ratio of free silicon to bonded silicon decreases first before finally decreasing This implies a significantly different surface composition for hydrogenated silicon compared to oxidized silicon DOE

N82-10541# Sandia Labs, Albuquerque, N Mex
SOLAR ENERGY SYSTEM DESIGN: A SIMPLE METHOD FOR SIZING THE COLLECTOR FIELD AND THERMAL STORAGE
Ralph R Peters Jul 1981 81 p refs
(Contract DE-AC04-76DP-00789)
(DE81-028852, SAND-81-1541) Avail NTIS HC A05/MF A01

The Zero Marginal Cost (ZMC) technique to enable quick, accurate designs of parabolic trough solar energy systems was developed The ZMC technique is discussed and it is shown that systems designed with this technique compare quite favorably with those designed using expensive computer codes DOE

N82-10542# SRI International Corp, Menlo Park, Calif
CONCEPTUAL DESIGN OF A GLASS-REINFORCED CONCRETE SOLAR COLLECTOR
Arthur J Slemmons, Dale W Ploeger, and Ron Lundgren (Sandia Labs, Albuquerque, N Mex) Jul 1981 51 p refs
(Contract DE-AC04-76DP-00789)
(DE81-029280, SAND-81-7011) Avail NTIS HC A04/MF A01

An investigation of the properties and characteristics of glassfiber-reinforced concrete (GRC) was made to determine its suitability as a reflector substrate and structure for heliostats and solar collectors The material properties and characteristics of GRC were established by tests on small flat panels A conceptual design of a 2-m x 6-m parabolic trough solar collector module and a preliminary production-cost analysis were also completed DOE

N82-10543# Boeing Computer Services, Inc, Seattle, Wash
INTERMEDIATE PHOTOVOLTAIC-SYSTEM APPLICATION EXPERIMENT OPERATIONAL PERFORMANCE REPORT. VOLUME 1: FOR LOVINGTON SQUARE SHOPPING CENTER SITE, LOVINGTON, NEW MEXICO
Jul 1981 18 p Prepared for Sandia Labs, Albuquerque, N Mex
(Contract DE-AC04-76DP-00789)
(DE81-028971, SAND-81-7085/1) Avail NTIS HC A02/MF A01

A 100 kwp photovoltaic flat panel system is planned for application in a shopping center to assess problems associated with utility tie-in and to provide utility experience with a photovoltaic system The project is briefly outlined, and the participants are listed Relevant weather data and reference operating conditions are given and four operational modes are described System specifications are given and the solar array, control, protection, and data acquisition and instrumentation subsystems are described DOE

N82-10547# Mid-American Solar Energy Complex, Minneapolis, Minn
SUMMARY OF PASSIVE-SOLAR-RETROFIT WORKSHOPS
Jun 1981 12 p
(Contract DE-AC02-79CS-30150)
(DE81-028146, MASEC-CF-81-028) Avail NTIS HC A02/MF A01

Efforts are described to provide training in the latest passive solar retrofit techniques to a wide sector of residential design and construction professionals Three 20-hour passive solar single-family retrofit workshops were attended by 116 residential construction-related participants Each of the three workshops is described. The workshop topics and workbook were evaluated by 65 participants, and suggestions were made for improvement DOE

N82-10558# Lincoln Lab, Mass Inst of Tech, Lexington
TESTING AND EVALUATION OF A SOLAR PHOTOVOLTAIC FLYWHEEL ENERGY STORAGE SYSTEM
Philip O Jarvinen, Bronwyn L Prench, R Duncan Hay, and Neil F Rasmussen (American Power Conversion, Burlington, Mass) 1981 6 p Presented at the IECEC Conf, Atlanta, 9-14 Aug 1981
(Contract DE-AC02-76ET-20279)
(DOE/ET-20279/130, CONF-810812-4) Avail NTIS HC A02/MF A01

Measurements made on a 1/10 scale, magnetically levitated, residential solar photovoltaic (PV) flywheel energy storage system which acts as a complete interface between a solar PV array and an ac load are reported The overall in/out electrical storage efficiency of the flywheel unit was measured along with the power transfer efficiencies of individual components and the system spin down tar losses An overall storage efficiency of 82 percent was measured for the flywheel storage system when operated in a utility interactive mode DOE

N82-10563# Midwest Research Inst., Golden, Colo Solar Energy Research Inst

APPLICATION OF SOLAR THERMAL ENERGY TO BUILDINGS AND INDUSTRY

Charles F Kutscher May 1981 32 p refs Presented at the Energy and the Man-Built Environment Conf., Vail, Colo., 3-5 Aug 1981, sponsored by Am Soc of Civil Eng

(Contract DE-AC02-77CH-00178)

(SERI/TP-641-1222, CONF-810808-6) Avail NTIS HC A03/MF A01

Flat plate collectors and evacuated tube collectors are described, as are parabolic troughs, Fesnel lenses, and compound parabolic concentrators Use of solar energy for domestic hot water and for space heating and cooling are discussed Some useful references and methods of system design and sizing are given This includes mention of the importance of economic analysis The suitability of solar energy for industrial use is discussed, and solar ponds, point-focus receivers and central receivers are briefly described The use of solar energy for process hot water, drying and dehydration, and process steam was examined, industrial process heat field tests by the Department of Energy are discussed, and a solar total energy system in Shenandoah, GA is briefly described. DOE

N82-10568# Institute of Gas Technology, Chicago, Ill

ELECTROCHEMICAL PHOTOVOLTAIC CELLS Quarterly Technical Progress Report, 1 Nov. 1980 - 31 Jan. 1981

Peter G P Ang, Anthony J Tiller, Anthony A Rossignuolo, and Anthony F Sammells Apr 1981 24 p ref Sponsored in cooperation with Midwest Research Inst

(Contract EG-77-C-01-4042)

(DE81-769704, SERI/PR-9175-1-T3) Avail NTIS HC A02/MF A01

The photoelectrochemical properties of p-Si, p-InP, p-MoS2, and n-CdSe semiconductors are presented A number of redox storage systems are discussed Characteristics of single crystal systems and of surface treatments are investigated Long term testing was performed with polycrystalline CdSe and with p-InP single crystal in electrochemical cells The quality and long term stability of various electrodes, electrolytes, and separator materials are studied DOE

N82-10569# Pennsylvania State Univ., University Park Materials Research Lab

CONTROLLED CADMIUM TELLURIDE THIN FILMS FOR SOLAR-CELL APPLICATIONS Quarterly Report, 1 Dec. 1980 - 1 Feb. 1981

M B Das and S W Krishnaswamy 15 May 1981 14 p refs

(Contract DE-AC02-77CH-00178)

(DE81-023275, SERI/PR-9131-1-T3, QR-3) Avail NTIS HC A02/MF A01

Indium doped CdTe films cadmium vacancies occur which cause the presence of deep level acceptor states in the material are discussed By sputtering at a cadmium overpressure it was possible to compensate for these vacancies and improve the device quality Extensive temperature dependent measurements of dark and illuminated I/V characteristics of gold metalized Schottky barrier diodes based on these improved and reproducible films were made Characteristics showing I/sub sc/ and V/sub oc/ at different temperatures and different illumination level are presented DOE

N82-10570# Sandia Labs., Albuquerque, N Mex Photovoltaic Projects Div

SOLAR PHOTOVOLTAIC SYSTEM ENGINEERING PERSPECTIVES

Gary J Jones 1981 7 p refs Presented at the Energy in Man-Built Environ The Next Decade Spec Conf., Vail, Colo., 3 Aug 1981

(Contract DE-AC04-76DP-00789)

(DE81-023179, SAND-81-1164C, CONF-810808-7) Avail NTIS HC A02/MF A01

The activities of the national photovoltaic program which aid the photovoltaic system background information are presented and major issues are highlighted DOE

N82-10571# Messerschmitt-Boelkow-Blohm G m b H., Ottobrunn (West Germany) Space Div

TECHNOLOGICAL ACTIVITIES FOR HIGH PERFORMANCE RECEIVERS Final Report

Guenther Schmidt, Erich Kirner, and Helmut Zewen Bonn Bundesministerium fuer Forschung und Technologie Dec 1980 86 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-80-133, MBB-UR-39979-79, ISSN-0340-7608) Avail NTIS HC A05/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 18,05

Preliminary studies were carried out on the optimization of the energy transfer efficiency from the incident solar radiation into the heat transfer medium of solar thermal plants by designing high performance receivers The transfer efficiency has a direct impact on the overall plant efficiency and the size of the cost effective collector field Two main lines were followed, closed Rankine cycles with organic heat transfer media at temperatures between 350 and 400 C, and gas turbine cycles at temperatures from 800 to 900 C A test receiver cooled by organic media was built and its thermal and mechanical resistance as well as the behavior of different heat transfer media with respect to thermal efficiency and stability were analyzed Industrial application appears feasible Author (ESA)

N82-10577# Department of Agriculture, Washington, D C

THE YOUNG SOLAR COLLECTOR: AN EVALUATION OF ITS MULTIPLE FARM USES

Walter G Heid, Jr May 1981 21 p ref

(PB81-214132, AER-466) Avail NTIS HC A02/MF A01 CSCL 13A

The features of the Young collector and reports on its physical and economic performance were studied The collector is portable and tiltable, with a flexible airflow system It is found that it satisfactorily dries grain, provides home heating, and saves energy The homemade, low cost Young flat plate solar collector for multiple uses on the farm was designed by a farm couple and the small farm energy project GRA

N82-10863# Sandia Labs., Albuquerque, N Mex Photometrics and Optical Development Div

AUTOMATED FRESNEL LENS TESTER SYSTEM

Gary S Phipps Jul 1981 71 p

(Contract DE-AC04-76DP-00789)

(DE81-029483, SAND-81-1187) Avail NTIS HC A04/MF A01

An automated data collection system controlled by a desktop computer for testing Fresnel concentrators (lenses) intended for solar energy applications was developed The system maps the two dimensional irradiance pattern formed in a plane parallel to the lens, whereas the lens and detector assembly track the Sun A point detector silicon diode measures the irradiance at each point of an operator defined rectilinear grid of data positions Comparison with a second detector measuring solar insolation levels results in solar concentration ratios over the image plane. Summation of image plane energies allows calculation of lens efficiencies for various solar cell sizes DOE

N82-10952# Argonne National Lab., Ill

SOLAR DATA BASE MANAGEMENT SYSTEM

I Singh (Mohawk Coll., Hamilton, Ont.), R M Wolosewicz, H Singh, and P S Chopra 1980 8 p refs Presented at the ASME Century 2 Emerging Technol Conf., San Francisco, 12-15 Aug 1980

(Contract W-31-109-eng-38)

(DE81-023122, CONF-800804-40) Avail NTIS HC A02/MF A01

The data base management system established to handle the reliability and materials assessment data generated by over 100 solar heating and cooling systems was assessed The planning, the design, and some of the software used to handle data processing and reduction requirements are described DOE

N82-11209*# Jet Propulsion Lab., California Inst of Tech., Pasadena

FRACTURE MECHANICS OF CELLULAR GLASS

J G Zwissler and M A Adams 1 Feb 1981 53 p refs

(Contracts NAS7-100, DE-AI01-81ET-20307)

(NASA-CR-164959, JPL-Pub-81-16) Avail NTIS HC A04/MF A01 CSCL 11A

The fracture mechanics of cellular glasses (for the structural substrate of mirrored glass for solr concentrator reflecting panels) are discussed Commercial and developmental cellular glasses were tested and analyzed using standard testing techniques and

models developed from linear fracture mechanics Two models describing the fracture behavior of these materials were developed Slow crack growth behavior in cellular glass was found to be more complex than that encountered in dense glasses or ceramics The crack velocity was found to be strongly dependent upon water vapor transport to the tip of the moving crack The existence of a static fatigue limit was not conclusively established, however, it is speculated that slow crack growth behavior in Region 1 may be slower, by orders of magnitude, than that found in dense glasses BW

N82-11247# California Univ, Livermore Lawrence Livermore Lab
SOLAR COAL-GASIFICATION REACTOR FOR HYDROCARBON-FREE SYNTHESIS GAS
W R Aiman Jun 1981 10 p Presented at the STTF Users Assoc Ann Meeting, Pasadena, Calif, 23 Apr 1981
(Contract W-7405-eng-48)
(DE81-026600, UCRL-86260, CONF-810469-3) Avail NTIS HC A02/MF A01

The products from a coal gasification process are discussed In synthesis gas production, the end product is a high Btu gas composed of methane and higher hydrocarbons Furthermore, the liquid hydrocarbons can be even more valuable as feedstocks for other processes In other applications such as methanol production, the hydrocarbon content of the synthesis gas is a non-reactive diluent that must be bled away from the product synthesis area to keep its concentration from building up In addition to the above benefits, this reactor requires substantially less steam in the coal gasification process The reactor is able to produce hydrocarbon-free synthesis gas because it withdraws the pyrolysis gases from the reactor as they are formed and reinjects them above the char gasification zone where they are steam reformed into CO, CO2, and H2 Since almost all of the hydrocarbons released in coal gasification come off with the pyrolysis gases, the reactor will produce nearly hydrocarbon-free gas DOE

N82-11316# Mid-American Solar Energy Complex, Bloomington, Minn
MASEC SOLAR 80 HOME DESIGNS
1980 19 p
(DE81-028344, MASEC-PA-80-007) Avail NTIS HC A02/MF A01

Plans of passive solar homes designed by ten teams from various sections of the mid-American region are presented The energy efficient designs use up to 80% less fossil fuel energy for heating than those built to conventional construction standards Energy conserving and passive design techniques are discussed The design features of the ten (RidgeWay, ClaireMont, SolarWay, KirkWood, SunSource, ParkLand, CedarWood, SunRise, SunCrest, and WaterFord) homes are presented DOE

N82-11325# Booz-Allen and Hamilton, Inc, Bethesda, Md Energy and Environment Div
USER NEEDS FOR SOLAR DECISION-MAKING TOOLS: THE HOMEBUILDING INDUSTRY Final Report
Min Kantrowitz John Kurtz, and Kimball Hart 1981 131 p refs Prepared in cooperation with Midwest Research Inst, Golden, Colo
(Contracts DE-AC02-77CH-00178, EG-77-C-01-4042)
(DE81-027293, SERI/TR-98252-1b) Avail NTIS HC A07/MF A01

The need for decision tools and design tools to be used by decision makers considering using solar energy in the single-family residential construction sector was studied Three builder groups were found based upon decision making patterns relative to innovation and a five-step decision process Eleven existing design tools were reviewed against identified user needs The principal conclusions are that decision tools are largely lacking and design tools do not easily fit user needs Recommendations for further study are made DOE

N82-11407# Science Applications, Inc, McLean, Va Solar Technology Div
PARAMETRIC SENSITIVITY STUDY FOR SOLAR-ASSISTED HEAT-PUMP SYSTEMS Final Report
N M White and J H Morehouse Jul 1981 110 p refs Prepared for Midwest Research Inst, Golden, Colo
(Contracts DE-AC02-77CH-0017, EG-77-C-01-4042)
(DE81-030309, SERI/TR-98288-1) Avail NTIS HC A06/MF A01

The engineering and economic parameters affecting life-cycle costs for solar-assisted heat pump systems are investigted The change in energy usage resulting from each engineering parameter varied was developed from computer simulations, and is compared with results from a stand-alone heat pump system Three geographical locations are considered Washington, DC, Fort Worth, TX, and Madison, WI Results indicate that most engineering changes to the systems studied do not provide significant energy savings The most promising parameters to ary are the solar collector parameters tau (-) and U/sub L/ the heat pump capacity at design point, and the minimum utilizable evaporator temperature Costs associated with each change are estimated, and life-cycle costs computed for both engineering parameters and economic variations in interest rate, discount rate, tax credits, fuel unit costs and fuel inflation rates Results indicate that none of the feasibile engineering changes for the system configuration studied will make these systems economically competitive with the stand-alone heat pump without a considerable tax credit DOE

N82-11413# Brookhaven National Lab, Upton, N Y Dept of Energy and Environment
DOE SOLAR-ASSISTED HEAT-PUMP PROGRAM: ITS EVOLUTION AND ITS POTENTIAL
J W Andrews 1981 5 p refs Presented at the Active Solar Contractors' Rev Meeting, Washington, D C Sep 1981
(Contract DE-AC02-76CH-00016)
(DE81-026055, BNL-29677, CONF-810912-10) Avail NTIS HC A02/MF A01

Progress in the solar assisted heat pump program is described in terms of the progressive modification of original assumptions on the basis of accumulating experience The ways in which these modifications led to enhanced system potential are explained A major impetus for progress is the assimilation and reconciliation of divergent systems analysis results Technical accomplishments in the program are described, and needed future activities are listed DOE

N82-11544*# Teledyne Brown Engineering, Huntsville, Ala Engineering Services Div
INVESTIGATION OF DIRECT SOLAR-TO-MICROWAVE ENERGY CONVERSION TECHNIQUES Final Report
N E Chatterton, T K Mookherji, and P K Wunsch Jan 1978 107 p refs
(Contract NAS8-32643)
(NASA-CR-161883, ESD-78-MSFC-2174) Avail NTIS HC A06/MF A01 CSCL 10A

Identification of alternative methods of producing microwave energy from solar radiation for purposes of directing power to the Earth from space is investigated Specifically, methods of conversion of optical radiation into microwave radiation by the most direct means are investigated Approaches based on demonstrated device functioning and basic phenomenologies are developed There is no system concept developed, that is competitive with current baseline concepts The most direct methods of conversion appear to require an initial step of production of coherent laser radiation Other methods generally require production of electron streams for use in solid-state or cavity-oscillator systems Further development is suggested to be worthwhile for suggested devices and on concepts utilizing a free-electron stream for the intraspace station power transport mechanism SL

N82-11548*# Jet Propulsion Lab, California Inst of Tech, Pasadena
THE EFFECTS OF IMPURITIES ON THE PERFORMANCE OF SILICON SOLAR CELLS
K A Yamakawa 1 Sep 1981 75 p refs
(Contracts NAS7-100, EX-76-A-29-1012, DE-AI01-76ET-20356)
(NASA-CR-164945, JPL-Pub-81-76, DOE/JPL-1012-57) Avail NTIS HC A04/MF A01 CSCL 10A

The major factors that determine the tolerable concentrations of impurities in silicon feedstock for solar cells used in power generation are discussed in this report It is concluded that a solar-grade silicon can be defined only for a specific manufacturing process It is also concluded that it is the electrical effects, efficiency and resistivity, that are dominant in determining tolerable

concentrations of impurities in the silicon feedstock Crystal growth effects may become important when faster growth rates and larger crystal diameters are developed and used Author

N82-11549*# Jet Propulsion Lab, California Inst of Tech, Pasadena

IRRIGATION MARKET FOR SOLAR THERMAL PARABOLIC DISH SYSTEMS

Hamid Habib-agahi and Sue Campbell Jones 1 Sep 1981 40 p refs

(Contracts NAS7-100, DE-AT04-81AL-16228)

(NASA-CR-164955, JPL-Pub-81-85, DOE/JPL-1060-49) Avail NTIS HC A03/MF A01 CSCL 10A

The potential size of the onfarm-pumped irrigation market for solar thermal parabolic dish systems in seven high-insolation states is estimated The study is restricted to the displacement of three specific fuels gasoline, diesel and natural gas The model was developed to estimate the optimal number of parabolic dish modules per farm based on the minimum cost mix of conventional and solar thermal energy required to meet irrigation needs The study concludes that the potential market size for onfarm-pumped irrigation applications ranges from 101,000 modules when a 14 percent real discount rate is assumed to 220,000 modules when the real discount rate drops to 8 percent Arizona, Kansas, Nebrasks, New Mexico and Texas account for 98 percent of the total demand for this application, with the natural gas replacement market accounting for the largest segment (71 percent) of the total market Author

N82-11550*# Jet Propulsion Lab, California Inst of Tech, Pasadena

SECONDARY AND COMPOUND CONCENTRATORS FOR PARABOLIC DISH SOLAR THERMAL POWER SYSTEMS

L D Jaffe and P T Poon 15 Apr 1981 47 p refs Sponsored in part by DOE

(Contract NAS7-100)

(NASA-CR-164960, JPL-Pub-81-27, DOE/JPL-1060-43) Avail NTIS HC A03/MF A01 CSCL 10A

A secondary optical element may be added to a parabolic dish solar concentrator to increase the geometric concentration ratio attainable at a given intercept factor This secondary may be a Fresnel lens or a mirror, such as a compound elliptic concentrator or a hyperbolic trumpet At a fixed intecept factor, higher overall geometric concentration may be obtainable with a long focal length primary and a suitable secondary matched to it Use of a secondary to increase the geometric concentration ratio is more likely to e worthwhile if the receiver temperature is high and if errors in the primary are large Folding the optical path with a secondary may reduce cost by locating the receiver and power conversion equipment closer to the ground and by eliminating the heavy structure needed to support this equipment at the primary focus Promising folded-path configurations inclue the Ritchey-Chretien and perhaps some three element geometries Folding the optical path may be most useful in systems that provide process heat Author

N82-11551*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

SOLAR CELL DEVELOPMENT FOR THE POWER EXTENSION PACKAGE

Cosmo R Baraona and James L Cioni (NASA, Johnson Space Center) 1981 8 p refs Presented at the 16th Intersoc Energy Conversion Conf, Atlanta, 9-14 Aug 1981

(NASA-TM-82685, E-922) Avail NTIS HC A02/MF A01 CSCL 10A

The PEP is a 32 kilowatt flexible substrate, retrievable, solar array system for use on the Space Shuttle Solar cell costs will be reduced by increasing cell area and simplifying cell and coverglass fabrication processes and specifications The cost goal is to produce cells below $30 per watt Two and ten ohm-cm silicon cells were investigated In phase I of the cell development program a few thousand candidate cells will be produced and evaluated for utility and quality In phase II a large number of cells will be fabricated to verify production readiness and cell yields and costs This schedule is compatible with PEP initial operational capability in 1984 Approximately 140,000 large area (5 9 x 5 9 cm) cells will be required for two PEP solar arrays The status of the cell development and testing, including a radiation damage test and side-by-side comparison of candidate cell types with pre- and post-irradiation airplane calibration of outer space short-circuit current, is reported . T M

N82-11554# Arkansas Univ, Fayetteville

MISSISSIPPI COUNTY COMMUNITY COLLEGE SOLAR PHOTOVOLTAIC PROJECT Final Report

F K Deaver, M M Johnson, Tom Pugh, Ray Snowden, W D Turner, J D Wall, J G Williams, and J R Yeargan Nov 1980 256 p refs

(Contract DE-FG05-77CS-20347, Grant EG-77-G-05-5565)

(DE81-030669, DOE/ET-20347/T1) Avail NTIS HC A12/MF A01

A weather station was maintained from April 1978 to April 1980 Daily totals of direct normal and global insolation are given, and an hour-by-hour printout of direct normal, global, and diffuse solar radiation for the entire two year period is included A number of studies were conducted, including daylighting, energy conservation and management, design tradeoffs, and landscaping The collector selection process included the writing of specifications, providing design data, reviewing the various collector designs, inspecting potential vendor facilities, monitoring on-site tests, and the final selection A simulation was made of the entire system, including both an electrical and thermal simulation of the photovoltaic array and a thermal simulation of the various buildings Example printouts of the simulations are included DOE

N82-11557# RCA Labs, Princeton, N J

AMORPHOUS BORON-SILICON-HYDROGEN ALLOYS FOR THIN-FILM HETEROJUNCTION SOLAR CELLS Quarterly Technical Progress Report, 1 Sep. - 30 Nov. 1980

A R Moore, D E Carlson, and R W Smith May 1981 18 p refs

(Contract DE-AC02-77CH-00178)

(DE81-027234, SERI/PR-0-9010-2, QTPR-2) Avail NTIS HC A02/MF A01

The conductivity of a-B Si H films increases with substrates temperature and annealing temperature for temperatures up to 5000 C (highest investigated) However, increasing the conductivity causes the optical gap to decrease Preliminary results on a-B Si H/a-Si H heterojunction devices are not encouraging as interface states appear to limit the conversion efficiency to approx 1 5% DOE

N82-11558# RCA Labs, Princeton, N J

AMORPHOUS BORON-SILICON-HYDROGEN ALLOYS FOR THIN-FILM HETEROJUNCTION SOLAR CELLS Quarterly Technical Progress Report, 1 Dec. 1980 - 28 Feb. 1981

A R Moore, D E Carlson, and R W Smith Jun 1981 18 p refs Prepared for Midwest Research Inst, Golden, Colo

(Contract DE-AC02-77CH-00178)

(DE81-027254, SERI/PR-0-9010-3, QTPR-3) Avail NTIS HC A02/MF A01

Amorphous boron-silicon-hydrogn (a-B Si H) alloys were used to make heterojunction contacts to hydrogenated amorphous silicon (a-Si H) films The performance of a-B Si H/a-Si H heterojunction cells are limited mainly by a large density of interface states Another p-type, wide bandgap material, microcrystalline silicon-carbon-hydrogen (M-Si C H) was investigated Three techniques are explored for production of m-Si C H films glow discharge deposition, thermal annealing of a-Si C H films, and laser annealing of a-Si C H films DOE

N82-11560# Automation Industries, Inc, Silver Spring, Md Vitro Labs Div

SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: FOREST CITY DILLON, WASHINGTON, D.C., JANUARY 1980 - DECEMBER 1980

D W Missal 1980 82 p refs

(Contract DE-AC02-79CS-30027)

(DE81-028174, SOLAR/1041-81/14) Avail NTIS HC A05/MF A01

An active solar energy system consisting of single glazed flat plate collectors, 3200 gallons of storage liquid, and an auxiliary oil fired boiler, was designed to supply 59% of the hot water demand for a high rise apartment building The annual solar fraction predicted by the f chart simulation was 37%, and the solar fraction measured was 32% Other measures of performance, including solar system coefficient of performance, are given The performance of the collector, storage, and domestic hot water subsystems is discussed DOE

N82-11561# Automation Industries, Inc, Silver Spring, Md Vitro Labs Div

SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: MONTECITO PINES, SANTA ROSA, CALIFORNIA, NOVEMBER 1979 - APRIL 1980
E N Ashman 1980 80 p refs
(Contract DE-AC01-79CS-30027)
(DE81-028175, SOLAR/1045-80/14) Avail NTIS HC A05/MF A01

An active solar energy system consisting of 950 square feet of flat plate collectos, gas fired auxiliary boilers, and 2000 gallons of storage was designed The solar fractions actually achieved were 11% for heating and 44% for hot water Measures of performance are given, including, solar savings ratio, conventional fuel savings, system performance factor, and solar system coefficient of performance The performance of the collector, storage, space heating and domestic hot water subsystems are discussed DOE

N82-11564# McDonnell-Douglas Corp , Huntington Beach, Calif
SECOND GENERATION HELIOSTAT, VOLUME 1 Final Report
D A Steinmeyer Apr 1981 428 p Prepared for Sandia Labs , Livermore, Calif 2 Vol
(Contract DE-AC04-76DP-00789)
(DE81-029618, SAND-81-8177-Vol-1) Avail NTIS HC A19/MF A01

The heliostat subsystem design is described The test program is summarized, including component testing, subsystem operation and the shipment and installation The production heliostat description, the manufacturing process definitions, and the manufacturing facility definition are summarized The installation, operations, and maintenance requirements for the 50 MWe field are reviewed Future development activities aimed at further cost reduction are discussed DOE

N82-11566# Sandia Labs , Livermore, Calif
STUDY OF PHOTOVOLTAIC COST ELEMENTS. VOLUME 1: EXECUTIVE REPORT. VOLUME 2: PROJECT BACKGROUND Final Report
James B Ayers Jul 1981 269 p Prepared in cooperation with Barry (Theodore) and Associates, Los Angeles 5 Vol
(Contract DE-AC04-76DP-00789)
(DE81-030982, SAND-81-7014-Vol-1, SAND-81-7014-Vol-2) Avail NTIS HC A12/MF A01

Two models used for estimating installation costs for residential and intermediate photovoltaic energy systems are summarized The modeling rationale is reviewed, and the results obtained when the models were applied to 10 residential and 10 intermediate PV systems are listed Output reports for each of the test cases are appended DOE

N82-11567# Sandia Labs , Livermore, Calif
STUDY OF PHOTOVOLTAIC COST ELEMENTS. VOLUME 3: SANDIA NATIONAL LABORATORIES PHOTOVOLTAIC SYSTEMS DESIGN CATALOG Final Report
James B Ayers Jul 1981 207 p Prepared in cooperation with Barry (Theodore) and Associates, Los Angeles
(Contract DE-AC04-76DP-00789)
(DE81-030986, SAND-81-7014-Vol-3) Avail NTIS HC A10/MF A01

Basic system data sheets, which include project title and location, prime contractor, PV system general description, and energy storage capacity, are shown for 29 intermediate PV systems and 19 residential PV systems In addition, cost data and output reports generated by TB and A's PV installation cost models are included for 10 intermediate systems and 10 residential systems DOE

N82-11568# Sandia Labs , Livermore, Calif
STUDY OF PHOTOVOLTAIC COST ELEMENTS. VOLUME 4: INSTALLATION COST MODEL FOR RESIDENTIAL PV SYSTEMS: USERS MANUAL Final Report
James B Ayers Jul 1981 89 p Prepared in cooperation with Barry (Theodore) and Associates, Los Angeles 5 Vol
(Contract DE-AC04-76DP-00789)
(DE81-031921, SAND-81-7014-Vol-4) Avail NTIS HC A05/MF A01

A quantitative methodology is presented for estimating installation costs of residential photovoltaic systems The installation cost model for residential PV systems is comprised of 144 estimating equations selectively exercised, based on user definition of the system At the input stage, residential PV systems can be fully described by 9 design option categories and 9 system specification categories All assumptions were validated with installers of solar thermal systems A discussion of the model is included as well as an example of its use with an 8 KW PV system for a Southwest all-electric residential design DOE

N82-11569# Sandia Labs , Livermore, Calif
STUDY OF PHOTOVOLTAIC COST ELEMENTS. VOLUME 5: INSTALLATION COST MODEL FOR INTERMEDIATE PV SYSTEMS: USERS MANUAL Final Report
James B Ayers Jul 1981 137 p Prepared in cooperation with Barry (Theodore) and Associates, Los Angeles 5 Vol
(Contract DE-AC04-76DP-00789)
(DE81-030981, SAND-81-7014-Vol-5) Avail NTIS HC A07/MF A01

A cost modeling methodology is presented for estimating installation costs associated with intermediate photovoltaic (PV) systems With only a parametric description of an intermediate power system, the model can be used to develop an installation cost estimate for that system The model is based on conventional cost-estimating procedures widely used by the construction industry and was validated by comparing estimates for the same 10 systems made independently by a cost engineering firm A description of the model is included as well as an example of its use with a 200 KW solar breeder plant design to be located in Rockville, Maryland DOE

N82-11575# Brookhaven National Lab , Upton, N Y
IMPURITY EFFECTS IN a-Si:H SOLAR CELLS
A E Delahoy and R W Griffith 1981 10 p refs Presented at 15th IEEE Photovoltaic Specialists Conf , Orlando, Fla , 12-15 May 1981
(Contract DE-AC02-76CH-00016)
(DE81-025069, BNL-29668, CONF-810526-38) Avail NTIS HC A02/MF A01

The deleterious effects on device performance of phosphine and monochlorosilane are discussed Solar cells fabricated using plasma deposited a-Si H alloys can be degraded by the incorporation of certain impurities during deposition of the a-Si H materials Nominally intrinsic layers are adversely affected by the addition to the plasma of air, N2 + O2 mixtures, PH3 or SiH3Cl (monochlorosilane) Modification of the a-Si H gap state density owing to synergistic effects of oxygen and nitrogen in the plasma leads to a collapse of the space charge region and the reduction of the micro tau product for holes DOE

N82-11576# Sandia Labs , Livermore, Calif
DESIGN, COST AND PERFORMANCE COMPARISONS OF SEVERAL SOLAR THERMAL SYSTEMS FOR PROCESS HEAT. VOLUME 1: EXECUTIVE SUMMARY
Patrick J Eicker, Ernest D Eason, Joe D Hankins, Larry D Hostetler, Joseph J Iannucci, and James B Woodward Mar 1981 24 p refs
(Contract DE-AC04-76DP-00789)
(DE81-029881, SAND-79-8279-Vol-1) Avail NTIS HC A02/MF A01

Conceptual designs of central receiver, parabolic dish, and parabolic trough systems for several process heat applications were analyzed Cost and performance estimates are made for each of these designs and used to calculate levelized delivered process heat costs This indicated that central receiver systems will provide energy costs competitive with that afforded by the parabolic trough and parabolic dish systems over the range of demand sizes and temperatures studies DOE

N82-11577# Delaware Univ , Newark Inst of Energy Conversion
Zn3P2 AS AN IMPROVED SEMICONDUCTOR FOR PHOTOVOLTAIC SOLAR CELLS Quarterly Report, 1 Dec. 1980 - 28 Feb. 1981
1981 49 p refs Prepared of Midwest Research Inst
(DE81-025587, SERI/PR-8062-1-T12, QR-10) Avail NTIS HC A03/MF A01

Zinc oxide zinc solar cells heterojunction devices were studied to establish the origin of the low open circuit voltage Activation energy determination from JO vs T-measurements, dark current voltage characteristics, and diffusion volage determination by high frequency capacitance voltage measurements are investigated development oriented Zn3P2 crystals is reported The optical absorption and photoluminescence spectra of Mg3P2 was

measured, and the diffusion by coefficient of magnesium in Zn3P2 was measured at 750C and 1500C by spectral response method Diffusion of aluminum is also measured The diffusion voltage of p/n junction devices to improving the fill factor is reported DOE

N82-11583# Brookhaven National Lab, Upton, N Y Dept of Energy and Environment
SOLAR HEAT PUMP SIMULATOR
M A Catan 1981 5 p refs Presented at the Active Solar Contractors' Rev Meeting, Washington, D C, Sep 1981
(Contract DE-AC02-76CH-00016)
(DE81-024368, BNL-29678, CONF-810912-3) Avail NTIS HC A02/MF A01

A simulator was utilized to provide controlled-temperature sources and sinks to an experimental water-to-water laboratory heat pump test bed This combination was used to demonstrate and explore the potential of the vapor-compression cycle to deliver high COP's at SAHP source temperatures Results from the simulator were used in computer simulations of complete systems performed by BNL, by the SAHP contractors, and by others A two-speed compressor was first tested at high source temperatures on the BNL simulator In view of the decision by both contractors to construct water-to-air (rather than water-to-water) heat pumps, the BNL simulator was fitted with an air-side test loop The prototype heat pump was tested under steady-state conditions on the BNL simulator DOE

N82-11584# Brookhaven National Lab, Upton, N Y Dept of Energy and Environment
LOW-COST SOLAR FLAT-PLATE-COLLECTOR DEVELOPMENT
W G Wilhelm 1981 5 p Presented at the Active solar Contractors' Rev Meeting, Washington, D C, Sep 1981
(Contract DE-AC02-76CH-00016)
(DE81-025081, BNL-29680, CONF-810912-4) Avail NTIS HC A02/MF A01

Cost goals were developed for the collector which led to the rejection of conventional approaches and to the exploration of thin film technology A thin film solar absorber suited for high speed continous-roll manufacture at low cost was designed The absorber comprises two sheets of aluminum-foil/polymeric-material laminate bonded together at intervals to form channels with water as the heat transfer fluid Several flat-plate panels were fabricated and tested DOE

N82-11593# California Univ, Berkeley Lawrence Berkeley Lab Energy and Environment Div
CONTROLS FOR SOLAR HEATING AND COOLING
M Warren, Steven Schiller, and Michael Wahlig Jun 1981 4 p refs Presented at the Active Solar Contractors' Rev Meeting, Washington, D C, Sep 1981
(Contract W-7405-eng-48)
(DE81-025209, LBL-12751, CONF-810912-8) Avail NTIS HC A02/MF A01

Solar heating system operation with two different operating strategies were run direct collector to load heating and storage coupled heating No significant improvement in system performance was found for the direct heating strategy Simulation analysis of the interaction of the solar heating system with the building load and thermostat was completed It is indicated that using a conventional room thermostat, large temperature swings can be expected when the storage tank is charged to a high temperature DOE

N82-11599# Los Alamos Scientific Lab, N Mex
TEST RESULTS AND ANALYSIS OF A CONVECTIVE LOOP SOLAR AIR COLLECTOR
Franz A Biehl 1981 6 p refs Presented at the 6th Natl Passive Solar Conf, Portland, Oreg, 8-12 Sep 1981
(Contract W-7405-eng-36)
(DE81-028151, LA-UR-81-2252, CONF-810925-3) Avail NTIS HC A02/MF A01

The purpose of the test program is to validate simulation model that can also be extended to other collector arrangements and to a variety of weather patterns Details of the collector configurations, typical test results, simulation model, and comparison between test and analysis results are discussed The good agreement between test and analysis suggests that the analytical model can be employed for sensitivity studies. A range of desirable collector lengths, based upon efficiency considerations, was determined employing the analytical model DOE

N82-11600# Los Alamos Scientific Lab, N Mex
LONG-TERM PERFORMANCE OF THE HUNN PASSIVE SOLAR RESIDENCE
B D Hunn 1981 6 p refs Presented at 6th Natl Passive Conf, Portland, Oreg, 8-12 Sep 1981
(Contract W-7405-eng-36)
(DE81-028735, LA-UR-81-2251, CONF-810925-6) Avail NTIS HC A02/MF A01

Detailed performance and annual energy consumption data are reported, as well as occupant observations and conclusions, for three heating seasons in the Hunn hybrid passive/active solar residenced located in Los Alamos, New Mexico The performance data were gathered by the Los Alamos National Laboratory and include hourly storage wall and interior temperature data for a midwinter period, an interior air-temperature histogram, and measured auxiliary energy consumption and solar heating fraction for each heating season Also, energy and cost savings over the three-year period are estimated DOE

N82-11602# Los Alamos Scientific Lab, N Mex
HEAT STORAGE DURATION
J Douglas Balcomb 1981 6 p refs Presented at 6th Natl Passive Conf, Portland, Oreg, 8 Sep 1981
(Contract W-7405-eng-36)
(DE81-026635, LA-UR-81-2186, CONF-810925-4) Avail NTIS HC A02/MF A01

Both the amount and duration of heat storage in massive elements of a passive building are investigated Data taken or one full winter in a solar home are analzyed with the aid of subsystem simulation models Heat storage duration is tallied into day intervals Heat storage location is discussed and related to overall energy flows DOE

N82-11606# Midwest Research Inst, Golden, Colo Solar Energy Research Inst
USE OF SOLAR THERMAL ENERGY TO GENERATE ELECTRICITY
L M Murphy Jul 1981 22 p refs Presented at Energy in the Man-built Environ The Next Decade Specialty Conf, Vail, Colo, 3-5 Aug 1981, sponsored by ASME
(Contracts DE-AC02-77CH-00178, EG-77-C-01-4042)
(DE81-028797, SERI/TP-632-1287, CONF-810808-9) Avail NTIS HC A02/MF A01

Solar thermal electric technology is reviewed Technical approaches which result in net solar to electric conversion efficiencies ranging from less than 1 percent to more than 20 percent are discussed The status of the various solar thermal electric concepts and the principal areas of research for each respective concept are reslted Cost issues and prospects for the economic competitiveness of solar thermal electric systems with conventional systems are outlined DOE

N82-11609# Midwest Research Inst, Golden, Colo Solar Energy Research Inst
NATIONAL PHOTOVOLTAIC PROGRAM IN AMORPHOUS MATERIALS
Jack Stone, Ed Sabisky, Harry Mahan, Tom McMahon, and Frank Jeffrey May 1981 6 p refs Presented at the 15th Photovoltaic Specialists Conf, Orlando, Fla 12-15 May 1981
(Contracts DE-AC02-77CH-00178, EG-77-CH-01-4042)
(DE81-025906, SERI/TP-614-1216) Avail NTIS HC A02/MF A01

The development of high efficiency (10% goal), cost effective (15-40 cents per peak watt goal), thin film solar cells is investigated The status of this program, other research activities, and expected near term performance improvements are summarized DOE

N82-11615# Old North Mfg Co, Inc, Lenoir, N C
SOL-CYCLE: A SOLAR-ASSISTED SOLVENT-RECYCLING PROCESS FOR ASPHALT-IMPREGNATION OF FIBER BOARD
Ben E Edwards 1 Apr 1981 12 p
(DE81-903377, NCEI-0031) Avail NTIS HC A02/MF A01

To conserve resources and energy in the production of Flex-Joint, an asphalt-impregnated fiber board, a manufacturing

process was developed The Sol-Cycle process provides for (1) recycle of the solvent used in the saturation step, (2) conversion of raw to finished board in 24 hours, (3) better control of the saturation step, and (4) the use of solar energy for a part of the driving force to accomplish (1) and (2) DOE

N82-11617# Sandia Labs, Albuquerque, N Mex
PERFORMANCE TESTING OF THE TOLTEC TI-410 CONCENTRATING SOLAR COLLECTOR
V E Dudley (Edgerton, Germeshausen and Grier, Inc) and R M Workhoven Jul 1981 55 p refs
(Contract DE-AC04-76DP-00789)
(DE81-029994, SAND-81-0369) Avail NTIS HC A04/MF A01

Results of tests conducted on the collector are summarized Collector efficiency, thermal loss, and receiver differential pressure were measured at fluid temperatures from 20 C to 200 C The collector was evaluated with a glass mirror and with an acrylic/polyester film reflector surface Four different receiver designs were tested DOE

N82-11622# Lincoln Lab, Mass Inst of Tech, Lexington
CARLISLE HOUSE: AN ALL-SOLAR ELECTRIC RESIDENCE
Burt E Nichols and Steven J Strong (Solar Design Associates, Lincoln, Mass) 1981 4 p Presented at the 15th IEEE Photovoltaic Specialist Conf, Orlando, Fla, 11-15 May 1981 Sponsored by DOE
(DOE/ET-20279/133, CONF-810526-16) Avail NTIS HC A02/MF A01

A solar photovoltaic array on the roof produces electricity, passive solar features provide much of the space heating, thermal collectors provide domestic hot water, and energy conservation measures reduce electrical and thermal energy requirements to a minimum The overall performance of the system was reviewed TM

N82-11623# Georgia Inst of Tech, Atlanta School of Social Sciences
AN ASSESSMENT OF SELECTED SOLAR ENERGY INDUSTRY ACTIVITIES
J David Roessner Nov 1980 129 p refs
(PB81-222424, NSF/PRA-80-SP-1187) Avail NTIS HC A07/MF A01 CSCL 05C

The past, present, and near-term conditions of four industries based on solar energy technologies are examined-solar heating, photovoltaics, concentrating solar collectors for process heat and electric power applications, and passive components such as skylights and greenhouses The report identifies key, unresolved issues for government policies intended to influence future solar industrial development, assesses the past and current federal role in these industries, and draws tentative conclusions about how government policies have affected their evolution This evolution is compared to the evolution of typical, innovation-based industries For each of the four solar industries researched, the collected data are discussed as follows characteristics of sales, the government role, investment strategies and R & D activities, near-term trends, and comparisons with other industries GRA

N82-11625# Rensselaer Polytechnic Inst, Troy, N Y Dept of Mechanical Engineering, Aeronautical Engineering and Mechanics
THE ROGERS FOCUSING HELIOSTAT EXPERIMENTAL PROGRAM AT RENSSELAER POLYTECHNIC INSTITUTE
W E Rogers, D N Borton, and M P Rice Dec 1980 39 p Sponsored by New York State Energy Research and Development Authority
(PB81-226813, Rept-80-24, NYSERDA-80-24) Avail NTIS HC A03/MF A01 CSCL 10A

A research effort to develop a solar collector package designed specifically with the needs and solar resources of the Northeast in mind is described The heliostat is a concentrating solar collector which is 30 feet high, 34 feet wide and has 864 square feet of mirror concentrator Electric controls move the structure so it tracks the path of the Sun as it rises and sets and moves across the sky When the Sun is not shinning, the mirrors turn down, shielding them from the dirt, ice and snow However, when it rains the mirrors turn up for cleaning, helping to keep them in peak operating condition The heliostat's design incorporates a concentrating capability which takes the diffuse energy of the Sun and focuses it, creating temperatures of more than 3,600 F and producing enough steam as a result to displace 70 kW of electricity at peak operation The unit tested in this demonstration was used for space heating, and domestic hot water as well as to fire an absorption air conditioner GRA

N82-12279# *Aerospace Corp, El Segundo, Calif Energy and* Resources Div
SOLAR HEATING AND COOLING OF BUILDINGS (SHACOB): REQUIREMENTS DEFINITION AND IMPACT ANALYSIS-2. VOLUME 2: DOMESTIC HOT WATER SYSTEMS
C K Cretcher Nov 1980 121 p refs Sponsored by Electric Power Research Inst
(EPRI Proj 553-2)
(DE82-900207, EPRI-EM-1506-Vol-2) Avail NTIS HC A06/MF A01

The various types of solar domestic hot water systems are discussed including their advantages and disadvantages The problems that occur in hydronic solar heating systems are reviewed with emphasis on domestic hot water applicatons System problems in retrofitting of residential buildings are also discussed including structural and space constraints for various components and subsystems System design parameters include various collector sizing methods, collector orientation, storage capacity and heat loss from pipes and tanks The installation costs are broken down by components and subsystems The approach used for utility economic impact analysis is reviewed The simulation is described, and the results of the economic impact analysis are given A summary assessment is included DOE

N82-12280# Aerospace Corp, El Segundo, Calif Energy and Resources Div
SOLAR HEATING AND COOLING OF BUILDINGS (SHACOB): REQUIREMENTS DEFINITION AND IMPACT ANALYSIS-2. VOLUME 3: CUSTOMER LOAD MANAGEMENT SYSTEMS
C K Cretcher and R C Rountredd Nov 1980 87 p refs Sponsored by Electric Power Research Inst
(EPRI Proj 553-2)
(DE82-900208, EPRI-EM-1506-Vol-3) Avail NTIS HC A05/MF A01

Customer Load Management Systems, using off-peak storage and control at the residences, are analyzed to determine their potential for capacity and energy savings by the electric utility Areas broadly representative of utilities in the regions around Washington, DC and Albuquerque, NM were of interest Near optimum tank volumes were determined for both service areas, and charging duration/off-time were identified as having the greatest influence on tank performance The impacts on utility operations and corresponding utility/customer economics were determined in terms of delta demands used to estimate the utilities' generating capacity differences between the conventional load management, (CLM) direct solar with load management (DSLM), and electric resistive systems Energy differences are also determined These capacity and energy deltas are translated into changes in utility costs due to penetration of the CLM or DSLM systems into electric resistive markets in the snapshot years of 1990 and 2000 DOE

N82-12540*# Boeing Aerospace Co, Seattle, Wash
SPS LARGE ARRAY SIMULATION
S Rathjen, B R Sperber, and Ervin J Nalos *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and *Reception 1980 p 14-23*

Avail NTIS HC A99/MF A01 CSCL 10A

The computer programming efforts were directed primarily to beam pattern analysis The computer programs used for simulation provide verification of the reference design, definition of feasible departures such as quantized distributions, the study of far-out sidelobe roll-off characteristics, the analysis of errors and failures, illumination function analysis to develop beam patterns for efficient collection, and beam shaping synthesis to meet environmental constraints TM

N82-12544*# LinCom Corp, Pasadena, Calif
PERFORMANCE ANALYSIS AND SIMULATION OF THE SPS

REFERENCE PHASE CONTROL SYSTEM
W C. Lindsey and C M Chie *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 58-74 refs

(Contract NAS9-15782)
Avail NTIS HC A99/MF A01 CSCL 10A

Key results pertinent to the SPS reference phase control system design are summarized These results are a consequence of extensive system engineering tradeoffs provided via mathematical modeling, optimization, analysis and the development/utilization of a computer simulation tool called SOLARSIM T M

N82-12545*# Lockheed Engineering and Management Services Co , Inc , Houston, Tex
DESIGN AND BREADBOARD EVALUATION OF THE SPS REFERENCE PHASE CONTROL SYSTEM CONCEPT
P M Hopkins and V R Rao *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 75-84
(Contract NAS9-15800)
Avail NTIS HC A99/MF A01 CSCL 10A

Efficient operation of a very large phased array such as the proposed solar power satellite, requires precision focusing and pointing of the power beam, i e , the power beam must have a planar wavefront directed precisely at the center of the target antenna (rectenna) To maintain such a power beam requires real-time phase compensation at each subaperture in order to adjust for structural deformations and other transitory factors In the current solar power satellite (SPS) baseline, the spaceborne antenna (Spacetenna) is an active retrodirective array A pilot signal transmitted from the center of the rectenna is phase-conjugated at each subaperture (power module) of the spacetenna, thereby assuring that the radiated composite wave is focused on the target This scheme requires a large amount of precision electronic circuitry on the spacetenna Specifically, pilot receivers must be located at each power module and an adaptive distribution network is required in order to provide a properly phased reference signal at each conjugator T M.

N82-12578# Mazria (Edward) and Associates, Albuquerque, N Mex
PASSIVE SOLAR TECHNICAL PLANNING STUDY Final Report
Edward Mazria and M S. Baker Oct 1980 120 p refs
(EPRI-EM-1591, EPRI-TPS-79-750) Avail NTIS HC A06/MF A01

The most promising passive solar techniques in buildings and their potential impact on electric utilities are examined The differences between passive design and good energy conservation practices and the correlation between the passive solar contribution relative to reducing the building load from normal design practices are addressed The potential for passive solar systems to alter residential load profiles, especially to reduce peaks for back-up energy needs is discussed Computer code analysis techniques and capabilities required to simulate passive designs are presented S L

N82-12598# Arizona Univ , Tucson Solar Energy Research Facility
GUIDEBOOK FOR SOLAR PROCESS-HEAT APPLICATIONS
Rocco Fazzolare, George Mignon, Leonel Campoy, and Francisco Luttmann Jan 1981 169 p refs
(DE81-027977, DOE/TIC-1027977) Avail NTIS HC A08/MF A01

The potential for solar process heat in Arizona and some of the general technical aspects of solar, such as insolation, siting, and process analysis are explored Major aspects of a solar plant design are presented Collectors, storage, and heat exchange are discussed Reducing hardware costs to annual dollar benefits is also discussed Rate of return, cash flow, and payback are discussed as they relate to solar systems Design analysis procedures are presented The design cost optimization techniques using a yearly computer simulation of a solar process operation is demonstrated DOE

N82-12599# International Energy Agency, Paris (France)
OPTIMIZATION OF SOLAR HEATING AND COOLING SYSTEMS
T L. Freeman (Atlas Corp , Santa Cruz, Calif) Jun 1981 56 p refs
(NP-1903997) Avail NTIS (US Sales Only) HC A04/MF A01, DOE Depository Libraries

A review of general techniques and specific methods useful in the optimization of solar heating and cooling systems is undertaken A discussion of the state of the art and the principal problems in both the simplified thermal performance analysis and economic analysis portions of the optimization problem are presented Sample economic analyses are performed using several widely used economic criteria The predicted thermal results of one typical, widely used simplified method is compared to detailed simulation results A methodology for and the results of a sensitivity study of key economic parameters in the life cycle cost method are presented Finally, a simple graphical optimization technique based on the life cycle cost method is proposed DOE

N82-12600# Brookhaven National Lab , Upton, N Y Technology and Data Div
COMPARATIVE ECONOMIC PERFORMANCE OF SELECTED PASSIVE SOLAR HEATING AND COOLING TECHNOLOGIES
W Rutter May 1981 24 p refs
(Contract DE-AC02-76CH-00016)
(DE81-030220, BNL-51394) Avail. NTIS HC A02/MF A01

The economic performance of selected passive solar heating and cooling technologies which incorporate energy storage is assessed by using a set of uniform assumptions and methodologies Where data are available, a given system is assessed at more than one geographical location Results are obtained in the form of both payback period and net present value for residential applications, and in terms of net present value only for industrial/commercial uses Results indicate that ventilated trombe walls, solar roof ponds, and certain night effect/floor storage strategies are cost effective, but night effect/rock bed cooling is not Results also show that, although direct gain out-performs trombe walls in most parts of the country, both direct gain and trombe walls usually produce a net savings in the residential sector Generally, nowever, tax regulations result in net economic loss for direct gain and trombe walls used to heat industrial and commercial buildings DOE

N82-12601# Sandia Labs , Albuquerque, N Mex Thermal Sciences Div
COMPARATIVE ECONOMICS OF SOLAR THERMAL CENTRAL RECEIVERS
Miriam J Fish Aug 1981 56 p refs
(Contract DE-AC04-76DP-00789)
(DE81-029623, SAND-81-8236) Avail. NTIS HC A04/MF A01

For both electrical and industrial process heat (IPH) generation, central receivers compare favorably with oil and gas, and in many cases, coal Calculational results are presented in which the levelized energy costs from central receiver plants are compared with those from oil, gas, and coal fired plants. Both electrical and IPH applications are discussed Uncertainties in future capital costs, fuel price escalation rates, and the underlying economic climate are included in the analysis DOE

N82-12602# Boeing Computer Services, Inc., Seattle, Wash
INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION EXPERIMENT OPERATIONAL PERFORMANCE: EXECUTIVE SUMMARY. VOLUME 1: FOR NEWMAN POWER STATION, EL PASO, TEXAS
Aug 1981 9 p
(Contract DE-AC04-76DP-00789)
(DE81-031934, SAND-81-7100-Vol-1, MR-14) Avail NTIS HC A02/MF A01

The data given for a 20 kWp photovoltaic flat panel power system for an uninterruptable power supply load includes total electrical energy produced during the month of June 1981, and for each day of the month, total incident solar energy in the plane of the collector during the month and for each day of the month, and array efficiency The monthly average direct normal insolation during the month during daylight hours is also reported T.M.

N82-12608# Motorola, Inc , Phoenix, Ariz
PHOTOVOLTAIC MECHANISMS IN POLYCRYSTALLINE

THIN FILM SILICON SOLAR CELLS Quarterly Technical Progress Report, 1 Feb. - 30 Apr. 1981
Bhushan Sopori 29 Aug 1981 43 p refs
(Contract DE-AC02-77CH-00178)
(DE81-030370, DOE/SERI-9234/3, QTPR-3) Avail NTIS HC A03/MF A01

Efforts are described in developing a technique for rapid identification of isolated line dislocations and dislocation networks in RTR ribbons This was accomplished by extending the technique of Cu decoration to determine defect propagation in polycrystalline substrates The basic characteristics of (100) textured surfaces are described, followed by a ray optics approach towards the analysis of textured surfaces with and without AR coatings The technique of optimization is demonstrated for a standard cell and an ultraviolet cell DOE

N82-12609# Massachusetts Inst of Tech , Cambridge
PHOTOVOLTAIC MARKET ANALYSIS PROGRAM: BACKGROUND, MODEL DEVELOPMENT, APPLICATIONS AND EXTENSIONS
Gary L Lilien and Frank H Fuller Apr 1981 158 p refs
(Contract DE-AM01-76EI-02295)
(DE81-029711, MIT-EL-81-012) Avail NTIS HC A08/MF A01

Tools and procedures to help guide government spending decisions associated with stimulating photovoltaic market penetration were developed The program has three main components (1) theoretical analysis aimed at understanding qualitatively what general types of policies are likely to be most cost effective in stimulating PV market penetration; (2) operational model developent (PV1), providing a user oriented tool to study quantitatively the relative effectiveness of specific government spending options and (3) field measurements, aimed at providing objective estimates of the parameters used in the diffusion model used in PV1 Existing models of solar technology diffusion are reviewed and the structure of the PV1 model is described Theoretical results on optimal strategies for spending federal market development and subsidy funds are reviewed The validity of these results is checked by comparing them with PV1 projections of penetration and cost forecasts for 15 government policy strategies which are simulated on the PV1 model DOE

N82-12610# Massachusetts Inst of Tech , Cambridge
COST GOALS FOR A RESIDENTIAL PHOTOVOLTAIC/THERMAL LIQUID COLLECTOR SYSTEM SET IN THREE NORTHERN LOCATIONS
Thomas L Dinwoodie and John P Kavanaugh Oct 1980 61 p refs
(Contract DE-AC02-76ET-20279)
(DE81-029700, MIT-EL-80-028) Avail NTIS HC A04/MF A01

The allowable costs for a residential PV/T liquid collector system are compared with those of both PV only and side-by-side PV and thermal collector systems Four typs of conventional energy systems provide backup all oil, all gas, all electric resistance, and electric resistance hot water with space heating by parallel heat pump Electric space cooling is modeled, and the electric utility serves as backup for all electrical needs The analysis is separated into two parts (1) a base case study using conservative market and financial parameters for comparing PV/T economics in three northern locations, and (2) the sensitivity of PV/T economics to pertinent physical, market, and financial variables is examined The difference in economic outlook for PV/T in retrofit applications is also estimated It is indicated that, it for northern locations modeled, is less than that of separate (side-by-side) collector systems, at total array areas between 40-80 sq m Below this range, allowable costs diverge, benefiting optimally sized separate collector systems DOE

N82-12611# Midwest Research Inst , Perth (Australia) Solar Energy Research Inst
STATUS OF SOLAR ENERGY RESEARCH AND DEVELOPMENT IN AUSTRALIA
Susan G Saunders May 1981 28 p refs Presented at the Solar Systems Develop Assoc , Tokyo, 27 May 1981
(NP-1903916, Rept-1007) Avail NTIS HC A03/MF A01

The solar energy research and development program in Australia is described Programs with promise of widespread application researched are (1) solar industrial process heat, (2) solar air conditioning, (3) solar electricity production, and (4) biomass fuels DOE

N82-12612# Mid-American Solar Energy Complex, Minneapolis, Minn
SOLAR ENERGY INFORMATION DATA BANK (SEIDB) PROGRAM, FY 1981 Final Project Report
Jun 1981 24 p
(Contract DE-AC02-79CS-30150)
(DE81-030054, MASEC/R-81-074) Avail NTIS HC A02/MF A01

The background, program objectives, technical highlights, FY 81 program activity, and recommendations for the SEIDB are reviewed DOE

N82-12615# Midwest Research Inst , Golden, Colo Solar Energy Research Inst
NEAR-TERM IMPROVEMENTS IN PARABOLIC TROUGHS: AN ECONOMIC AND PERFORMANCE ASSESSMENT
R Gee and L M Murphy Aug 1981 54 p refs
(Contract DE-AC02-77CH-00178)
(DE82-001158, SERI/TR-632-870) Avail NTIS HC A04/MF A01

Improved parabolic trough concentrating collectors which result from better design, improved fabrication techniques, and the development and utilization of improved materials are analyzed The improvements considered are evacuated receivers, silvered glass reflectors, improved receiver, selective coatings, higher optical accuracy concentrations, and higher transmittance receiver glazings Upper bound costs for each improvement are provided as well as estimates of the increased solar system rates of return that are made possible by these improvements It is shown that the performance and economic potential of these improvements are substantial, especially at higher collector operating temperatures DOE

N82-12616# Sandia Labs , Albuquerque, N Mex Theoretical Div
USER'S GUIDE TO HELIOS: A COMPUTER PROGRAM FOR MODELING THE OPTICAL BEHAVIOR OF REFLECTING SOLAR CONCENTRATORS PART 1: INTRODUCTION AND CODE INPUT
C N Vittitoe and Frank Biggs Aug 1981 64 p refs
(Contract DE-AC04-76DP-00789)
(DE81-031920 SAND-81-1180-Pt-1) Avail NTIS HC A04/MF A01

HELIOS is a flexible computer code for evaluating designs for central receiver, parabolic dish, and other reflecting solar energy collector systems, for safety calculations on the threat to personnel and to the facility itself, for determination of how various input parameters alter the power collected, for design trade offs, and for heliostat evaluations Input variables include atmospheric transmission effects, reflector shape and surface errors suntracking errors focusing and alignment strategies, receiver design, placement positions of the tower and mirrors, and time of day and day of the year for the calculation Complete input instructions and a description of the code structure are given DOE

N82-12618# Sandia Labs , Livermore, Calif Thermal Sciences Div
SOLAR THERMAL CENTRAL RECEIVERS FOR INDUSTRIAL PROCESS HEAT GENERATION: USER VIEWS AND RECOMMENDATIONS FOR COMMERCIALIZATION
M J Fish Aug 1981 66 p refs
(Contract DE-AC04-76DP-00789)
(DE81-029611, SAND-81-8235) Avail NTIS HC A04/MF A01

Results of recent meetings with several private industrial groups in which solar thermal central receivers were discussed in depth as a potential for industrial process heat generation are summarized Topics covering potential economics, technical requirements, and actions to promote commercialization of the technology are presented These findings are then translated into recommendations for commercialization in private industrial markets Key points include the need for small scale systems integration projects in addition to the 10 MW/sub e/ plant under construction at Barstow, CA, and the adoption of financial incentives, such as tax credits, for getting the early commercial plants built DOE

N82-12623# Midwest Research Inst , Golden, Colo
FLEXIBILITIES IN PASSIVE DESIGN: EXAMINING SOME LIMITING SOLAR MYTHS

R G Derickson and K S Sadlon Jul 1981 5 p refs Presented at 6th Natl Passive Conf, Portland, Oreg, 8 Sep 1981
(Contract DE-AC02-77CH-00178)
(DE81-028401, SERI/TP-721-1342, CONF-810925-15) Avail NTIS HC A02/MF A01

Frequently cited rules-of-thumb or general guidelines that needlessly limit designer choice and freedom are examined It is found that a rectangular design with an E-W elongation is not really essential to proper passive design, east and west windows do not necessarily detract from passive heating performance or negatively impact cooling efficiency, and a passive house need not be crammed with thermal mass Some flexible design alternatives are explored and factors other than E-W elongation, windows, and thermal mass are considered DOE

N82-12624# Westinghouse Electric Corp, East Pittsburgh, Pa Advanced Systems Technology Div
ECONOMIC ASSESSMENT OF ADVANCED CENTRAL-RECEIVER SOLAR-THERMAL POWER SYSTEMS: EXECUTIVE SUMMARY
Oct 1980 23 p refs
(Contract DE-AC03-79SF-10601)
(DOE/SF-10601/0) Avail NTIS HC A02/MF A01

The value and potential electric utility impact of several advanced central receiver solar thermal plant concepts in the role of electric generating stations were estimated Economics, the cost of producing electricity, fuels displaced, and utility system reliability are examined The central receiver plants evaluated included solar/fossil hybrid concepts and solar stand-alone plants with thermal storage It is indicated that if the cost goals are achieved and projected solar plant performance attained, the advanced solar thermal concepts can be competitive in regions with good insolation and some continued use of oil or other surrogate distillate or gaseous fuels DOE

N82-12625# Oak Ridge National Lab, Tenn Energy Div
SEASONAL PERFORMANCE FACTORS FOR ACTIVE SOLAR SYSTEMS AND HEAT-PUMP SYSTEMS
R L Reid and L A Abbatiello 1981 7 p refs Presented at the IECEC Conf, Atlanta, 9 Aug 1981
(Contract W-7405-eng-26)
(DE81-028569, CONF-810812-35) Avail NTIS HC A02/MF A01

Methods of evaluating solar systems are discussed and compared Heating seasonal performance factor (SPFH) and annual coefficient of performance (ACOP) are selected as being of the most vaue to the consumer in determining his purchased energy requirements and also allow the direct comparison of solar and heat pump systems A search of the literature produced seasonal or annual data from 20 solar and 12 heat pump systems that were instrumented well enough to measure the loads and energy consumptions necessary to calculate the SPFH and/or ACOP Tables of these results show that well-designed solar systems have SPFHs of 1 6 to 2 8 compared to heat pump SPFHs of 1 6 to 2 0 However, the heat pump Annual Cycle Energy System ACOP was measured as 3 1 compared to a projected maximum ACOP for a solar system with heat pump cooling of 2 4 to 2 8 DOE

N82-12626# Midwest Research Inst, Golden, Colo Solar Energy Research Inst
PERFORMANCE ANALYSIS OF 11 DENVER METRO PASSIVE HOMES
D E Claridge Jul 1981 7 p refs Presented at the AS/ISES 6th Natl Passive Solar Conf, Portland, Oreg, 8-12 Sep 1981
(Contracts DE-AC02-77CH-00178, EG-77-C-01-4042)
(DE81-025473, SERI/TP-721-1325, CONF-810925-12) Avail NTIS HC A02/MF A01

The auxiliary heating requirements for 11 passive solar homes were calculated using SLR or SUNCAT-2 4 with a standard set of basic assumptions It is shown that seven of the homes should use less than half as much heating fuel as typical houses, two should use about half, and two should use about two-thirds or more These results are compared with performance estimates and show large discrepancies Differences are attributed largely to specific differences in assumptions in every case but one DOE

N82-12627# Midwest Research Inst, Golden, Colo Solar Energy Research Inst
SUMMERTIME RESULTS FROM THE CLASS B PASSIVE-SOLAR PERFORMANCE-MONITORING PROGRAM
J Swisher Jul 1981 3 p Presented at the 6th Natl Passive Solar Conf, Portland, Oreg, 8-12 Sep 1981
(Contracts DE-AC02-77CH-00178, EG-77-C-01-4042)
(DE81-025471, SERI/TP-721-1317, CONF-810925-8) Avail NTIS HC A02/MF A01

The program is designed to provide, at relatively low cost, accurate and consistent real-time estimates of building thermal performance, as well as detailed data regarding climate, indoor temperatures, and purchased energy needs As part of this program, a microprocessor-based data acquisition system was installed in each of ten passive solar houses in the Denver area, primarily to evaluate heating-season performance During the summer, however, the monitoring systems are used to study the overheating tendencies of the buildings Examination of the conditions that lead to overheating, using graphical and statistical techniques, will provide insight into the solar design practices that provide the most comfortable summer environment DOE

N82-12628# Midwest Research Inst, Golden, Colo Solar Energy Research Inst
SOLAR EXPLOSION
B C Baccei Apr 1981 5 p Presented at the 6th Natl Passive Solar Conf, Portland, Oreg, 8-12 Sep 1981
(Contracts DE-AC02-77CH-00178, EG-77-C-01-4042)
(DE81-026086, SERI/TP-721-1167R, CONF-810925-13) Avail NTIS HC A02/MF A01

The Solar Energy Research Institute (SERI) and the Department of Energy (DOE) Passive Solar Manufactured Buildings and Solar Home Builders Programs are developing much needed cost and performance data on solar buildings produced by large-volume home builders These programs also serve as a model on how government can work effectively with industry DOE

N82-12629# Los Alamos Scientific Lab, N Mex
PASSIVE-SOLAR-RETROFIT STUDY FOR THE UNITED STATES NAVY
William O Wray and Charles R Miles (Naval Civil Engineering Lab) 1981 6 p refs Presented at the 6th Natl Passive Solar Conf, Portland, Oreg, 8-12 Sep 1981
(Contract W-7405-eng-36)
(DE81-028921, LA-UR-81-2200, CONF-810925-7) Avail NTIS HC A02/MF A01

A passive solar retrofit study was conducted to determine the energy savings obtainable in concrete block buildings from several passive solar heating strategies Test cell data and computer simulation were employed to assess the merits of six retrofit options The six strategies selected were chosen on the basis of providing a series of options that deliver increasing energy savings at the cost of correspondingly increased levels of commitment DOE

N82-12630# Los Alamos Scientific Lab, N Mex
ECONOMIC IMPLICATIONS OF PASSIVE-SOLAR RETROFIT FOR SINGLE-FAMILY RESIDENCES IN ALBUQUERQUE, NEW MEXICO: A CASE STUDY
S W Martin (Public Service Company of New Mexico, Albuquerque) Jun 1981 125 p refs
(Contract W-7405-eng-36)
(DE81-028402, LA-8892-T) Avail NTIS HC A06/MF A01

Certain economic criteria are used to evaluate the potential of retrofitted passive solar systems Actual system and labor costs along with calculated Input-Output income and employment multipliers are used to estimate changes in income and employment levels within the study area Estimates of changing energy use patterns also are presented The methodology presented can be expanded to include other technologies and can be used to examine other potential scenarios DOE

N82-12632# Sandia Labs, Albuquerque, N Mex Div of Solar Technology
DEPARTMENT OF ENERGY SOLAR CENTRAL RECEIVER SEMIANNUAL MEETING
Jan 1981 273 p refs Meeting held in San Francisco, 15-16 Oct, 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-8049, CONF-8010129) Avail NTIS HC A12/MF A01

The goals and current status of the solar thermal program were reviewed The organization of the program is discussed, as

is funding for fiscal year 1981 Technical progress and future prospects are discussed T M

N82-12640# Nationale Raad voor Landbouwkundig Onderzoek TNO, The Hague (Netherlands)
BASIS FOR RESEARCH PROPOSALS CONCERNING (INDUSTRIAL) SOLAR ENERGY PRODUCTION PROCESSES DERIVED FROM BIOLOGICAL PRINCIPLES [BASIS VOOR ONDERZOEKVOORSTELLEN BETREFFENDE (INDUSTRIEELE) ZONNE-ENERGIEWINNINGSPROCESSEN AFGELEID VAN BIOLOGISCHE PRINCIPES]
1980 96 p refs In DUTCH
Avail NTIS HC A05/MF A01

The economic feasibility of photochemical conversion systems for solar energy production processes derived from biological principles was studied A global energy analysis shows that the period during which a solar energy installation has to deliver energy in order to regain the energy required for the construction is about one-seventh or one-eighth of its lifetime (10 times longer than conventional installations) Energy production with the help of photocatalytic systems in western Europe is only economical if the net conversion efficiency is substantially increased above 15% Complex photocatalytic processes or combined photoelectric, photochemical and thermal mechanisms may be applied, i e , coproduction, combining a photovoltaic or photocatalytic process with solar heat production or combining several photocatalytic systems A tentative evaluation of conversion processes for solar energy is presented Author (ESA)

N82-12642# Ludwig-Maximilians-Universitaet, Munich (West Germany) Inst fuer Experimentalphysik
IMPROVEMENT OF THERMAL EFFICIENCY OF FLAT PLATE SOLAR COLLECTORS Final Report
Hubert Boeck, Reinhard Hallermayer, Wolfgang Schoelkopf, and Alfred Wiesmeth Bonn Bundesministerium fuer Forschung und Technologie Dec 1980 62 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-194, ISSN-0340-7608) Avail NTIS HC A04/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 13

Measuring methods (spectral resolution of absorptivity and the evaluation of overall absorptivity with a solar spectrum) and further developed (calorimetric device to measure the hemispherical thermal emissivity of various speciments) were examined The convective heat transfer between cover and absorber of a flat plate collector is partially suppressed by various inserted structures The optical transmission of the cover of flat plate collectors is improved by interference layers Thus an improvement is important when a correct azimuthal orientation of the collector is impossible Results of an experimental comparative test of several commercial flat plate collectors are presented
Author (ESA)

N82-12644# Technical Research Centre of Finland, Espoo LVI-Tekniikan Lab
THE PROPERTIES OF SOLAR AND HEAT PUMP HEATING SYSTEMS OF SMALL HOUSES AND ADDITIONAL HEAT SOURCES
Tino Kalema and Kari Wellman Apr 1981 121 p refs In FINNISH, ENGLISH summary
(VTT-56, ISBN-951-38-1199-9, ISSN-0355-3469, RISO-M2241) Avail NTIS HC A06/MF A01

The active use of solar energy in heating of small houses was studied with a computer program developed for this purpose The calculations clear up the thermal properties of seven solar and heat pump systems with different operational principles The following topics are studied (1) how much energy is obtained from different heat sources (basic heat source, solar radiation, earth and wood), and (2) the influence of collector size, structure, and storage on the energy obtained from the collector in each system The influence of the size and depth of the heat pump Earth pipes on compressor electricity consumption, Earth temperatures and freezing are also studied Author (ESA)

N82-12647# Joint Publications Research Service, Arlington, Va
SOLAR PROJECT AT ALMERIA NEARS COMPLETION
Hans Fricker *In its* W Europe Rept Sci and Technol , No 72 (JPRS-78876) 1 Sep 1981 p 15-17 Transl into ENGLISH from Chem Rundschau (Zurich), 25 May 1981 p 3 and 5
Avail NTIS HC A03/MF A01

Ninety-three mirrors (heliostats), steered by a computer, reflect the sunlight at all times of the day and year into the opening of a combustion chamber (receiver) mounted on a 43-meter high tower in southern Spain The cooling medium, liquid sodium, is heated from 270 C to 530 C, after which it flows to the hot storage tank installed on the ground below As needed, sodium can be circulated out of the tank through the steam generator into a cold storage tank and from there back to be reheated in the receiver The steam created in the steam generator expands in a steam engine, the mechanical energy created there drives the 500 kW generator, which produces the electric power The selection of sodium as the cooling medium, and the design of the receiver and the pressure relief system which guarantees the safety of the plant in the unlikely event of a steam pipe bursting are described A R H

N82-12707# Automation Industries, Inc , Silver Spring, Md Vitro Labs Div
ENVIRONMENTAL DATA FOR SITES IN THE NATIONAL SOLAR DATA NETWORK
Aug 1981 176 p Prepared for Argonne National Lab (Contract DE-AC01-79CS-30027)
(DE82-000071, SOLAR/0010-81/08) Avail NTIS HC A09/MF A01

Environmental information collected at the sites of the National Solar Data Network is tabulated for each solar site The sites are grouped into 12 zones, each of which consists of several adjacent states The insolation table presents the total, diffuse, direct, maximum, and extraterrestrial radiation for the site It also shows the ratio of total to extraterrestrial radiation The temperature table gives the average, daytime, nighttime, maximum, minimum, and inlet-water temperature for the site All of the passive and some active solar sites are equipped with wind sensors which provide information on wind speed and direction For some sites, a humidity tables provides relative humidity values for day and night It also gives values for the maximum and minimum humidity for each day A technical discussion of the instruments and measurements used to obtain the data is included DOE

N82-13039*# Hughes Research Labs , Malibu, Calif
STUDY OF RADIATIVELY SUSTAINED CESIUM PLASMAS FOR SOLAR ENERGY CONVERSION Final Report, 1 Jul. 1978 - 30 Jun. 1980
A J Palmer and G J Dunning Jul 1980 67 p refs (Contract NAS2-10001)
(NASA-CR-166265) Avail NTIS HC A04/MF A01 CSCL 10A

The results of a study aimed at developing a high temperature solar electric converter are reported The converter concept is based on the use of an alkali plasma to serve as both an efficient high temperature collector of solar radiation as well as the working fluid for a high temperature working cycle The working cycle is a simple magnetohydrodynamic (MHD) Rankine cycle employing a solid electrode Faraday MHD channel Research milestones include the construction of a theoretical model for coupling sunlight in a cesium plasma and the experimental demonstration of cesium plasma heating with a solar simulator in excellent agreement with the theory Analysis of a solar MHD working cycle in which excimer laser power rather than electric power is extracted is also presented The analysis predicts a positive gain coefficient on the cesium-xenon excimer laser transition R J F

N82-13265# Midwest Research Inst , Golden, Colo Solar Energy Research Inst
APPLIANCE EFFICIENCY AND THE SOLAR BUILDING
Joel Swisher Jun 1981 30 p refs
(Contracts EG-77-C-01-4042, DE-AC02-77CH-00178)
(DE81-029073, SERI/TR-721-1119) Avail NTIS HC A03/MF A01

Energy use in residential appliances is examined Current appliance energy use was evaluated and technologically feasible improvements were studied A typical set of household appliances was developed, and modified by three classes of efficiency improvements Significant energy saving potential was found in all major appliance energy uses, with the largest savings in

water heaters and refrigerators Costs of the improvements are relatively low, providing short payback times The effects of the improvements on building thermal loads and electricity demand profiles were also examined DOE

N82-13491*# Jet Propulsion Lab, California Inst of Tech, Pasadena
SPACE APPLICABLE DOE PHOTOVOLTAIC TECHNOLOGY: AN UPDATE
J Scott-Monck, P Stella, and P Berman 15 Nov 1981 25 p refs
(Contract NAS7-100)
(NASA-CR-165021, JPL-Pub-81-91) Avail NTIS HC A02/MF A01 CSCL 10A

Photovoltaic development projects applicable to space power are identified When appropriate, the type of NASA support that would be necessary to implement these technologies for space use is indicated It is conducted that the relatively small market and divergent operational requirements for space power are mainly responsible for the limited transfer of terrestrial technology to space applications Information on the factors which control the cost and type of technology is provided Terrestrial modules using semiconductor materials are investigated S L

N82-13492*# Jet Propulsion Lab, California Inst of Tech, Pasadena
DISTRIBUTED PHOTOVOLTAIC SYSTEMS: UTILITY INTERFACE ISSUES AND THEIR PRESENT STATUS
M Hassan and J Klein 15 Sep 1981 166 p refs
(Contracts NAS7-100 DE-AI01-76ET-20356 JPL Proj 5240-11)
(NASA-CR-165019 JPL-Pub-81-89, DOE/ET-20356/3) Avail NTIS HC A08/MF A01 CSCL 10A

Major technical issues involving the integration of distributed photovoltaics (PV) into electric utility systems are defined and their impacts are described quantitatively An extensive literature search, interviews, and analysis yielded information about the work in progress and highlighted problem areas in which additional work and research are needed The findings from the literature search were used to determine whether satisfactory solutions to the problems exist or whether satisfactory approaches to a solution are underway It was discovered that very few standards, specifications, or guidelines currently exist that will aid industry in integrating PV into the utility system Specific areas of concern identified are (1) protection, (2) stability, (3) system unbalance, (4) voltage regulation and reactive power requirements, (5) harmonics, (6) utility operations, (7) safety, (8) metering, and (9) distribution system planning and design Author

N82-13495*# Jet Propulsion Lab, California Inst of Tech, Pasadena
DISH STIRLING SOLAR RECEIVER COMBUSTOR TEST PROGRAM
C P Bankston and L H Back 15 Aug 1981 45 p refs
(Contracts NAS7-100, DE-AI01-81ET-20307, JPL Proj 5105-76)
(NASA-CR-165017, JPL-Pub-81-23, DOE/JPL-1060-41) Avail NTIS HC A03/MF A01 CSCL 10A

The operational and energy transfer characteristics of the Dish Stirling Solar Receiver (DSSR) combustor/heat exchanger system was evaluated The DSSR is designed to operate with fossil fuel augmentation utilizing a swirl combustor and cross flow heat exchanger consisting of a single row of 4 closely spaced tubes that are curved into a conical shape The performance of the combustor/heat exchanger system without a Stirling engine was studied over a range of operating conditions and output levels using water as the working fluid Results show that the combustor may be started under cold conditions, controlled safety, and operated at a constant air/fuel ratio (10 percent excess air) over the required range of firing rates Furthermore, nondimensional heat transfer coefficients based on total heat transfer are plotted versus Reynolds number and compared with literature data taken for single rows of closely spaced tubes perpendicular to cross flow The data show enhanced heat transfer for the present geometry and test conditions Analysis of the results shows that the present system meets specified thermal requirements, thus verifying the feasibility of the DSSR combustor design for final prototype fabrication J.M.S.

N82-13496*# Solarex Corp, Rockville, Md
A MODULE EXPERIMENTAL PROCESS SYSTEM DEVELOPMENT UNIT (MEPSDU) Quarterly Report, 1 May - 31 Aug. 1981
31 Aug 1981 57 p refs Sponsored in part by DOE Prepared for JPL, Pasadena
(Contract JPL-955902)
(NASA-CR-165014, QR-3, JPL-9950-603, DOE/JPL-955902-81/3) Avail NTIS HC A04/MF A01 CSCL 10A

A cost effective process sequence and machinery for the production of flat plate photovoltaic modules are described Cells were fabricated using the process sequence which was optimized, as was a lamination procedure Insulator tapes and edge seal material were identified and tested Encapsulation materials were evaluated S L

N82-13501*# Spectrolab, Inc, Sylmar, Calif
HIGH RESOLUTION, LOW COST SOLAR CELL CONTACT DEVELOPMENT Final Report
N Mardesich [1981] 82 p Sponsored in part by DOE Prepared for JPL, Pasadena, Calif
(Contract JPL-955725)
(NASA-CR-165032, JPL-9950-611, DOE/JPL-955725-81/1) Avail NTIS HC A05/MF A01 CSCL 10A

The MIDFILM cell fabrication and encapsulation processes were demonstrated as a means of applying low-cost solar cell collector metallization The average cell efficiency of 12 0 percent (AM1, 28 C) was achieved with fritted silver metallization with a demonstration run of 500 starting wafers A 98 percent mechanical yield and 80 percent electrical yield were achieved through the MIDFILM process High series resistance was responsible for over 90 percent of the electrical failures and was the major factor causing the low average cell efficiency Environmental evaluations suggest that the MIDFILM cells do not degrade A slight degradation in power was experienced in the MIDFILM minimodules when the AMP Solarlok connector delaminated during the environmental testing T M

N82-13514# Solarex Corp, Rockville, Md
SILICON SOLAR CELL OPTIMIZATION Final Report, 15 Aug. 1978 - 15 Feb. 1981
Alan L Scheinine, John H Wohlgemuth, and Eileen Sparks
Wright-Patterson AFB, Ohio AFWAL Jun 1981 99 p refs
(Contract F33615-78-C-2039, AF Proj 3145)
(AD-A106005, AFWAL-TR-81-2052) Avail NTIS HC A05/MF A01 CSCL 10/2

This research program has resulted in improvements in vertical junction solar cell techniques leading to higher efficiencies and improved handleability Vertical junction solar cells have now been fabricated with AMO conversion efficiency greater than 15% (25 C) A variety of cells have been fabricated including different groove depths, substrate thicknesses and bulk resistivities Cell performance has been measured both before and after irradiation Theoretical analyses has been performed to generate computer models of I-V curves for various cell geometries Author (GRA)

N82-13528# Midwest Research Inst, Golden, Colo Solar Energy Research Inst
INEXPENSIVE THERMOGRAPHIC TECHNIQUES FOR DETERMINING RELIABLE SOLAR-COLLECTOR-ARRAY PERFORMANCE
A Eden and T Haverty Sep 1981 35 p refs
(Contracts DE-AC02-77CH-00178, EG-77-C-01-4042)
(DE82-001151, SERI/TR-721-1161) Avail NTIS HC A03/MF A01

Thermographic equipment, capable of detecting flow blockages, flow imbalances, and total array shutdown in residential and commercial solar energy collector systems is investigated The abilities of inexpensive thermographic equipment to perform solar array examinations in the field environment are described It was found that less expensive instruments, in combinations to enhance the capabilities of each general type, can be used to examine solar collector arrays Expert infrared equipment operators are not required to obtain some conclusions on system problems A combination of pot radiation thermometers with either a hand-held imager or thermoprofile instrument is a viable inspection tool Assessment of reliable flow control components, blocked collectors, unbalanced flow distribution, and reversed flow can all be observed with the combination of instruments DOE

N82-13530# Sandia Labs, Livermore, Calif
SOLAR-CENTRAL-RECEIVER FUELS AND CHEMICALS Project Status Report, Oct. 1980 - Jun. 1981
R W Carling, J D Fish, L G Radosevich, and J Vitko, Jr Aug 1981 22 p refs
(Contract DE-AC04-76DP-00789)
(DE82-000941, SAND-81-8232) Avail NTIS HC A02/MF A01

Solar central receiver fuels and chemicals processes were studied Ethane pyrolysis and steam reforming of methane were investigated in-depth in addition to coal gasification, oil shale retorting, and biomass flash pyrolysis The study criteria, status of ongoing work, and future activities are described DOE

N82-13531# Midwest Research Inst, Golden, Colo Solar Energy Research Inst
SOLAR THERMAL ENERGY SYSTEMS Annual Technical Progress Report
Jul 1981 157 p refs
(Contracts DE-AC02-77CH-00178, EG-77-C-01-1012)
(DE81-029295, DOE/CS-4042/2) Avail NTIS HC A08/MF A01

Technical progress in the solar thermal energy systems program is summarized Each project description includes a brief history, significant achievements, future activities, and a forecast of anticipated achievements Point focus, central receiver and line focus technologies, research and advanced development components, materials, fuels and chemicals, and solar ponds are discussed DOE

N82-13532# Sandia Labs, Albuquerque, N Mex
INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION EXPERIMENT OPERATIONAL PERFORMANCE REPORT. VOLUME 2 FOR BEVERLY HIGH SCHOOL, BEVERLY, MASS.
Sep 1981 21 p Prepared in cooperation with Boeing Computer Services Co, Seattle, Wash
(Contract DE-AC04-76DP-00789)
(DE82-000811, SAND-81-7088-2) Avail NTIS HC A02/MF A01

Performance data were listed and graphed for an intermediate photovoltaic system at a high school in Massachusetts for the month of July 1981 The energy production, incident solar energy and efficiency are given, and the daily energy production and efficiency, and energy production as a function of power and voltage are graphed The output of the power conditioner, insolation, heating and cooling loads, temperature and wind data, and the number of freeze thaw cycles are presented DOE

N82-13533# Lincoln Lab, Mass Inst of Tech, Lexington
DATA REPORT FOR THE NORTHEAST RESIDENTIAL EXPERIMENT STATION, JUNE 1981
M C Russell, P Raghuraman, and J J Farrell Aug 1981 14 p
(Contract DE-AC02-76ET-20279)
(DE82-000068, DOE/ET-20279/154) Avail NTIS HC A02/MF A01

Five prototype residential photovoltaic systems consisting of a roof-mounted array, sized to meet at least 50 percent of the annual electrical demand of an energy-conserving house, and an enclosed structure to house the remainder of the photovoltaic equipment, test instrumentation, and work space are being monitored to provide authoritative and accurate information concerning system performance and the typical loads which they serve One month of physical data is presented for each system as well as an hour-by-hour tabulation for an average day of the month A common feature of all the systems is that excess solar-generated electric energy is fed back to the utility grid, thus eliminating the need for on-site storage A R H

N82-13543# California Univ, Livermore Lawrence Livermore Lab
DESIGN AND TEST OF TWO-STEP SOLAR OIL SHALE RETORT
D W Gregg, R W Taylor, W R Aiman, and R Ruiz 24 Sep 1981 35 p refs
(Contract W-7405-eng-48)
(DE82-000964, UCID-19199) Avail NTIS HC A03/MF A01

A design of a two step solar retort, the logic for the design, and the results from a preliminary test of the design at the White Sands Solar Furnace, New Mexico are presented Solar retorting of oil shale is a technically feasible process where focused solar energy can displace fossil energy in the production of liquid fuels The predicted result is a 10 to 40% improvement in the exportable fuel (oil + gas) production per ton of raw shale Greater improvements are achieved with the lower grade shales where with nonsolar processes a larger fraction of the fuel content has to be used in the processing DOE

N82-13548# Swedish Inst for Materials Testing, Boras Lab foer Ytskydd och Korrosion
AGING AND CORROSION PROBLEMS WITH FLAT SOLAR ENERGY ABSORBERS. STUDY BASED UPON LITERATURE AND EXPERIMENT EXCHANGES [AALDRINGS-OCH KORROSIONS-PROBLEM HOS PLANA TERMISKA SOLFAANGARE. EN STUDIE BASERAD PAA LITTERATUR OCH ERFARENHETSUTBYTE]
Hans Wennerholm and Knut-Olof Lagerkvist 1979 72 p refs In SWEDISH
(SP-RAPP-1979/4) Avail NTIS HC A04/MF A01

The construction and the causes of damage to solar energy absorbers are reviewed Aging is due to ultraviolet radiation, temperature, humidity, oxygen, impurities in the air and other effects A literature review is given about the constituent parts The coverplate may be of glass, several types of plastics, fluoro-compounds, fiberglass, or silicones For the absorbing surface, sintered chromium oxide, black nickel, black iron, copper oxide, manganese oxides, or selective coated aluminium are used The insulation is often made of mineral wool or polyurethane resins Inspection data are reported for nine solar flat-shaped energy absorbers Most of them are used for the production of warm water and have been in use between three months and three years Nearly all coverplates bore important deposits caused by condensation Some of the nine aborbers show corrosion on the aborbing surface and/or on insulation Author (ESA)

N82-13549# National Bureau of Standards, Washington, D C
PASSIVE/HYBRID SOLAR COMPONENTS: AN APPROACH TO STANDARD THERMAL TEST METHODS
M E McCabe, W Ducas, M J Orloski, and K N Decorte Jul 1981 87 p refs Sponsored in part by DOE
(PB81-227886, NBSIR-81-2300) Avail NTIS HC A05/MF A01 CSCL 14B

A survey of passive solar products currently available or under development enabled the development of an interim classification system consisting of ten component classifications for purposes of thermal testing A survey of currently available thermal test procedures was performed to assess the applicability of these test methods for passive/hybrid solar components Existing test procedures that are useful for the direct gain fenestration system classification are identified and recommendations are made for evaluation of these laboratory-based procedures by comparison with field-based testing of components under controlled interior conditions Recommendations are also made for the development of new test procedures for passive/hybrid components classifications for which existing test methods are not applicable GRA

N82-14384# New Hampshire Univ, Durham Dept of Chemical Engineering
FUELS AND CHEMICALS MADE FROM SOLAR ENERGY
V K Mathur, F K Manasse, and S Lakshmanan 1981 10 p refs Presented at the 2nd World Congr of Chem Engr, Montreal, Canada, 4-9 Oct 1981
(Contract DE-AC02-79ET-21067)
(DE81-025018, CONF-811007-6) Avail NTIS HC A02/MF A01

The application of high temperature solar energy for the production of fuels and chemicals from various feed stocks is reviewed The promises and problems of this technology are highlighted The two-stage Sun gas process is described The role of chemical engineers and the future of Sun fuels and chemicals are discussed DOE

N82-14627*# DHR, Inc, Washington, D C
MARKET ASSESSMENT OF PHOTOVOLTAIC POWER SYSTEMS FOR AGRICULTURAL APPLICATIONS IN MOROCCO Final Report
Henry Steingass and Itil Asmon (ARD, Inc) Sep 1981 157 p refs

(Contract DEN3-180, DE-AI01-79ET-20485)
(NASA-CR-165477, DOE/NASA/0180-2, C4100-50) Avail NTIS HC A08/MF A01 CSCL 10A

Results of a month-long study in Morocco aimed at assessing the market potential for stand-alone photovoltaic systems in agriculture and rural service applications are presented The following applications, requiring less than 15 kW of power, are described irrigation, cattle watering, refrigeration, crop processing, potable water and educational TV Telecommunications and transportation signalling applications, descriptions of power and energy use profiles, assessments of business environment, government and private sector attitudes towards photovoltaics, and financing were also considered The Moroccan market presents both advantages and disadvantages for American PV manufacturers The principle advantages of the Moroccan market are a limited grid, interest in and present use of PV in communications applications, attractive investment incentives, and a stated policy favoring American investment Disadvantages include lack of government incentives for PV use, general unfamiliarity with PV technology, high first cost of PV, a well-established market network for diesel generators, and difficulty with financing The market for PV in Morocco (1981-1986), will be relatively small, about 340 kwp The market for PV is likely to be more favorable in telecommunications, transport signalling and some rural services The primary market appears to be in the public (i e , government) rather than private sector, due to financial constraints and the high price of PV relative to conventional power sector M D K

N82-14630*# Ross (Bernd) Associates, San Diego, Calif
DEVELOPMENT OF AN ALL-METAL THICK FILM COST EFFECTIVE METALLIZATION SYSTEM FOR SOLAR CELLS ***Quarterly Report, Nov. 1980 - Apr. 1981***
Bernd Ross Sep 1981 40 p refs
(Contract JPL-955688)
(NASA-CR-165043, DOE/JPL-955688-80/3, JPL-9950-604, QR-3) Avail NTIS HC A03/MF A01 CSCL 10A

The objectives of the investigation were to provide all-metal screenable pastes using economical base metals, suitable for application to low-to-high conductivity silicon of either conductivity type and possibly to aluminum surfaces Experiments were conducted with variations in paste parameters, firing conditions, including gas ambients, furnace furniture, silicon surface and others A liquid medium, intended to provide transport during the carbon fluoride decomposition was incorporated in the paste with promising results T M

N82-14631*# Solarelectronics, Inc , Bellingham, Mass
FLAT-PLATE SOLAR ARRAY PROJECT. TASK 1: SILICON MATERIAL: INVESTIGATION OF THE HYDROCHLORINATION OF SiC1SUB4 ***Quarterly Report, 9 Jul. - 30 Sep. 1981***
Jeffrey Y P Mui 1 Oct 1981 17 p refs
(Contract JPL-956061)
(NASA-CR-165042, DOE/JPL-956061/1, JPL-9950-607) Avail NTIS HC A02/MF A01 CSCL 10A

A two inch-diameter stainless steel reactor was designed to operate at pressure up to 500 psig and at temperature up to 600 C in order to study the hydrochlorination of silicon tetrachloride and metallurgical grade (m g) silicon metal to trichlorosilane The hydrochlorination apparatus is described and operation safety and pollution control are discussed A R H

N82-14634*# National Aeronautics and Space Administration Marshall Space Flight Center, Huntsville, Ala
SATELLITE POWER SYSTEM: CONCEPT DEVELOPMENT AND EVALUATION PROGRAM. VOLUME 4: ENERGY CONVERSION AND POWER MANAGEMENT
Nov 1981 369 p refs
(NASA-TM-58237-Vol-4) Avail NTIS HC A16/MF A01 CSCL 10A

Additional analyses that were performed to supplement the NASA/Department of Energy (DOE) Satellite Power System (SPS) reference system concept are presented in this volume A brief review of the reference concept is provided together with detailed descriptions of energy conversion, power distribution, and power management for solar photovoltaics (silicon and gallium arsenide), solar thermal (Brayton and Rankine cycles), and concept comparisons (solar thermal and energy conversion) Results of other studies concerning energy conversion and power management (environmental impacts, annealing, nuclear SPS concept, and thermionic) are included The data presented were taken from the SPS Concept Definition Studies performed under the direction of NASA by Rockwell International Corporation and Boeing Aerospace Company Author

N82-14635*# National Aeronautics and Space Administration Marshall Space Flight Center, Huntsville, Ala
SATELLITE POWER SYSTEM: CONCEPT DEVELOPMENT AND EVALUATION PROGRAM. VOLUME 7: SPACE TRANSPORTATION
Nov 1981 258 p refs
(NASA-TM-58238-Vol-7) Avail NTIS HC A12/MF A01 CSCL 10A

During the several phases of the Satellite Power System (SPS) Concept Definition Study, various transportation system elements were synthesized and evaluated on the basis of their potential to satisfy overall SPS transportation requirements and their sensitivities, interfaces, and impact on the SPS Additional analyses and investigations were conducted to further define transportation system concepts that will be needed for the developmental and operational phases of an SPS program To accomplish these objectives, transportation systems such as the Shuttle and its derivatives have been identified, new heavy-lift launch vehicle (HLLV) concepts, cargo and personnel orbital transfer vehicles (COTV and POTV), and intra-orbit transfer vehicle (IOTV) concepts have been evaluated, and, to a limited degree, the program implications of their operations and costs were assessed The results of these analyses have been integrated into other elements of the overall SPS concept definition studies Author

N82-14636*# General Dynamics/Convair, San Diego, Calif
STUDY OF MULTI-MEGAWATT TECHNOLOGY NEEDS FOR PHOTOVOLTAIC SPACE POWER SYSTEMS. VOLUME 1: EXECUTIVE SUMMARY
D M Peterson and R L Pleasant 1 Aug 1981 28 p refs 2 Vol
(Contract NAS3-21951)
(NASA-CR-165323-Vol-1, Rept-111-2401-204) Avail NTIS HC A03/MF A01 CSCL 10A

Possible missions requiring multimegawatt photovoltaic space power systems in the 1990's time frame and associated power system technology needs are examined The following concepts for photovoltaic power approaches are considered planar arrays, concentrating arrays, hybrid systems using Rankine engines, thermophotovoltaic and AC/DC power management approaches, battery, fuel cell, flywheel energy storage, and interactions with the electrical ion engine injection and stationkeeping system The levels of modularity for efficient, safe, constructable, serviceable, and cost effective system design are analyzed, and the benefits of alternate approaches developed Both manned low Earth orbit and unmanned geosynchronous Earth orbit applications were examined for technological development Technology developments applicable to power systems which appear to have benefits independent of the absolute power level are suggested M D K

N82-14637*# General Dynamics/Convair, San Diego, Calif
STUDY OF MULTI-MEGAWATT TECHNOLOGY NEEDS FOR PHOTOVOLTAIC SPACE POWER SYSTEMS, VOLUME 2 **Final Report**
D M Peterson and R L Pleasant 19 Mar 1981 285 p refs 2 Vol
(Contract NAS3-21951)
(NASA-CR-165323-Vol-2, GDC-AST-81-019-Vol-2) Avail NTIS HC A13/MF A01 CSCL 10A

Possible missions requiring multimegawatt photovoltaic space power systems in the 1990's time frame and power system technology needs associated with these missions are examined Four specific task areas were considered (1) missions requiring power in the 1-10 megawatt average power region, (2) alternative power systems and component technologies, (3) technology goals and sensitivity trades and analyses, and (4) technology recommendations Specific concepts for photovoltaic power approaches considered were planar arrays, concentrating arrays, hybrid systems using Rankine engines, thermophotovoltaic approaches, all with various photovoltaic cell component technologies Various AC/DC power management approaches, and battery, fuel cell, and flywheel energy storage concepts are evaluated Interactions with the electrical ion engine injection and stationkeeping system are also considered M D K

N82-14643# Arabian Exhibition Management Ltd., Manama (Bahrain)
SOLTECH 80
1980 174 p Conf held at Bahrain, 10-11 Nov 1980
(DE81-901931, CONF-801178) Avail NTIS (US Sales Only) HC A08/MF A01, DOE Depository Libraries

Three solar related activities solar radiation monitoring, effects of dust accumulation on collector performance, and salt gradient solar pond analytical and experimental studies are described Measurements of total horizontal and direct radiation are made continuously, and the data are presented in a user oriented format on an hourly basis Diffuse radiation and total radiation on a surface tilted to the local latitude angle are calculated The system is presently being expanded to allow measurement of several additional radiation parameters of interest as well as six meteorological parameters The effects of atmospheric dust on radiation attenuation, as well as the clearness index, anti K/sub T/ are shown The impact of surface dust accumulation on the performance of photovoltaic and thermal collectors is also studied DOE

N82-14656# Lincoln Lab., Mass. Inst. of Tech., Lexington
PHOTOVOLTAIC SYSTEMS PERFORMANCE EXPERIENCE
F J Solman 1981 8 p refs Presented at IEEE Photovoltaic Specialists Conf., Orlando, Fla., 11-15 May 1981
(Contract DE-AC02-76ET-20279)
(DE81-025725; DOE/ET-20279/147, CONF-810526-39) Avail NTIS HC A02/MF A01

The photovoltaic power systems at Natural Bridges National Monument in southeastern Utah and at radio station WBNO in Bryan, Ohio, provided reliability experience and case histories on failures and repairs of large photovoltaic systems The PV systems are used for illustration of potential sources of system outages and measures that can be taken to improve the reliability and repair economy of present and future PV systems Both systems have experienced lighting strikes, and the results are reported E A K

N82-14657# Lincoln Lab., Mass Inst of Tech., Lexington
SOLAR PHOTOVOLTAIC RESIDENTIAL PROJECT. PROJECT INTEGRATION MEETING, AGENDA AND ABSTRACTS
1981 63 p refs Presented at Solar Photovoltaic Residential Project Integration Meeting, Cambridge, Mass., 24-25 Jun 1981
(Contract DE-AC02-76ET-20279)
(DE81-028433, DOE/ET-20279/150, CONF-8106143) Avail NTIS

Thirty three abstracts are presented covering residential photovoltaic design, economics and requirements, balance of system components, PV/thermal collectors, PV interfaced with passive solar design, and utilities related aspects DOE

N82-14658# Midwest Research Inst., Golden, Colo
SYSTEMS ANALYSIS OF THERMAL STORAGE
R J Copeland Aug 1981 8 p refs Presented at the Ann Meeting on Thermal and Chem Storage, Tysons Corner, Va., 14-16 Sep 1981
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(DE81-030288, SERI/TP-253-1369, CONF-81940-2) Avail NTIS HC A02/MF A01

Analyses were conducted on thermal storage concepts for solar thermal applications These studies include estimates of both the obtainable costs of thermal storage concepts and their worth to a user (i e, value) Based on obtainable costs and performance, an in-depth study evaluated thermal storage concepts for water/steam, organic fluid, and gas/Brayton solar thermal receivers Promising and nonpromising concepts were identified Thermal storage concepts were evaluated for a liquid metal receiver The value of thermal storage in a solar thermal industrial process heat application was analyzed Several advanced concepts studied, include ground-mounted thermal storage for parabolic dishes with Stirling engines DOE

N82-14661# Mid-American Solar Energy Complex, Minneapolis, Minn
SEMINARS FOR PRIVATE COLLEGE ADMINISTRATORS ON SOLAR APPLICATIONS FOR COLLEGE BUILDINGS
Jun. 1981 8 p
(Contract DE-AC02-79CS-30150)
(DE81-027981, MASEC-CF-81-038) Avail: NTIS HC A02/MF A01

The objective of this project was to increase the working knowledge of key private college decision makers on passive and active solar fundamentals, proven passive and active technology, and conservation means integral to these technologies in the renovation of college buildings or their energy systems, to be achieved by conducting a series of three seminars A summary of the project activities and a brief summary of workshop evaluations are given DOE

N82-14665# Colorado State Univ., Fort Collins Solar Energy Applications Lab
REPEAT FACILITY. REPORT FOR MAY, JUNE, JULY Progress Report, May - Jul. 1981
C Byron Winn Aug 1981 79 p refs
(Contract DE-AS02-80CS-30259)
(DE81-028156; DOE/CS-30259/6) Avail NTIS HC A05/MF A01

The construction of the REPEAT facility, a test facility for passive and hybrid solar heating systems is reported The development of a simulation program for envelope type passive solar systems, constructing an envelope test cell, collecting data to validate the program, and application of the program to determine the best envelope type design are discussed A low cost monitoring system using a dedicated microprocessor system, an inexpensive, high accuracy A/D converter, and minimum system hardware is developed A method to determine the average temperature and the average daily temperature variation inside a passively heated solar building is presented DOE

N82-14668# Department of Agriculture, Washington, D C National Economics Div
SOLAR-SUPPLEMENTED, NATURAL AIR DRYING OF SHELLED CORN: THE ECONOMIC LIMITATIONS
Walter G Heid, Jr and David F Aldis Jun 1981 45 p refs (PB81-235681, TB-1654) Avail NTIS HC A03/MF A01 CSCL 02C

It is not economically feasible to supplement natural air drying of high-moisture shelled corn by adding heat (solar and otherwise) In some cases, that drying method speeds product deterioration A simulation analysis of the west central Great Plains determined that benefits from adding solar heat to batch-in-bin and layer-in-bin grain drying methods failed to offset the solar heat installation costs and product deterioration losses Findings also suggest that high-speed, high-temperature drying is necessary to avoid field losses and to ensure marketable corn of high quality GRA

N82-15247# Argonne National Lab., Ill
PERFORMANCE PREDICTIONS OF PASSIVE SOLAR COMMERCIAL BUILDINGS
T L Kurbowski 1981 5 p refs Presented at 2nd Natl Tech Conf on Earth Sheltered Buildings, Tulsa, Okla., 16 Oct 1981
(Contract W-31-109-eng-38)
(DE81-027979, CONF-811034-1) Avail. NTIS HC A02/MF A01

Many Earth bermed and high mass commercial structures tending to require cooling and lighting rather than heating were designed, built, and instrumented to record segregated or partitioned energy usage Design solutions, preliminary performance, and cost information are addressed for the earth integrated projects DOE

N82-15526*# Vanderbilt Univ., Nashville, Tenn Dept. of Physics and Astronomy
ADVANCED SOLAR ENERGY CONVERSION Annual Progress Report, 1 Sep. 1980 - 31 Aug. 1981
Ja H Lee 31 Aug 1981 22 p refs
(Contract NCC1-8)
(NASA-CR-165060) Avail NTIS HC A02/MF A01 CSCL 10A

An atomic iodine laser, a candidate for the direct solar pumped lasers, was successfully excited with a 4 kW beam from a xenon arc solar simulator, thus proving the feasibility of the concept The experimental set up and the laser output as functions of operating conditions are presented The preliminary results of the iodine laser amplifier pumped with the HCP array to which a Q switch for giant pulse production was coupled are included. Two invention disclosures - a laser driven magnetohydrodynamic generator for conversion of laser energy to electricity and solar pumped gas lasers - are also included. S L.

N82-15529# Varta Batterie A G, Kelkheim (West Germany) Forschungs- und Entwicklungszentrum
ENERGY STORAGE SYSTEMS FOR TERRESTRIAL SOLAR GENERATORS Final Report, Dec. 1980
Margarete Jung Bonn Bundesministerium fuer Forschung und Technologie May 1981 76 p refs In GERMANY; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-082, ISSN-0340-7608) Avail NTIS HC A05/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 16

Mercury can react with Raney nickel to form the alloy NiHg4 This intermetallic compound is the basis of an excellently rechargeable positive electrode material In combination with cadmium it forms a rechargeable cadmium/mercury oxide cell which can be operated under hermetically sealed conditions Since both electrodes are thermodynamically stable in aqueous alkaline electrolytes, the self discharge rate of the cell is very low and hence the Coulomb efficiency even at very low charge rates in the order of 1000 - 2000 hrs is higher than 95% The cadmium/mercury oxide cells can be cycled more than a hundred times These cells are particularly qualified to serve as an energy storage in combination with photovoltaic cells Author

N82-15530# Internationale Atomreaktorbau Gesellschaft, Bensberg (West Germany) Abt Anlagenbau
GAS COOLED SOLAR POWER PLANT FOR GENERATING ELECTRICAL ENERGY IN THE 20MWe OPERATING RANGE (GAST): PRELIMINARY DESIGN PHASE Final Report, Nov. 1980
Siegfried Kostrzewa and Peter Wehowsky Bonn Bundesministerium fuer Forschung und Technologie Jul 1981 33 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-097, ISSN-0340-7608, IAT-BS-100000-010) Avail NTIS HC A03/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 7

R&D work required for the erection of a pilot plant was defined Since the location of the site is not yet determined, the project work was based on preliminary basic data Significant results of the preliminary design phase include both the choice of a combined gas/steam thermal energy conversion process for the reference concept and basic concepts for heliostat, heliostat field arrangement, receiver, tower and master control/process computer system A R H

N82-15532# Dornier-Werke G m b H, Friedrichshafen (West Germany) New Energy Technology
DEVELOPMENT OF A PROTOTYPE OF A 10 kW SMALL SOLAR POWER PLANT Final Report, Sep. 1979
Franz Maier and Josef Haenfling Bonn Bundesministerium fuer Forschung und Technologie Jun 1981 170 p ref In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-101, ISSN-0340-7608) Avail NTIS HC A08/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 33,50

Activities performed in the design and construction of a solar driven 10 kW turbogenerator for local TV-educational systems, irrigation pumps and other applications in developing countries include (1) System design and thermodynamic calculation, (2) Design of the collector array and construction (3) Fixing of components and auxiliary units, (4) Turbine design, construction, manufacture and test run, (5) Generator design, construction, manufacture and test run, (6) Turbogenerator integration and test, (7) Electrical supply, plant control and regulation, and (8) Test assembly, performance and analysis Component tests are being run and are being evaluated by a data acquisition unit installed on site A R H

N82-15534# Prins Maurits Lab TNO, Rijswijk (Netherlands) Inst voor Chemische en Technologische Research
SOLAR POWER SYSTEMS SMALLER THAN 500 W FOR MILITARY USE
P P M M Wittgen Nov 1979 27 p refs In DUTCH, ENGLISH summary
(Contract A78/KL/125)
(PML-1980-06, TDCK-73397) Avail NTIS HC A03/MF A01

A literature search of the feasibility of using photovoltaic cells for the energy supply of low power-consuming military equipment is presented Progress in the technology of solar cells in the coming years offers good prospects for the use of photovoltaic systems A hybrid system consisting of an array of solar cells combined with secondary batteries in a sunny climate is capable of supplying equipment with energy Climatic conditions in the Netherlands and the northern part of Germany are too bad for a fully self-supporting year round system Especially in winter the intensity and quantity of the radiation is too low In these northern regions the hybrid solar system can only be used when additional primary or secondary batteries are accepted in the winter period J D H

N82-15537# Messerschmitt-Boelkow-Blohm G m b H, Ottobrunn (West Germany). Unternehmensbereich Raumfahrt
ORGANIC FLUIDS FOR THE PRACTICAL USE IN ENERGY CONVERSION SYSTEMS OF SOLAR POWER PLANTS Final Report, Jun. 1980
Guenther Schmidt, Dietmar Wolf, and Eberhard Raasch Bonn Bundesministerium fuer Forschung und Technologie Sep 1981 76 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-154, ISSN-0340-7608) Avail. NTIS HC A05/MF A01

With respect to their specific performance, the most promising organic fluids were determined for their practical use in Rankine cycles operating in the temperature range between 150 and 400 C For these fluids, the process cycle efficiencies were compared for different temperature levels Laboratory experiments with a great number of fluids and lubricants results in the estimation of the operation limit in Rankine Cycles A test facility consisting of a heating system, an organic Rankine cycle and a control and measurement system was designed, built, and put into operation for testing various working fluids. Author

N82-15538# Dornier-Werke G m b H, Friedrichshafen (West Germany)
HIGH EFFICIENT COLLECTOR FOR SMALL SOLAR-POWERED FACILITIES Final Report
Eugen Obermayr, Wolfgang Molt, Dieter Schneller, and Klaus Speidel Bonn Bundesministerium fuer Forschung und Technologie Sep 1981 100 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-156, ISSN-0340-7608) Avail NTIS HC A05/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 21

A series of preliminary investigations and laboratory, tests were performed as a basis for developing a new type of solar collector The vacuum flat plate collectors are actually evaporators, where the working medium is evaporated within the collector itself Prototypes of direct evaporation collectors were constructed and tested In the temperature range seen for this application (130 - 150 C), the collector efficiency is about 40 - 50 percent L F M

N82-15541# Messerschmitt-Boelkow-Blohm G m b H, Ottobrunn (West Germany) Space Div
COMPARISON OF CONCEPTS FOR SOLAR-HEATED OR SOLAR-DRIVEN ABSORPTION AND COMPRESSION COOLING MACHINES FOR AIR CONDITIONING AND FOOD PRESERVATION PURPOSES, PHASE 1 Final Report, Nov. 1978
Herbert Grallert, Manfred Herbricht, and Martin Margulies Bonn Bundesministerium fuer Forschung und Technologie Sep 1981 91 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-165, ISSN-0340-7608) Avail NTIS HC A05/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 19,10

For the cooling power range of about 10 to 500 kW and for cooling temperatures of +20, 0, and -20 C, a comparison was made between solar heated absorption machines and compression machines, which are driven by a solar heated Rankine cycle Comparison criteria are C O P, energy prices, and application risks All partial efficiencies and costs were determinated by component analyses For several cooling loads an annual system simulation was performed using M B B computer programs Furthermore, the electric energy demand for absorption cooling systems was estimated and initial application recommendations are given Author

N82-15544# Midwest Research Inst., Golden, Colo Solar Energy Research Inst

LOW-COST PASSIVE-SOLAR RETROFITS FOR NEW AND EXISTING MOBILE HOMES

Steve Brant and Michael Holtz Jul 1981 6 p refs Presented at the 6th AS/ISES Natl Passive Conf., Portland, Oreg., 8-12 Sep 1981

(Contracts DE-AC02-77CH-00178, EG-77-C-01-4042)

(DE81-028356, SERI/TP-721-1138R, CONF-810925-17) Avail NTIS HC A02/MF A01

Passive solar heating and cooling retrofit options can significantly reduce the energy consumption of new and existing mobile homes The initial efforts of the Solar Energy Research Institute to explore the solar potential for the existing stock of mobile homes and those in the production stage are described DOE

N82-15545# Midwest Research Inst., Golden, Colo

INDUSTRIAL PROCESS HEAT APPLICATIONS FOR SOLAR THERMAL TECHNOLOGIES

David Feasby and David W Kearney Jun 1981 9 p refs Presented at the 3rd Intern Conf on Energy Use Management, West Berlin, 26 Oct 1981

(Contract DE-AC02-77CH-00178)

(DE81-025934, SERI/TP-733-1278, CONF-811006-2) Avail NTIS HC A02/MF A01

Selected solar industrial process heat (IPH) activities under development in the US are reviewed Included are a summary of the IPH field test program, status of solar thermal technologies, and results of specific technology/application matching and market studies The near term viability of solar technologies in the industrial sector is dependent upon both the economic and technical issues which vary depending on the application, plant site, and system selected DOE

N82-15551# Monsanto Research Corp., Dayton, Ohio

LOW-COST MIRROR CONCENTRATOR BASED ON INFLATED, DOUBLE-WALLED, METALLIZED, TUBULAR FILMS Final Report

J L Schwendeman, G L Ball, III, J W Leffingwell, and C E McClung Jul 1981 121 p refs

(Contract DE-AC04-78AL-04227)

(DE81-027813, MRC-DA-944, ALO-4227-6) Avail NTIS HC A06/MF A01

A potentially low cost, inflatable plastic solar mirror concentrator based on segments of a cylinder joined along the length of the collector on a plane passing through the axis of the absorber tube was designed and built This design results in a savings of approximately 40% in the amount of window and mirror material and in a savings of about 20% of the land area occupied by a single collector when compared to a fully cylindrical one The type of construction permits the assembling of the mirror/window envelope to the collector without disturbing the collector frame, absorber tube, or the associated plumbing Aluminum foil plastic laminates were used as an alternative to aluminized polyester films, because of their potential low cost and durability Specially ultraviolet stabilized and polyester scrim reinforced flexible polyvinyl chloride film was developed for use as the outer cover material DOE

N82-15563# Mid-American Solar Energy Complex, Minneapolis, Minn

SOLAR ENERGY TRAINING PROGRAM FOR CODE ENFORCEMENT PERSONNEL

Jun. 1981 17 p

(Contract DE-AC02-79CS-30150)

(DE81-030053; MASEC-CF-81-023, P-101-12/A-101-4) Avail NTIS HC A02/MF A01

A training program for building code officials is discussed The development of a new model building code for solar was coordinated and course materials was developed A manual to inform code officials about the basics of passive and active solar energy and the model code is developed Michigan was selected as the target state DOE

N82-15564# Mid-American Solar Energy Complex, Minneapolis, Minn

SUMMARY OF PASSIVE SOLAR MULTI-FAMILY DESIGN WORKSHOPS

Jun 1981 14 p

(Contract DE-AC02-79CS-30150)

(DE81-030353, MASEC-CF-81-035; P-103-4) Avail. NTIS HC A02/MF A01

Instructional materials on the design, construction, and marketing of passive solar multi-family residential buildings were developed An outline of the workbook used for the workshops is presented, along with a list of the workshops. Promotional activities are described briefly DOE

N82-15569# Midwest Research Inst., Golden, Colo Photoconversion Research Branch

PHOTOELECTROCHEMICAL SOLAR CELLS: STABILIZATION OF SMALL-BAND-GAP SEMICONDUCTOR IN AQUEOUS SOLUTION BY SURFACE-ATTACHED ORGANIC CONDUCTING POLYMER

Arthur J Frank Sep 1981 13 p refs Presented at the Intern Conf on Low-Dimensional Conductors, Boulder, Colo., 10-14 Aug 1981

(Contracts DE-AC02-77CH-00178, EG-77-C-01-4042)

(DE81-030312, SERI/TP-233-1388, CONF-810864-1) Avail NTIS HC A02/MF A01

Surface-attached polypyrrole films are shown to produce a marked improvement in the stability of n-type single-crystal and polycrystalline Si against oxidation in an aqueous electrolyte The current production of n-type polycrystalline Si coated with polypyrrole deteriorates less than 30% during 122 hr of irradiation whereas the unprotected bare electrode stops producing photocurrent within 30 s The polymer protection of the n-type single-crystal Si is significantly less than that of the polycrystalline material because of differences in the adhesion of the polymer film to the electrode surfaces The adhesion strength is shown to depend on various surface properties of Si and other electrode materials Moreover, the surface morphology of the electrode affects the topography of the growing surface of the polypyrrole film Requirements are discussed for the applications of organic conducting polymers to photoelectrochemical devices utilized for solar energy conversion DOE

N82-15571# Brookhaven National Lab., Upton, N Y Dept of Energy and Environment

COMPARATIVE THERMAL PERFORMANCE OF DIRECT GAIN, TROMBE, AND SUNSPACE WALLS

H T Ghaffari and R F Jones 1981 8 p refs Presented at the 6th Natl Passive Conf., Portland, Ore., 8-12 Sep 1981 sap

(Contract DE-AC02-76CH-00016)

(DE81-030546, BNL-29970, CONF-810925-21) Avail NTIS HC A02/MF A01

The natural thermal storage features of the Brookhaven superinsulated house were analyzed and verified These include the Trombe and sunspace passive-solar-collection walls and the superinsulated south-facing wall The thermal contributions of each system were demonstrated Several thermal characteristic factors, in relation to each design for the hourly and daily period, were assessed Further, the interior temperature fluctuations and the reductions in the required auxiliary energy with regard to incorporated passive designs were evaluated T M

N82-15572# Department of Energy, Washington, D C Office of the Assistant Secretary for Conservation and Renewable Energy

ANNUAL DOE ACTIVE SOLAR HEATING AND COOLING CONTRACTORS REVIEW MEETING

Sep 1981 286 p refs Proc of Conf held in Washington, D C, Sep 1981

(DE81-028052, CONF-810912) Avail NTIS HC A13/MF A01

Ninety three project summaries dicussing the following aspects of active solar heating and cooling are presented Rankine solar cooling systems, absorption solar cooling systems, desiccant solar cooling systems, solar heat pump systems, solar hot water systems, special projects (such as the National Solar Data Network, hybrid solar thermal/photovoltaic applications, and heat transfer and water migration in soils), administrative/management support, and solar collector, storage, controls, analysis, and materials technology DOE

N82-15575# California Univ., Berkeley Lawrence Berkeley Lab

INCREMENTAL COOLING LOAD DETERMINATION FOR

PASSIVE DIRECT GAIN HEATING SYSTEMS
Paul W. Sullivan, Douglas Mahone, Winslow Fuller, James Gruber, Ron Kammerud, Wayne Place, and Brandt Anderson May 1981 5 p refs Presented at the Am Sect. of the Intern Solar Energy Soc., Philadelphia, 27-30 May 1981
(Contract W-7405-eng-48)
(DE81-029882; LBL-12048, CONF-810509-40) Avail NTIS HC A02/MF A01

The applicability of the National Association of Home Builders (NAHB) full load compressor hour method for predicting the cooling load increase in a residence attributable to direct gain passive heating systems is examined The NAHB method predictions are compared with the results of 200 hour-by-hour simulations using BLAST, and the two methods show reasonable agreement The degree of agreement and the limitations of the NAHB method are discussed DOE

N82-15576# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
SERI SOLAR-ENERGY-STORAGE PROGRAM
Charles E Wyman Aug 1981 3 p refs Presented at the Ann. DOE Active Solar Heating and Cooling Contractors Rev Meeting, Washington, D C., 14-16 Sep 1981
(Contracts DE-AC02-77CH-00178, EG-77-C-01-4042)
(DE81-029476; SERI/TP-620-1344; CONF-810912-11) Avail NTIS HC A02/MF A01

The program provides research, system analysis, and assessments of thermal energy storage and transport in support of the Thermal Energy Storage Program of the DOE Division of Energy Storage Technology; emphasis is on thermal energy storage for solar thermal power and process heat applications and on thermal energy transport Currently, research is in progress on direct-contact thermal energy storage and thermochemical energy storage and transport In addition, SERI is directing the definition of new concepts for thermal energy storage and supporting research on thermal energy transport by sensible and latent heat media SERI is performing systems analyses of thermal energy storage for solar thermal application and coordinating thermal energy storage activities for solar applications DOE

N82-15577# California Univ., Berkeley Lawrence Berkeley Lab Energy and Environment Div
OVERVIEW OF ACTIVE SOLAR ABSORPTION/RANKINE COOLING PROGRAM
Michael Wahlig, Al Heitz, Harry Angerman, Ron Glas, and Mashun Warren Jul 1981 7 p Presented at the Active solar Contractors' Review Meeting, Washington, D C 9-12 Sep 1981, sponsored by DOE
(Contract W-7405-eng-48)
(DE81-028041; LBL-13054-Rev, CONF-810912-13) Avail NTIS HC A02/MF A01

The individual absorption and Rankine projects along with the main features and accomplishments/status of each and future plans were identified The absorption program, was three active component development projects, four systems field test projects, one advanced fluid study project and one advanced cycle study project Rankine program, includes five active component development projects, two system field test projects, and one advanced study project DOE

N82-15578# California Univ., Berkeley Lawrence Berkeley Lab Energy and Environment Div
VERIFICATION OF BLAST BY COMPARISON WITH MEASUREMENTS OF A SOLAR-DOMINATED TEST CELL AND A THERMALLY MASSIVE BUILDING
Brandt Andersson, Fred Bauman, William Carroll, Ronald Kammerud, and Nina Friedman Apr. 1981 12 p refs Presented at the 3rd Ann. Systems Simulation and Econ Anal Operational Results Conf., Solar Energy Div., Reno, Nev., 27 Apr - 1 May 1981, sponsored by ASME
(Contract W-7405-eng-48)
(DE81-029883, LBL-11387, CONF-810405-16) Avail NTIS HC A02/MF A01

Temperatures were compared in a direct solar gain test cell and temperatures were predicted. The comparisons were performed for two distinct climate period The test cell configuration and weather data manipulations, quantitative evaluations of the comparisons between measured and predicted interior temperatures, limitations of the comparisons, and sensitivities of the simulation results to uncertainties in the measured parameters are examined In the second study, comparisons of BLAST predictions to temperatures and loads measured in a massive structure were carried out The tests verifying the program's ability to (1) calculate full scale building loads, and (2) accurately model hybrid cooling using forced ventilation DOE

N82-15581# Los Alamos Scientific Lab., N Mex
USE OF OXIDE DECOMPOSITIONS IN ADVANCED THERMOCHEMICAL HYDROGEN CYCLES FOR SOLAR HEAT SOURCES. APPLICATION OF THE TRICOBALT TETRAOXIDE-COBALT MONOXIDE PAIR
W M Jones and M G. Bowman 1981 9 p refs Presented at Intern Energy Agency Annex 1 Workshop on Thermochem Hydrogen, Julich, West Germany, 23 Sep 1981
(DE81-030235, LA-UR-81-2628, CONF-810942-6) Avail NTIS HC A02/MF A01

The concept of utilizing oxide decompositions in advanced thermochemical hydrogen cycles for solar heat sources is introduced It allows direct transmission of energy to the process through an air window Reaction (2) gives a high concentration of MgI2 that would be favorable for (3) The solutions contain iodine dissolved as polyiodide, partly offsetting this advantage It is indicated that reaction (2) is slow at 150 C It is surmised that the mechanism of (2) consists of the iodine disproportionation reaction (6), followed by reaction (7) It was found that (6) was relatively fast and with a good yield at 150 C Reaction (7) is sufficiently slow at 150 C to account for the slowness of (2) The yield of (7) is proportional to the square root of the time, suggesting that iodate must diffuse through an adherent, accumulating C0304 layer DOE

03
HYDROGEN

Includes hydrogen production, storage, and distribution

A82-10398 **Hydrogen generation by means of catalyzed Mg-Al hydrolysis.** K. Hohne and P. Jager (Siemens AG, Forschungslaboratorien, Erlangen, West Germany). *Siemens Forschungs- und Entwicklungsberichte*, vol 10, no. 5, 1981, p. 323-326. 5 refs.

Based on considerations of reactivity, costs, and the volume of hydrogen which can be expected per mass fraction of metal, Al and Mg offer good possibilities in metal hydrolysis. Since these metals hardly react with water, however, a catalyst is used to accelerate the Mg-Al hydrolysis process. Experiments show that a mixture of Mg and Al reacts strongly with water in the presence of CO3O4, MoO3, and Cl-ions, with an optimum combination of all the participants in the reaction, the H2 yield can amount to 100% Various methods are discussed for constructing a hydrogen generator using this new method of metal hydrolysis. A hydrogen generator plant is described, in which pressed powder pellets are used. An aluminum-magnesium-cobalt oxide powder mixture is introduced into the reactor in the form of cylindrical pellets, which are pulverized in the reactor chamber. The powder falls into the salt water in the reactor and is converted. The hydrogen produced has a purity potentially greater than 99.9%. J.F.

A82-10966 # **A LH2 engine fuel system on board - Cold GH2 injection into two-stroke engine with LH2 pump** S Furuhama (Musashi Institute of Technology, Tokyo, Japan), Y Kobayashi, and M Iida *American Society of Mechanical Engineers and American Institute of Chemical Engineers, National Heat Transfer Conference, 20th, Milwaukee, WI, Aug 2-5, 1981, ASME Paper 81-HT-81* 10 p 14 refs. Members, $2 00, nonmembers, $4 00

An LH2-tank with a range of 400 km was installed in the rear trunk of a small passenger car in June, 1980 Tests demonstrated the overall feasibility of a hydrogen-fueled car the tank attained a maximum power 20% to 20% higher than its gasoline counterpart and about twice as high as those of premixed engines There was no backfire or knocking, and a very low NOx emission level was achieved by injecting -30 to -50 C cold hydrogen gas, pressurized by an LH2-pump, into the two-stroke engine. The LH2-pump was developed by the Musashi Institute of Technology, the barrel and the plunger are made of metal and a durable, low friction material, respectively The plunger clearance was reduced to about 3 microns under operating conditions, thereby making fuel leakage from the plunger clearance negligible. Proper tank pressures were obtained according to the pump speed The maximum speed of the car was recorded at 135 km/h Future objectives include the production of an engine with a higher compression ratio through the development of a high pressure pump having a discharge pressure above 6 MPa, and the improvement of the heat insulation performance of the LH2-tank. J.F.

A82-10968 # **Liquid hydrogen for automotive vehicles Experimental results.** W. Peschka (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Technische Physik, Vaihingen, West Germany) *American Society of Mechanical Engineers and American Institute of Chemical Engineers, National Heat Transfer Conference, 20th, Milwaukee, WI, Aug 2-5, 1981, ASME Paper 81-HT-83* 14 p. 21 refs. Members, $2 00, nonmembers, $4.00

A BMW-518 has been adapted for LH2-fuel, representing the first LH2-fueled car in Europe This is a joint program between the German Research and Testing Laboratory for Aeronautics and the Research Institute for Motor-Transport Service and Automotive Engines at the University of Stuttgart. The program was established for demonstration of successful car-operation and and the safe handling of LH2-fuel during car operation and refueling. Based on earlier papers, more recent test results and experiences are reported about car operation and engine performance The car has been driven over an accumulated distance of about 1800 km on a test track The test track consists of a loop of about 2.5 km in length, including a proper combination of straight level sections, curved sections and ascending sections. In order to demonstrate a safe liquid hydrogen refueling procedure that could also be used by untrained people, a semiautomatic computer operated refueling station has been developed This refueling station is in successful operation. (Author)

A82-11784 # **Improved efficiency in the sulfur dioxide - Iodine hydrogen cycle through the use of magnesium oxide.** C F V Mason and M G Bowman (California, University, Los Alamos, NM). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 2. New York, American Society of Mechanical Engineers, 1981, p 1411-1414 10 refs Research sponsored by the U S Department of Energy

The reaction of iodine with dry magnesium oxide and magnesium sulfite hexahydrate was studied experimentally as a possible means of improving the efficiency of the sulfur dioxide-iodine cycle. When no extra water was introduced, the maximum product yield was 67% obtained at 423 K With excess water vapor, a nonporous plug was formed which prevented complete reaction. In the second case, maximum yield was 62% measured at 423 K showing that added water does not increase reaction products This reaction gives an alternate route for producing hydrogen from water via the sulfur dioxide-iodine process (Author)

A82-11785 # **Parametric study of the cadmium thermoelectrochemical hydrogen cycle.** J D Schreiber and R. H Carty (Institute of Gas Technology, Chicago, IL). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 2 New York, American Society of Mechanical Engineers, 1981, p 1415-1419. 21 refs

Hydrogen production by thermochemical water-splitting has been proposed as an energy conversion process for using heat to produce a chemical fuel, hydrogen, from water One cyclic process of this type is based on the high-temperature thermal decomposition of cadmium oxide. To be efficient, this chemically simple cycle requires about 75% of its total energy input as nearly isothermal heat above 1500 K to drive the CdO decomposition step It appears, therefore, to be ideal for an employment in conjunction with a solar heat source capable of supplying nearly isothermal heat. Attention is given to the electrochemistry oxidation of cadmium, the thermal decomposition of cadmium hydroxide, and the thermal decomposition of cadmium oxide A description is given of a flow sheet analysis, taking into account evaluation studies conducted with the aid of a computer program G R

A82-11786 # **Alkaline solution water electrolysis - '81.** J. N Murray (Teledyne Energy Systems, Timonium, MD) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 2 New York, American Society of Mechanical Engineers, 1981, p 1420-1424 8 refs. Research supported by the U S Department of Energy.

During the last two years several improvements in the alkaline solution electrolysis technology have been implemented in form of practical hardware Attention is given to the catalyst system 'C-AN', alternative anode structures, a new proprietary anode electrocatalyst, alternates to the conventional chrysotile asbestos separator, the current status of hardware development, and the employment of simplistic and complex models for establishing the economics of hydrogen via water electrolysis G R

A82-11787 # **Development status of the General Electric solid polymer electrolyte water electrolysis technology.** L. J. Nuttall (General Electric Co., Wilmington, MA) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2 New York, American Society of Mechanical Engineers, 1981, p. 1425-1429.

The solid polymer electrolyte used by the considered technology is a thin sheet (5 to 10 mil thickness) of a sulfonated fluoropolymer. It is a high strength plastic material which serves as the sole electrolyte, and also forms a rugged barrier between the hydrogen and oxygen chambers. The electrodes consist of a thin catalyst layer bonded to the surfaces of the plastic sheet A

description is presented of a 60-cell module, operating at the normal design point of 1000 amps per square foot The module generates more than 2000 standard cubic feet per hour of hydrogen at a pressure of approximately 100 psig. Performance and cost projections are discussed. G.R.

A82-11788 # **Solar hydrogen system design considerations.** S. Lin, G H. Parker, and M E. Stella (Westinghouse Electric Corp., Advanced Energy Systems Div , Pittsburgh, PA) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2. New York, American Society of Mechanical Engineers, 1981, p. 1430-1435

Attention is given to the Sulfur Cycle, a hybrid thermochemical-electrochemical process for the production of hydrogen and oxygen from water. The process, in its most general form, consists of two chemical reactions. The net result of the process is the decomposition of water into hydrogen and oxygen The sulfur oxides are involved solely as recycling intermediates The electrical power needed is much smaller than the power required in conventional water electrolysis A description of the pressurized test unit is provided, and an investigation is conducted of key process variables G.R.

A82-11790 # **Lightweight hydrides for automotive storage of hydrogen.** D A. Rohy, J F. Nachman, and T. A. Argabright (Solar Turbines International, San Diego, CA) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 2 New York, American Society of Mechanical Engineers, 1981, p. 1444-1448 Research supported by the U.S Department of Energy.

The primary objectives of the considered investigations are related to the reduction of the dissociation temperature of lightweight materials, and the development of new lightweight hydrides containing little, if any, critical material. Attention is given to the characteristics of metal hydrides, the characteristics of a magnesium-base alloy which is to be employed in hydrogen storage systems for automobiles, aspects of alloy development, and the evaluation of magnesium hydride alloys with the aid of a hydride cycling rig. New information concerning the effect of cycling on magnesium alloys is discussed. G R

A82-11791 # **A study of factors influencing thermally induced backfiring in hydrogen fueled engines, and methods for backfire control.** C. A. MacCarley (Denver, University, Denver, CO). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2. New York, American Society of Mechanical Engineers, 1981, p. 1449-1453. 12 refs.

As an I.C engine fuel, hydrogen offers the advantages of no carbon compound exhaust emissions and high thermal efficiency. However, the problems of intake manifold backfire and decreased engine power output have been obstacles to automotive hydrogen use. Thermal causes of backfiring are investigated using a Cooperative Fuel Research engine and an electronically controlled, timed fuel injection system Correlation of backfiring and injection timing are reported It is concluded that both maintenance of low average in-cylinder temperatures and the use of some means for timed, delayed fuel delivery are essential to achieving backfire-free operation under all conditions A mechanical timed port injection system incorporating air flow controlled fuel metering is described as a means for providing delayed fuel delivery with variable injection timing Data are presented on the performance of a 2.6 liter, 4 cylinder engine using this system in naturally aspirated and turbocharged configurations (Author)

A82-11792 # **Small-scale uses and costs of hydrogen derived from OTEC ammonia.** G Strickland (Brookhaven National Laboratory, Upton, NY). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2. New York, American Society of Mechanical Engineers, 1981, p 1459-1467. 32 refs Research sponsored by the U.S Department of Energy.

Ocean Thermal Energy Conversion (OTEC) plantships could produce NH3 from air and water, using energy derived from thermal gradients in tropical oceans NH3 can serve both as a commodity, for the fertilizer and chemical industries, and as a liquid energy carrier for fuel use Attention is given to the economic prospects for using OTEC NH3 as a hydrogen transport and storage medium for small users who want to assess the purchase of hydrogen vs. the cost of producing hydrogen at their sites. Hydrogen is readily obtained from NH3 at the point of end use, by dissociation and purification as required, for use as a chemical commodity or fuel It is shown that high-purity H2 derived from OTEC NH3 might be competitive with H2 made at the point of end use via water electrolysis, or via steam reforming of natural gas G.R.

A82-11844 * # **The GA sulfur-iodine water-splitting process - A status report.** G E Besenbruch, H. D. Chiger, K H McCorkle, J. H Norman, J. S. Rode, J. R Schuster, and P. W Trester (General Atomic Co , San Diego, CA) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 3 New York, American Society of Mechanical Engineers, 1981, p 2143-2147. Research supported by the Gas Research Institute, Metal Properties Council, and General Atomic Co , Contracts No DE-AC02-80ET-26225, No. JPL-955263

The development of a sulfur-iodine thermal water splitting cycle is described The process features a 50% thermal efficiency, plus all liquid and gas handling. Basic chemical investigations comprised the development of multitemperature and multistage sulfuric acid boost reactors, defining the phase behavior of the HI/I2/H2O/H3PO4 mixtures, and development of a decomposition process for hydrogen iodide in the liquid phase. Initial process engineering studies have led to a 47% efficiency, improvements of 2% projected, followed by coupling high-temperature solar concentrators to the splitting processes to reduce power requirements. Conceptual flowsheets developed from bench models are provided, materials investigations have concentrated on candidates which can withstand corrosive mixtures at temperatures up to 400 deg K, with Hastelloy C-276 exhibiting the best properties for containment and heat exchange to I2 M S K.

A82-16346 **Halogen acid electrolysis in solid polymer electrolyte cells.** E. N Balko, J. F. McElroy, and A. B. LaConti (General Electric Co., Wilmington, MA). *International Journal of Hydrogen Energy*, vol. 6, no. 6, 1981, p. 577-587. 27 refs.

The use of solid polymer electrolyte systems has been extended to the electrolysis of aqueous HCl and HBr. The reduced internal losses in these cells permits the production of hydrogen and the halogen at an energy consumption considerably less than that reported previously. Data are presented for the operational characteristics of the solid polymer electrolyte acid electrolysers operating over a range of current densities, pressures, feedstock compositions, and temperatures. (Author)

A82-16347 **Mechanically stable hydride composites designed for rapid cycling.** E. E Eaton, C. E. Olsen, H. Sheinberg, and W. A. Steyert (Los Alamos National Laboratory, Los Alamos, NM). *International Journal of Hydrogen Energy*, vol 6, no. 6, 1981, p. 609-623. 18 refs.

A number of porous composites were prepared by combining LaNi5 with copper, aluminium, lead-tin solder, lead, and polyurethane. The preparation methods, hydrogen absorption, electrical and thermal conductivities, and kinetics of these mechanically stable, machinable composites are reported. (Author)

A82-16734 **Technological innovation for success - Liquid hydrogen propulsion.** J. L. Sloop (International Consultants on Energy Systems, Bethesda, MD) In Between Sputnik and the Shuttle - New perspectives on American astronautics. San Diego, CA, Univelt, Inc., 1981, p. 225-239 23 refs.

Hydrogen produces the highest exhaust velocity of all chemical fuels, thus producing the highest rocket velocities, but also has a low density, only one-quarter that of water The development of hydrogen as a rocket fuel was begun in the early 1900s, though experiments were few due to the difficulty of obtaining liquid hydrogen. Para- and orthohydrogen were discovered in 1926, and catalysts to prevent the natural conversion of para to ortho, which tended to boil away liquefied hydrogen, were invented in the 1950s. Rocket testing using liquid hydrogen began in the 1940s, and the demand for liquid hydrogen increased for testing of thermonuclear

weapons, although the supply of LH did not grow until the possibility for its use as a fuel for high altitude reconnaissance planes was investigated. Once NASA was created, the progress of an LH fueled stage for the Atlas rocket accelerated LH research, and led to NASA control of the development of the Saturn CV launch vehicle. An alternative use of liquid hydrogen as an automotive fuel is indicated. M.S K

A82-16784 Metal hydrides 1980; Proceedings of the International Symposium on the Properties and Applications of Metal Hydrides, Colorado Springs, CO, April 7-11, 1980. Volumes 1 & 2. Symposium sponsored by the U.S. Department of Energy, MPD Technology Corp., and Sandia National Laboratory. Edited by G. G. Libowitz (Allied Chemical Corp., Morristown, NJ) and G. D. Sandrock (Inco Research and Development Center, Suffern, NY). Lausanne, Elsevier Sequoia, S.A., 1980. Vol 1, 395 p., vol. 2, 485 p. Price of two volumes, $165.

Papers were presented on the thermodynamics, kinetics, and surface effects of hydrides, in addition to nuclear magnetic resonance and Mossbauer studies. Attention was also given to hydrides of Laves-phase intermetallics and superconductivity in hydrides. Crystal structures and phase relations in hydrides were examined, as were the physical and electronic properties of various hydrides and their band structure. The general theory of hydrides was explored, and further notice was made of miscellaneous hydride systems, applications of hydrides, and the behavior of hydrogen in metals. M.S.K.

A82-17129 Hydrogen from solar energy (Wasserstoff aus Sonnenenergie). W. Schnurnberger, W. Seeger, and H. Steeb (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur technische Physik, Stuttgart, West Germany). *DFVLR-Nachrichten,* Nov. 1981, p. 11-15. In German.

It is expected that, at some time in the foreseeable future, processes for obtaining hydrogen on the basis of a use of nonfossil energy will be economically feasible. Nonfossil energy sources considered are related to water power, nuclear energy, and solar energy. The current status of various approaches for the decomposition of water is examined, taking into account a supply of the required energy in form of heat, electric power, or light energy. At the present time only the technology of water electrolysis is sufficiently advanced to provide hydrogen on a large scale. Considerable improvements regarding current electrolysis technology with respect to efficiency and required capital costs should be possible within the foreseeable future. Approaches are considered to obtain the required electric power for the electrolysis with the aid of processes based on the utilization of solar cells. Attention is given to improved procedures for water electrolysis, and approaches for achieving optimal operational relations between solar-cell generators and electrolysis equipment. G.R.

A82-17130 The storage of hydrogen (Zur Wasserstoff-Speicherung). C. Carpetis (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur technische Physik, Stuttgart, West Germany). *DFVLR-Nachrichten,* Nov. 1981, p. 15-22. In German.

It is pointed out that a storage of hydrogen with the aid of conventional methods is technically feasible, taking into account the storage of hydrogen as a gas at higher pressures and its storage as a liquid. On the basis of the currently foreseeable production costs for hydrogen, an employment of conventional storage procedures appears acceptable. There are, in addition to the conventional methods, also a number of novel concepts for hydrogen storage. However, the practical feasibility of an employment of these concepts in connection with hydrogen production and distribution systems has still to be demonstrated. A brief description is presented of the conventional storage procedures. In connection with a discussion of the novel concepts, attention is given to a storage of hydrogen in the form of metal hydrides and approaches to store hydrogen with the aid of materials which adsorb it at low temperatures (60 to 100 K). A comparative study concerning the economics of the various storage procedures is also conducted. G.R.

A82-17131 The generation of current from hydrogen (Stromerzeugung aus Wasserstoff). H. J. Sternfeld, H. Wojkowsky, and K. Wolfmuller (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur chemische Antriebe und Verfahrenstechnik, Lampoldhausen, West Germany). *DFVLR-Nachrichten,* Nov 1981, p. 22-26. In German.

Factors regarding the storage of electrical energy and approaches to meet peak loads demands will become increasingly important in the future. A chemical storage of electrical energy in the form of hydrogen appears to offer a suitable approach to satisfy requirements related to these trends. For an implementation of such an approach, it will be necessary to solve the problem of an economical generation of electrical power from hydrogen. Procedures for such a generation of electric power can be divided into two categories, which are related to a use of fuel cells and an employment of steam or gas turbine processes. Suitable fuel cells can be based on a use of hydrogen and oxygen or an employment of hydrogen and air. The use of the power generation procedures of the second category involves a primary transformation of the chemical energy of the fuel into heat. A description is presented of an evaluation study regarding the different types of power stations. Attention is given to a possible technological employment of steam generators based on the use of hydrogen and oxygen in the 1980's. G.R.

A82-17132 Aspects concerning the safety of hydrogen (Sicherheitsaspekte des Wasserstoffs). M. Fischer and H. Eichert (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut für technische Physik, Stuttgart, West Germany). *DFVLR-Nachrichten,* Nov 1981, p. 33-37. In German.

Questions regarding the safety of operations and processes involving hydrogen arise in connection with the envisaged employment of hydrogen in a global energy system. A description is presented of an investigation in which physical-chemical characteristics and safety-technological parameters of hydrogen are compared with the corresponding data for methane and gasoline. An examination of the environmental effects related to a use of hydrogen as fuel shows that there are no pollutants in the case of terrestrial applications. The effects of an introduction of certain amounts of water vapor into the higher layers of the atmosphere would have to be considered in connection with an employment as aircraft fuel. Attention is given to ignition limits, the energy required for ignition, the combustion rate, density, ignition temperature, the diffusion coefficient, deflagration, detonation, storage, transportation, safety aspects regarding liquid hydrogen, experience related to an employment of hydrogen, hydrogen embrittlement, and further research required with respect to some aspects of safety technology. G.R.

A82-17150 Rechargeable metallic hydrides for hydrogen storage. H. C. Angus (MPD Technology, Ltd , Birmingham, England) *Physics in Technology,* vol. 12, Nov. 1981, p 245-250, 257. 5 refs.

The principles and methods of storing hydrogen in solid form in hydrides are examined. Hydrogen at certain temperatures and pressures is absorbed in large quantities by ternary hydride alloys, usually composed of Ti, Li, or Mg, with Fe and Ni Decreasing pressures, such as occur when the hydrogen gas is released, allow the flow of hydrogen from the solid. A plateau pressure is defined for the amount of heat required to 'fill' the hydride, and which is specific for each alloy. Properties of thermal conductivity, specific heat, the ability to absorb impurities, and volume change during hydriding affect the suitability of the hydriding material, and it is noted that most hydrides are brittle and must be chosen to not collapse into a powder during hydriding. Various hydrogen storage configurations are mentioned, with the largest static store now weighing a ton. M.S.K.

A82-17290 Liquid hydrogen - An outstanding alternate fuel for transport aircraft. W. M. Hawkins. In: Safe and efficient management of energy; Proceedings of the Thirty-third Annual International Air Safety Seminar, Christchurch, New Zealand, September 15-18, 1980. Arlington, VA, Flight Safety Foundation, Inc., 1980, p 270-295.

Liquid hydrogen is proposed as an excellent alternate aircraft fuel, owing to its worldwide availability, low cost, ability to be transported and stored without difficulty, and minimum impact on the environment. NASA compared the characteristics and performance of three aircraft using (1) synthetic Jet A, (2) liquid methane, and (3) liquid hydrogen. The liquid hydrogen aircraft was found to weigh considerably less than the others, thereby reducing the take-off gross weight. Every pound of hydrogen produces 51,590 BTU's, whereas a pound of Jet A produces only 18,400 BTU's.

Moreover the liquid hydrogen aircraft uses the least energy in spite of aerodynamic disadvantages of the aircraft and high energy needs for liquefaction and the manufacturing process. Liquid hydrogen also has a fly-over noise level of 89 decibels compared to the 94 decibels for the Synjet aircraft. A simple system of laminar flow maintenance using liquid hydrogen is discussed, and several safety features of the fuel are noted. J.F.

A82-18392 Thermochemical processes for hydrogen production by water splitting - From theory to practice. G. De Beni (Commission of the European Communities, Joint Research Center, Ispra, Italy). *(Electrochemical Society Meeting, Hollywood, FL, Oct. 5-10, 1980.) Electrochemical Society Journal*, vol. 129, Jan. 1982, p. 67-72. 27 refs.

Theoretical energy requirements for water splitting are well known. The values of Delta-H and Delta-S of 'ideal' chemical reactions suitable for thermochemical cycles can be computed. The chemists, however, must work with 'real' reactions. The constraints and the problems due to the 'nonideality' of reactions are discussed. These problems are: incertitude of thermodynamic data and phase diagrams; separation of excess water and other chemical products; low temperature side of the cycles; materials of construction, heat exchanges and heat coupling with available heat source. (Author)

N82-11223*# National Aeronautics and Space Administration, Washington, D C
TECHNICAL AND ECONOMIC ASPECTS OF HYDROGEN STORAGE IN METAL HYDRIDES
R Schmitt Sep 1981 44 p refs Transl into ENGLISH from Proc of the Intern Workshop on Hydrogen and its Perspectives, v 1, Liege, 1976 p 1-48 Presented at the Intern Workshop on Hydrogen and its Perspectives, Liege, 15-18 Nov 1976 Original language document was announced as A78-18842 Transl by Scientific Translation Service, Santa Barbara, Calif Original doc prep by Battelle Memorial Inst., Geneva
(Contract NASw-3198)
(NASA-TM-76610) Avail NTIS HC A03/MF A01 CSCL 21D

The recovery of hydrogen from such metal hydrides as LiH, MgH2, TiH2, CaH2 and FeTiH compounds is studied, with the aim of evaluating the viability of the technique for the storage of hydrogen fuel The pressure-temperature dependence of the reactions, enthalpies of formation, the kinetics of the hydrogen absorption and desorption, and the mechanical and chemical stability of the metal hydrides are taken into account in the evaluation Economic aspects are considered Development of portable metal hydride hydrogen storage reservoirs is also mentioned Author

N82-11225*# National Aeronautics and Space Administration, Washington, D C
THE STORAGE OF HYDROGEN IN THE FORM OF METAL HYDRIDES: AN APPLICATION TO THERMAL ENGINES
C Gales (Comm a l'Energie Atomique, Centre d'Etudes Nucl de Grenoble) and P Perroud (Comm a l'Energie Atomique, Centre d'Etudes Nucl de Grenoble) Aug 1981 39 p refs Transl into ENGLISH from Proceedings of the Assoc des Ingr Electriciens sortis de L'Inst Electrotech Montefiore, Belgium, v 1, 1977 p 1-34 Conf held at Liege, Belgium, 15-18 Nov 1976 Original language document was announced as A78-18845 Transl by Kanner (Leo) Associates, Redwood City, Calif
(Contract NASw-3199)
(NASA-TM-76609) Avail NTIS HC A03/MF A01 CSCL 21D

The possibility of using LaNi56, FeTiH2, or MgH2 as metal hydride storage sytems for hydrogen fueled automobile engines is discussed Magnesium copper and magnesium nickel hydrides studies indicate that they provide more stable storage systems than pure magnesium hydrides Several test engines employing hydrogen fuel have been developed a single cylinder motor originally designed for use with air gasoline mixture, a four-cylinder engine modified to run on an air hydrogen mixture, and a gas turbine S L

N82-11257# Brookhaven National Lab., Upton, N Y
FUSION AS A SOURCE OF SYNTHETIC FUELS
J R Powell, J A Fillo, and M Steinberg 1981 10 p refs Presented at the Energy in the Man-Built Environ The Next Decade Specialty Conf., Vail, Colo., 3 Aug 1981
(Contract DE-AC02-76CH-00016)
(BNL-29281, CONF-810808-2) Avail NTIS HC A02/MF A01

Efficient production of hydrogen-based fuels from fusion is addressed Water splitting reactions discussed include high temperature electrolysis of steam, thermochemical cycles, hybrid electrochemical/thermochemical, and direct thermal decomposition High temperature electrolysis appears to be the simplest and most efficient process with efficiencies of 50 to 70% (Fusion to hydrogen chemical energy), depending on process conditions DOE

N82-11262# Los Alamos Scientific Lab., N Mex
HYDROGEN STORAGE-BED DESIGN FOR TRITIUM SYSTEMS TEST ASSEMBLY
Hatice S Cullingford, Michael G Wheeler, and John W McMullen 1981 18 p refs Presented at the Intern Symp on Metal-Hydrogen Systems, Miami Beach, Fla., 13-15 Apr 1981
(Contract W-7405-eng-36)
(DE81-025336, LA-UR-81-1906, CONF-810497-1) Avail NTIS HC A02/MF A01

The Los Alamos National Laboratory complete the design of a hydrogen storage bed for the Tritium Systems Test Assembly (TSTA) Our objective is to store hydrogen isotopes as uranium hydrides and recover them by dehydriding The specific use of the storage bed is to store DT gas as U(D,T)3 when it is required for the TSTA The hydrogen storage bed consists of a primary container in which uranium powder is stored and a secondary container for a second level of safety in gas confinement The primary container inlet and outlet gas lines, cartridge heaters, and instrumentation are assembled in the secondary container The design of the hydrogen storage bed is presented, along with the modeling and analysis of the bed behavior during hydriding-dehydriding cycles DOE

N82-12266# Chemische Werke, Huels (West Germany) Marketforschung
ASSESSMENT OF POTENTIAL FUTURE MARKETS FOR THE PRODUCTION OF HYDROGEN FROM WATER Final Report
Helmut Kalenda and Gerhard Ruckelshauss Bonn Bundesministerium fuer Forschung und Technologie Jan 1981 232 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-012, ISSN-0340-7608) Avail NTIS HC A11/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 39,60

The market potential of hydrogen as a chemical raw material and a secondary energy carrier in the Federal Republic of Germany was assessed for various market sectors for the period from 1985 to 2025 The present status of research and technology is depicted The hydrogen demand in the market sectors of chemistry, petroleum refining industry, steel production, energy, and transport are assessed Hydrogen production costs for different actual and future technologies are asessed and compared with the production of competing energy carriers, including nuclear high temperature heat The anticipated demand of hydrogen, broken down according to market sectors is given for the years 1985, 2005 and 2025, taking into account the development of the national and global energy demand Eight technologies for the production of hydrogen and four technologies for the production of synthetic natural gas are compared, both technically and economically Hydrogen from high temperature electrolysis of steam is expected to enter the market as a competitive energy carrier not before 2015 to 2025 Author (ESA)

N82-14382# Brookhaven National Lab., Upton, N Y
DEVELOPMENT OF A METAL HYDRIDE PROCESS FOR HYDROGEN RECOVERY FROM SUPPLEMENTED NATURAL GAS
F Reidinger and F B Hill 1981 6 p refs Presented at the 2nd World Congr of Chem Engr., Montreal, Canada, 4 Oct 1981
(Contract DE-AC02-76CH-00016)
(DE81-022685, BNL-29461, CONF-811007-4) Avail NTIS HC A02/MF A01

A metal hydride hydrogen recovery process which has commercially attanable pretreatment requirements, a thermal reactivation procedure with temperatures not exceeding 500 C with reactivation rquired at intervals of 100 absorption desorption cycles, and an alloy lifetime of the order of 70,000 cycles is described Mercaptan-alloy interactions are considered The

interaction of CO with the alloy in the presence of hydrogen appears quite complicated The present work indicates that CO 2 concentrations up to 500 ppM may have negligible effect on the rate of hydrogen absorption after an initial exposure to CO2 and hydrogen If a slower hydrogen sorption rate can be tolerated then higher CO2 levels may be acceptable DOE

N82-15220# Brookhaven National Lab., Upton, N Y Dep.. of Energy and Environment

SYSTEMS ANALYSIS OF HYDROGEN/NATURAL GAS SUPPLEMENTATION AND SEPARATION

M. Beller, J DAcierno, and A Hermelee Apr 1981 6 p refs Presented at the 2nd World Congr of Chem Eng., Montreal, Oct 1981

(Contract DE-AC02-76CH-00016)

(DE81-021383; BNL-29520, CONF-811007-5) Avail NTIS HC A02/MF A01

Specific potential markets for hydrogen are investigated and then examines the mix of customers comprising these markets The pipeline infrastructure, its capability for use to store and transmit hydrogen, and the incentives and drawbacks in this area are studied There is sufficient use of both hydrogen and natural gas in potential hydrogen-consuming industries to overcome the problem of reinjection of natural gas into the pipeline after separation DOE

N82-15231# Futures Group, Glastonbury, Conn

AN ASSESSMENT OF NONFOSSIL HYDROGEN Final Report

E Fein and T Munson Dec 1980 221 p refs Prepared for Gas Research Inst.

(GRI Proj 50 14-310-0274)

(PB81-246522; GRI-79/0108) Avail NTIS HC A10/MF A01 CSCL 21D

The potential for hydrogen produced from nonfossil energy sources as an energy carrier is examined Water electrolysis, thermochemical systems, and various solar radiation processes are evaluated as hydrogen production methods. Long-term and short-term hydrogen storage technologies were also considered. Various possible hydrogen end-uses were appraised, including its role as an industrial chemical, a heating fuel for stationary applications, a vehicular fuel, and an aircraft fuel. The role of coal in future hydrogen production was seen as providing the major competitive technology to nonfossil hydrogen production. Conditions (constraints placed on the use of natural fossil fuels an synthetic fossil fuels) under which hydrogen might be produced primarily from nonfossil energy sources are analyzed. A possible scenario was suggested for the transition to a nonfossil energy era, and areas where hydrogen could be expected contribute to domestic energy needs were indicated GRA

N82-15542# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany) Inst fuer Technische Physik

HYDROGEN AS CARRIER OF SECONDARY ENERGY: PROPOSAL FOR A RESEARCH AND DEVELOPMENT PROGRAM

H Buhl, C Carpetis, J. Nitsch, W Peschka, T Schott, W. Seeger, W Schnurnberger, H Steeb, and H J Sternfeld Jun. 1981 94 p refs In GERMAN, ENGLISH summary Report will also be announced as translation (ESA-TT-732)

(DFVLR-Mitt-81-10) Avail NTIS HC A05/MF A01; DFVLR, Cologne DM 14.20

The nuclear or solar production of hydrogen may become economically attractive in the future The technological problems of the production and the introduction of hydrogen into the energy system are shown Suitable research development efforts are recommended to achieve a complete ensured scope of knowledge concerning hydrogen systems A.R.H.

04
FUELS AND OTHER SOURCES OF ENERGY

Includes fossil fuels, nuclear fuels, geothermal and ocean thermal energy, tidal energy, and wind energy

A82-10372 **Reduced heat flow - Mean heat flow relationship for the continental geothermal provinces.** S Maj (Polska Akademia Nauk, Instytut Geofizyki, Warsaw, Poland). *Acta Geophysica Polonica*, vol. 28, no. 3, 1980, p 233-240 10 refs.

A82-10965 # **Fuel for future transport aircraft.** G. D. Brewer (Lockheed-California Co., Burbank, CA). *American Society of Mechanical Engineers and American Institute of Chemical Engineers, National Heat Transfer Conference, 20th, Milwaukee, WI, Aug. 2-5, 1981, ASME Paper 81-HT-80.* 8 p. 6 refs. Members, $2.00; nonmembers, $4.00.

Despite attempts at conservation and the development of synthetic aviation-grade kerosene from alternative fossil fuel materials, it is widely recognized that alternatives to conventional petroleum-base aircraft fuels must become available in the near future The present paper discusses the prospects for liquid hydrogen as a future fuel for transport aircraft. Advantages of liquid hydrogen over synthetic fuels and liquid methane as alternative fuels in the areas of availability, safety, pollution, relative energy efficiency as a function of trip length and aircraft weight, overall costs and airport compatibility are considered The possible requirements for a development program aimed at preparing liquid hydrogen for use in operational aircraft are examined, and the probable time characteristics of fuel use during the transition to liquid hydrogen, which may significantly replace synthetic fuels by the year 2000, are considered A comprehensive plan for liquid hydrogen fuels R&D is then presented which is currently being considered for implementation on an international basis A.L.W.

A82-11033 **One-dimensional model of vapor-dominated geothermal systems.** J. M Straus (Aerospace Corp., Space Sciences Laboratory, Los Angeles, CA) and G Schubert (Aerospace Corp., Space Sciences Laboratory, California, University, Los Angeles, CA). *Journal of Geophysical Research*, vol. 86, Oct. 10, 1981, p. 9433-9438. 15 refs. NSF Grant No. ENG-76-82119.

A one-dimensional model of vapor-dominated geothermal systems in the natural state is developed in order to study the ranges of the heat and mass transport and flow resistance at which a system is capable of existing in the vapor-dominated state The model consists of a near-surface condensate layer lying above a two-phase counterflow region with rising steam and descending water in a porous saturated medium. Examination of models with condensate layers several hundred meters thick and reservoir temperatures near 513 K, characteristic of real systems, reveals them to have net mass flow rate/thermal conductivity ratios less than about 2 5 x 10 to the -7th K sec-squared/cu m and permeability/thermal conductivity ratios greater than 4.5 x 10 to the -17th m sec-cubed K/kg. Application of the model to the temperature and pressure data for the main reservoir of the Kawah Kamojang geothermal system in West Java indicates a permeability/thermal conductivity ratio between 10 to the -15th and 10 to the -14th m sec-cubed K/kg, or a permeability between 4 and 40 mdarcy for a thermal conductivity of 4 J/m per sec per K Results also require the existence of a lower permeability cap overlying the higher permeability main reservoir in order to stabilize the water layer above the steam region. A.L W.

A82-11834 # **Present status of Florida Power Corporation's D.O.E. funded feasibility study of the Higgins plant repowering/coal gasification project.** M. H. Kleinman (Florida Power Corp., St. Petersburg, FL) and E. Lechpammer (Stone and Webster Engineering Corp., Boston, MA) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 3. New York, American Society of Mechanical Engineers, 1981, p 2086-2090 Research supported by the U.S Department of Energy.

A82-11835 # **Status report on Central Maine Power Company's DOE Funded feasibility study of the Sears Island integrated gasification combined cycle power plant.** R. E Cummings and P C. Hastings (Central Maine Power Co , Augusta, ME) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 3 New York, American Society of Mechanical Engineers, 1981, p. 2091-2095. Research supported by the U.S Department of Energy.

A82-11836 # **Coal fired air turbine cogeneration.** R W Foster-Pegg (Westinghouse Electric Corp , Pittsburgh, PA) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 3

New York, American Society of Mechanical Engineers, 1981, p 2103-2108. 7 refs

Fuel options and generator configurations for installation of cogenerator equipment are reviewed, noting that the use of oil or gas may be precluded by cost or legislation within the lifetime of any cogeneration equipment yet to be installed A coal fueled air turbine cogenerator plant is described, which uses external combustion in a limestone bed at atmospheric pressure and in which air tubes are sunk to gain heat for a gas turbine The limestone in the 26 MW unit absorbs sulfur from the coal, and can be replaced by other sorbents depending on types of coal available and stringency of local environmental regulations Low temperature combustion reduces NOx formation and release of alkali salts and corrosion The air heat is exhausted through a heat recovery boiler to produce process steam, then can be refed into the combustion chamber to satisfy preheat requirements All parts of the cogenerator are designed to withstand full combustion temperature (1500 F) in the event of air flow stoppage Costs are compared with those of a coal fired boiler and purchased power, and it is shown that the increased capital requirements for cogenerator apparatus will yield a 2 8 year payback Detailed flow charts, diagrams and costs schedules are included M S K

A82-11837 # **Enthanol fuels from biomass projects.** B C. B Hsieh In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9 14, 1981, Proceedings Volume 3 New York, American Society of Mechanical Engineers, 1981, p 2109-2111.

About 100 projects are proposed or underway to convert organic crops such as corn and grains or waste organic material into a clean usable ethyl alcohol fuel Total production capacity could reach more than two billion gallons per year in 1985, excluding beverage and industrial uses Congressional appropriation of approximately one-half billion dollars to DOE/USDA for loan guarantees and federal and state laws exempting excise taxes can make this ethanol fuel from biomass possible. An overview and status of the projects will be reviewed Net energy production of ethyl alcohol from biomass and the impacts of increasing alcohol fuel use will also be discussed. (Author)

A82-11848 # ***An overview of peat gasification.*** D. V. Punwani (Institute of Gas Technology, Chicago, IL). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 3. New York, American Society of Mechanical Engineers, 1981, p. 2172-2177. 21 refs.

Thermal and biological peat gasification processes are reviewed, with research showing that peat is high in both oxygen and hydrogen, and also nitrogen, which can be used to form ammonia as a byproduct. The hydrogen-carbon ratio of peat has been shown to exceed that of subbituminous coal, indicating less of a need to supply more hydrogen in the formation of gaseous fuels. The gasification process involves crushing the peat into particles smaller than 2 mm, which cascade through drying air into a gasifier, where gases from the hydrogasifier induce hydropyrolysis. The char then flows into a reactor with steam and oxygen to make synthesis gas. Minnesota peat has shown the highest hydrocarbon yields in the U.S., and economic comparisons show peak gasification has economic parity with other means of producing SNG. Experiments have

also shown the feasibility of wet peat conversion using a peat-water slurry in an anaerobic digestor to produce methane. Building of pilot plants is suggested as necessary to verify existing processes. M.S.K.

A82-11849 # **Production of synthetic crude oil from coal using the TOSCOAL pyrolysis process.** D. H Cortex and C. J. LaDelfa (Tosco Corp., Los Angeles, CA). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 3. New York, American Society of Mechanical Engineers, 1981, p. 2178-2183.

A82-11850 # **An overview of fluidized-bed combustion /FBC/ design practice.** J.-Y Shang, J E. Notestein, and J. S. Mei (U S. Department of Energy, Morgantown Energy Technology Center, Morgantown, WV). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 3. New York, American Society of Mechanical Engineers, 1981, p. 2184-2191.

A short history of fluidized bed coal combustion is provided, noting that addition of a limestone bed contributes to sulfur retention, and comparisons are made with stoker and pulverized bed boilers. Advantages to fluidized bed combustion (FBC) are given as the thermal inertia of the limestone bed, inherent vigorous mixing for turbulent, efficient combustion, and larger particle size than in a catalytic cracker Major components of an FBC are described, including windbox, distributor, feeder system, combustion chamber, bed material drainage, and primary dust recovery system Fundamental differences between FBC and conventional boiler technology are stressed and design considerations for an FBC are listed with explanations. Recirculation of fly ash is shown to be effective only with an in-combustor vortex, which returns the ash to the flame before it has time to cool. Finally, ongoing experiments to determine the relative usefulness of burning various alternate fuels such as shales, lignite, and shredded tires in an FBC are reported M.S.K.

A82-11851 # **Application of HTGR process heat to oil shale retorting.** D. C. Wadekamper, I. N. Taylor, T. E. Gleason (General Electric Co., Pleasanton, CA). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 3. New York, American Society of Mechanical Engineers, 1981, p. 2192-2197.

The currently developed oil shale retorting processes depend on some portion of their product to provide heat energy for process operation. In an attempt to increase the fossil fuel reserves of the United States, as well as decrease environmental pollution, it has been suggested that an High Temperature Gas Reactor (HTGR) be used to supply the heat necessary for the retorting oil shale thus freeing additional petroleum products for sale. The TOSCO II process was selected as a typical oil shale retorting process and a detailed evaluation of the energy requirements was made. Various scenarios to replace selected portions of the process energy requirements with HTGR generated heat are described. The improvements in product yields and reductions in environmental pollution levels associated with a HTGR process heat scheme are summarized. (Author)

A82-12021 † **Jet fuel from carbon (Reaktivnoe toplivo iz uglia).** A A. Krichko, M K Iulin, A C Arifulin, T C Nikiforova, and V. A. Puchkov (Akademiia Nauk SSSR, Institut Goriuchikh Iskopaemykh, Moscow, USSR). *Khimiia i Tekhnologiia Topliv i Masel,* no. 9, 1981, p. 3-5. 8 refs In Russian.

A jet fuel of the T-8V type has been obtained by isomerization and hydrogenation at 4 MPa of the hydrorefined 180-320 C fraction of a liquid-phase carbon hydrogenation product The flow scheme and the material balance of the process are presented. V.L.

A82-12022 † **A protective additive for jet fuels (Zashchitnaia prisadka k reaktivnym toplivam).** O P. Lykov, G I. Shor, V P Lapin, V. V. Sashevskii, and L. I. Mosina (Moskovskii Institut Neftekhimicheskoi i Gazovoi Promyshlennosti, Moscow, USSR). *Khimiia i Tekhnologiia Topliv i Masel,* no 10, 1981, p 37-40. 6 refs In Russian

A study has been carried out to investigate the protective action of an additive to jet fuels which consists of a mixture of dimers and trimers of synthetic fat acids. Results indicate that there exists a correlation between changes in the protective properties of the fuel as a function of the additive content, on the one hand, and changes in certain electrophysical characteristics of the fuel (e.g., conductivity, contact potential difference change, and electrifiability), on the other hand. V.L.

A82-12275 **Geothermal systems: Principles and case histories.** Edited by L Rybach (Zurich, Eidgenossische Technische Hochschule, Zurich, Switzerland) and L J P Muffler (U.S Geological Survey, Menlo Park, CA) Chichester, Sussex, England and New York, Wiley-Interscience, 1981. 371 p $61 95.

The classification of geothermal systems is considered along with the geophysical and geochemical signatures of geothermal systems, aspects of conductive heat transfer and regional heat flow, and geothermal anomalies and their plate tectonic framework. An investigation of convective heat and mass transfer in hydrothermal systems is conducted, taking into account the mathematical modelling of hydrothermal systems, aspects of idealized convective heat and mass transport, plausible models of geothermal reservoirs, and preproduction models of hydrothermal systems Attention is given to the prospecting for geothermal resources, the application of water geochemistry to geothermal exploration and reservoir engineering, heat extraction from geothermal reservoirs, questions of geothermal resource assessment, and environmental aspects of geothermal energy development. A description is presented of a number of case histories, taking into account the low enthalpy geothermal resource of the Pannonian Basin in Hungary, the Krafla geothermal field in Northeast Iceland, the geothermal system of the Jemez Mountains in New Mexico, and extraction-reinjection at the Ahuachapan geothermal field in El Salvador G R

A82-12400 **Energy from biomass and wastes V; Proceedings of the Fifth Symposium, Lake Buena Vista, FL, January 26-30, 1981.** Symposium sponsored by the Institute of Gas Technology. Chicago, Institute of Gas Technology, 1981. 1100 p $75

Papers are presented in the areas of biomass production and procurement, biomass and waste combustion, gasification processes, liquefaction processes, environmental effects and government programs Specific topics include a water hyacinth wastewater treatment system with biomass production, the procurement of wood as an industrial fuel, the cofiring of densified refuse-derived fuel and coal, the net energy production in anaerobic digestion, photosynthetic hydrogen production, the steam gasification of manure in a fluidized bed, and biomass hydroconversion to synthetic fuels Attention is also given to the economics of deriving alcohol for power applications from grain, ethanol fermentation in a yeast-immobilized column fermenter, a solar-fired biomass flash pyrolysis reactor, particulate emissions from controlled-air modular incinerators, and the DOE program for energy recovery from urban wastes A.L.W

A82-12531 **U.S. Department of Energy liquid synfuels overview.** E. J Lievens, Jr. (U.S. Department of Energy, Washington, DC) In The year of the Shuttle, Proceedings of the Eighteenth Space Congress, Cocoa Beach, FL, April 29-May 1, 1981. Cocoa Beach, FL, Canaveral Council of Technical Societies, 1981, p. 3-1 to 3-17

The U.S. Department of Energy (DOE) has been participating in four programs to convert coal to liquid synfuels through direct liquefaction: the Solvent Refined Coal programs (SRC-I and SRC-II), the Exxon Donor Solvent Pilot Plant, and the Ebullated-Bed Pilot Plant (H-coal). The processes, products, and technical status of each of the DOE liquefaction programs are described. The Administration's proposal to discontinue DOE activities in these programs, while assisting industrial participants, is discussed. Finally, the results of DOE studies of industrial needs to implement a major coal derived liquid synfuel program are summarized. Results predict that resources are adequate to develop a capacity of liquid fuels equal to a million barrels/day by the year 2000, the impediments to increasing this capacity to three million barrels/day in that time span are identified J.F.

A82-12533 **Biomass resources for alcohol fuels.** J. E. MacDowell (Planning Research Corp., Cocoa Beach, FL). In The year of the Shuttle, Proceedings of the Eighteenth Space Congress, Cocoa Beach, FL, April 29-May 1, 1981. Cocoa Beach, FL, Canaveral Council of Technical Societies, 1981, p. 3-42 to 3-63. 20 refs.

The production of alcohol fuel from biomass represents a fast and practical means of adding to the dwindling petroleum supply. The biomass feed-stocks which will feed the alcohol distilleries must be carefully selected. Using food chain biomass crops for conversion to alcohol will cause a reduction in the amount of food available and increase the cost of food and alcohol feedstocks. The food chains should not be drastically interrupted, and agricultural economic balances should not be altered. Various alternatives to alcohol production are presented, which lie within the confines of selected biomass feedstocks and will not interrupt normal agricultural activities. A corn processing and distillation process is shown graphically as an example, the biomass to alcohol conversion potential of feedstocks is given, and the potential cropland for conversion in the U.S.A. is shown as a percentage of the nation's total land area. J.F.

A82-12888 Study of the electric conductivity of plasma from fuel combustion products containing a weakly ionizing impurity. E. K. Chekalin, V. A. Tishchenko, and I. B. Rozhdestvenskii (Gosudarstvennyi Nauchno-Issledovatel'skii Energeticheskii Institut, Moscow, USSR) *(Teplofizika Vysokikh Temperatur,* vol 19, Mar - Apr. 1981, p 225-229.) *High Temperature,* vol. 19, no 2, Sept. 1981, p. 159-163 12 refs. Translation.

The Q factor of a high-frequency circuit is measured to determine experimentally the electric conductivity of a combustion-product plasma using high-ash coals with potassium impurities at the outlet of a high-temperature cyclonic combustion chamber The electric conductivity of the plasma formed from the combustion products of the coal is calculated under conditions comparable to the experimental conditions. Calculations are carried out both for a completely equilibrium composition, taking into account condensed compounds of potassium with aluminum and silicon oxides, and for a 'frozen' composition in which potassium compounds of this type are neglected C.R.

A82-14008 # Implementation of a siting methodology for utility size WECS in western Massachusetts and northwestern Connecticut. R. H. Kirchhoff and F. C. Kaminsky (Massachusetts, University, Amherst, MA). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2540.* 10 p. 11 refs.

This paper describes a long term research project by Northeast Utilities and the University of Massachusetts to identify candidate sites for utility size wind energy systems in Western Massachusetts and Northwestern Connecticut. A generalized methodology is described for identifying the candidate sites. This methodology includes the use of biological wind prospecting, data collection with TALA kites, computerized wind mapping with MATHEW, and the installation of long run data collection stations. This paper also describes the use of a mass consistent flow model known as MATHEW in developing computerized wind maps for selected regions of the area under study. (Author)

A82-14395 # Aviation gasoline versus automotive gasoline. K. J Biehl (FAA, Technical Center, Atlantic City, NJ). *American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Conference, Dayton, OH, Aug. 11-13, 1981, Paper 81-1705.* 4 p. 5 refs.

FAA research on aviation gasoline versus automotive gasoline is reviewed, noting regulations governing engine/aircraft fuel systems. The research has shown that from the antiknock/octane rating standpoint, only aviation grade 80/87 fuel may be replaced by autogas. Fuel-system vapor lock is identified as a major problem requiring definition by aircraft fuel system design relative to operational limitations. Future testing will evaluate both high-wing and low-wing systems to investigate material incompatibility and corrosion; antiknock, preignition and deposit ignition, engine durability and spark-plug operation. S.C.S.

A82-14986 Fuels from biomass and wastes. Edited by D L. Klass (Institute of Gas Technology, Chicago, IL) and G. H. Emert (Arkansas, University, Fayetteville, AR). Ann Arbor, MI, Ann Arbor Science Publishers, Inc., 1981. 602 p. $39.95.

The production, use, and effects of fuels from biomass and waste energy sources are discussed. Biomass procurement from silviculture, including hybrid poplar and sycamore farms, in addition to the growth of mass algal culture and Jerusalem artichokes for fuels are considered. The conversion of biomass and solid waste materials through biological and thermal gasification, hydrolysis and extraction, and fermentation to produce ethanol, along with natural and thermal liquefaction processes involving euphorbia lathyris and cellulosic materials are elaborated. Environmental and health aspects of biomass and waste conversion systems are outlined, noting the large land surface areas needed for significant contributions to total demands from biomass, specific instances and case studies are reviewed for biomass use in Indiana, the Dominican Republic, the southeast U.S., and in small wood stoves. M.S.K.

A82-15722 † Optimization of the composition and antidetonation properties of AI-93 gasoline (Optimizatsiia komponentnogo sostava i antidetonatsionnykh svoistv benzina AI-93). B A Englin, Iu. N Nilov, V E Emel'ianov, and G. E. Levinson (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Neftianoi Promyshlennosti, Moscow, USSR). *Khimiia i Tekhnologiia Topliv i Masel,* no. 11, 1981, p. 19-23. 7 refs. In Russian

The antidetonation properties of AI-93 gasoline are examined and compared with detonation specifications on automobiles manufactured by the VAZ plant. It is shown that the octane number of AI-93 may be reduced by optimizing its composition. Results of an evaluation of 90-91-octane gasolines containing methyl-tert-butyl ether are presented. V.L.

A82-17007 Comparison of Michigan Basin crude oils. E. A. Vogler (Indiana, University, Bloomington, IN), P. A. Meyers (Michigan, University, Ann Arbor, MI), and W. A Moore (Central Michigan University, Mt. Pleasant, MI). *Geochimica et Cosmochimica Acta,* vol. 45, Nov. 1981, p 2287-2293. 24 refs Grant No. NGR-15-003-118.

Michigan Basin oils from the Ordovician Trenton, Silurian Niagaran, and Devonian Dundee formations have been geochemically compared by GC, GC-MS, and carbon isotope mass spectrometry. One oil from each formation was selected for detailed analysis which included measurement of individual n-alkane delta 13 C values. The Ordovician and Devonian oils are strikingly similar to one another, yet clearly different from the Silurian oil. This pattern is unexpected because Ordovician and Devonian reservoirs are physically separated by the Silurian strata. From time-temperature considerations, the Devonian oil probably was formed in older strata and has migrated to its present location. Our analyses suggest a common source for the Devonian and Ordovician oils (Author)

A82-17632 # Characteristics of vertical wind profiles. B. H. Bailey (New York, State University, Albany, NY). In: American Wind Energy Association, National Conference, Pittsburgh, PA, June 8-11, 1980, Proceedings. Washington, DC, American Wind Energy Association, 1980, p. 49-54. 10 refs. Research supported by the New York State Energy Research and Development Authority.

Results of vertical wind profile studies of four sites with similar surface roughness lengths in New York state are reported. Anemometry at several levels supplied 20 sec, one minute, and 15 minute interval readings covering 1-2 yr. Average power law coefficients for all sites were determined for different stability classes, i.e. lapse rate intervals expressing temperature changes with heights. Diurnal characteristics were determined as stable conditions dominating during the night while neutral and unstable conditions dominate during the day, when higher winds were measured. The power law coefficients were therefore large at night and low in daytime. Similarities in the power law coefficients are taken as evidence that vertical wind profile characteristics are not necessarily site specific, and the 1/6 or 1/7 power law is adequate in wind regimes of 7 m/sec or greater. M.S.K.

A82-17645 # Wind energy and the Nation's rural electric systems. W. Prichett, III (National Rural Electric Cooperative Association, Washington, DC). In: American Wind Energy Association, National Conference, Pittsburgh, PA, June 8-11, 1980, Proceedings. Washington, DC, American Wind Energy Association, 1980, p. 144-149.

A82-17974 The corrosion of some superalloys in contact with coal chars in coal gasifier atmospheres. D. L. Douglass

(California, University, Los Angeles, CA), V. S. Bhide (IBM Corp., San Jose, CA), and E. Vineberg (Climax Molybdenum Co., Ann Arbor, MI). *Oxidation of Metals*, vol. 16, Aug. 1981, p. 29-79. 7 refs.

A82-18114 **Biomass conversion processes for energy and fuels.** Edited by S. S. Sofer (Oklahoma University, Norman, OK) and O. R. Zaborsky (NSF, Washington, DC). New York, Plenum Press, 1981. 434 p. $49.50.

The book treats biomass sources, promising processes for the conversion of biomass into energy and fuels, and the technical and economic considerations in biomass conversion. Sources of biomass examined include crop residues and municipal, animal and industrial wastes, agricultural and forestry residues, aquatic biomass, marine biomass and silvicultural energy farms. Processes for biomass energy and fuel conversion by direct combustion (the Andco-Torrax system), thermochemical conversion (flash pyrolysis, carboxylolysis, pyrolysis, Purox process, gasification and syngas recycling) and biochemical conversion (anaerobic digestion, methanogenesis and ethanol fermentation) are discussed, and mass and energy balances are presented for each system. A.L.W.

A82-18122 **Alternate fuels; Proceedings of the International Congress and Exposition, Detroit, MI, February 23-27, 1981.** Congress and Exposition sponsored by the Society of Automotive Engineers. Warrendale, PA, Society of Automotive Engineers, Inc. (SAE Proceedings SP-480), 1981. 255 p. $24.95.

Alternative fuels for use in diesel engines are reviewed, and specific mention is made of multicylinder diesel engine tests with unstabilized water-in-fuel emulsions, fuel nitrogen conversion, performance, and emission characteristics of blended SRC-II in a high-speed diesel engine, and a diesel engine running on raw coal-diesel fuel slurries. Attention was also given to ethanol fuel in regards to efficiency and exhaust emissions, heavy duty truck operation on unstabilized methanol/diesel fuel emulsions, and the road performance of a diesel vehicle with a supplementary carburation of alcohol. The use of hydrogen fuels in automobiles is considered, along with onboard hydrogen generation for hydrogen injection into internal combustion engines, hydrogen fueled-vehicle testing to provide a data base, and liquid hydrogen onboard storage and servicing. M.S.K.

N82-10115 Louisiana State Univ and A&M Coll., Baton Rouge
METHANE PRODUCTION FROM ALKALINE FOOD WASTE Ph.D. Thesis
Wilson Thomas Gautreaux, Jr 1981 222 p
Avail Univ Microfilms Order No 8117624

Because of waste generated by potato processing contained significant quantities of carbohydrate degradation products and sodium carbonate anaerobic digestion was determined to be a reliable process for waste treatment and methane production The high sodium levels did not inhibit anaerobic digestion at a substate concentration of 1 0 wt percent alkaline peel solids In two-stage bench-scale studies at 37 C, methane production averaged 0 28 m cu/kg COD feed or 0 65 m cu/(m cu d) in a settled bacterial sludge methane fermenter with a 4 day retention time A pilot-scale anaerobic digestion system with a 15 4 m cu fermenter demonstrated the feasibility of a proposed anaerobic pond system for a food processing plant With a 1 0 wt percent alkaline solids feed and a 9-day retention time, methane production averaged 0 16 m cu/kg solids or 0 18 m cu/m cu d) A process for single cell protein production via the acid stage of anaerobic digestion was explored Bacterial cell and protein yields of 0 18 and 0 09 kg/k glucose consumed were obtained at a retention time of four hours Dissert Abstr

N82-10141# Illinois Inst of Tech Chicago Dept of Engineering
SEPARATION OF PARTICLES FROM COAL DERIVED LIQUIDS VIA SURFACE CHARGE PROPERTIES Final Report, Aug. 1977 - May 1981
Dimitri Gidaspow and Darsh Wasan Jul 1981 97 p refs
(Contract DE-AS02-77ET-10445)
(DE81-029088, DOE/ET-10445/1) Avail NTIS HC A05/MF A01

An improved method of removal of fine particles suspended in nonaqueous media by the application of a high-voltage (1000 to 10,000 V/cm) electric field was developed The technique is a modification of ordinary cross-flow filtration with a porous tube and of forced flow electrophoresis The electrofilter was tested with a synthetic nonaqueous slurry as well as samples of diluted H-coal process liquids obtained from a coal liquefaction pilot plant at various electric field strengths, driving pressures, and feed rates Models of clear boundary layers for flat and tubular cross-flow electrofilters were developed as a function of inlet Peclet number, electrophoretic velocity of particles, and rate of filtration DOE

N82-10143# State Univ of New York, Binghamton Dept of Chemistry
DESULFURIZATION WITH TRANSITION METAL CATALYSTS Quarterly Technical Progress Report, 28 Mar. - Jun. 1981
John J Eisch 31 Jul 1981 4 p
(Contract DE-AC22-79ET-14879)
(DE81-028935, DOE/ET-14879/T6) Avail NTIS HC A02/MF A01

The reactivity and the intermediates in the desulfurization of 2-methyl dibenzo thiophene and certain model sulfides and sulfones were examined The ratio of bis-1 5-cyclo octadiene nickel, the desulfurizing activity of soluble organo cobalt complexes, and the activity of aluminum hydride combinations with nickel (11), cobalt(11), and molybdenum(0) or molybdenum (IV) salts were also studied Experimental procedures for applying these techniques to coal derived liquids were also addressed DOE

N82-10144# Worcester Polytechnic Inst., Mass
KINETICS AND MECHANISMS OF CATALYTIC HYDROLIQUEFACTION AND HYDROGASIFICATION OF LIGNITE Quarterly Report, Apr. - Jun. 1981
Wilmer L Kranich, Kamel Guruz, and Alvin H Weiss 10 Aug 1981 24 p refs
(Contracts DE-FG22-81PC-40770, DE-AC22-77ET-10618)
(DE81-023581, DOE/PC-40770/T2, QR-2) Avail NTIS HC A02/MF A01

The variables involved in the hydroliquefaction and hydrogasification of lignite were studied Emphasis was placed on the catalytic batch hydroliquefaction of a range of low rank coals including two subbituminous coals, four lignites, and leonardite, as well as cellulose These were studied both as received and after partial demineralization by washing with hydrochloric acid DOE

N82-10148# Yale Univ., New Haven, Conn School of Medicine
DEVELOPMENT OF NEWER METHODS FOR THE ISOLATION AND IDENTIFICATION OF CERTAIN COMPONENTS FOUND IN COMPLEX MIXTURES DERIVED FROM ENERGY SOURCES AND THE DETERMINATION OF THEIR BIOLOGICAL ACTIVITY VIA BIOASSAY SYSTEMS Progress Report, Aug. 1980 - Jul. 1981
S R Lipsky Jul 1981 29 p refs Prepared in cooperation with LASL, N Mex
(Contract DE-AS02-76EV-02958)
(DE81-028311, DOE/EV-02958/T1) Avail NTIS HC A03/MF A01

A composite sample of Paraho crude oil was fractionated and the fractions chemically identified by multidimensional gas chromatography The fractions were then bioassayed to determine their biological activity DOE

N82-10150# Energy and Environmental Research Corp., Santa Ana, Calif
SOOT FORMATION IN SYNTHETIC FUEL DROPLETS Quarterly Technical Progress Report, 1 Apr. - 30 Jun. 1981
G England, J Kramlich, Y Kwan, and R Payne Jul 1981 36 p
(Contract DE-AC22-80PC-30298)
(DE81-028391, DOE/PC-30298/T3, QRPR-3) Avail NTIS HC A03/MF A01

Fuel screening studies in the 70000 Btu/h tunnel furnace were extended to include SRC-11 middle and heavy distillate fuel oils A total of eight fuels were investigated Soot, particulates, and NOx emission levels were obtained under comparable firing conditions for both normal and staged combustion, and at various overall excess air levels The combustion of single-droplet streams was investigated in a controlled flow reactor The trajectory of every SRC-11 fuel droplet was observed to determinate in a microexplosion High speed photography showed this to be an extremely rapid event resulting in the formation of a visible,

luminous soot cloud This behavior was not observed for a petroleum-derived No 6 oil and appeared to be pronounced for a blended SRC-11 than for either the middle or heavy distillate fuels Preliminary measurement were also made of local soot concentrations and of the temprature of the soot sheet in the *reactor system* J M S.

N82-10152# Air Products and Chemicals, Inc, Allentown, Pa
CRYOGENIC METHANE SEPARATION/CATALYTIC HYDROGASIFICATION PROCESS ANALYSIS Quarterly Report
J Klosek Aug 1981 42 p
(Contract DE-AC01-78ET-10325)
(DE81-029123, DOE/ET-10325/T11) Avail NTIS HC A03/MF A01

Two commercial gasification processor were evaluated in terms of their relative effectiveness in separating methanes from the reaction products and some of the other synthesis gas products recycled Cryogenic methane separation results from the process gas recovered by partial condensation and carbon absorption are reported Preliminary plant designs for acid gas removal and *cryogenic methane separation from the raw gas are also* reported R C T

N82-10153# Brookhaven National Lab, Upton, N Y
FLAME-RETENTION HEAD BURNER EFFICIENCY TEST RESULTS AND ANALYSIS: SPACE-HEATING-EQUIPMENT TEST PROGRAM
R J McDonald and R F Krajewski Nov 1980 26 p refs
(Contract DE-AC01-76CH-00016)
(DE81-030219, BNL-51321) Avail NTIS HC A03/MF A01

Fuel oil savings resulting from the use of flame-retention head burners in residential oil-fired hydronic heating units are summarized Results of laboratory and field tests are compared The fuel savings varied between 5 1% and 22 0% for various systems DOE

N82-10154# New Hampshire Univ, Durham
LIQUEFACTION OF BITUMINOUS COALS USING DISPOSAL ORE CATALYSTS AND HYDROGEN Quarterly Progress Report, 7 May - 7 Aug. 1981
V K Mathur Aug 1981 17 p
(Contract DE-AC22-81PC-41035)
(DE81-029134, DOE/PC-41035/1) Avail NTIS HC A02/MF A01

Hydrogenation of coal-oil slurry by hydrogen using disposal ore catalysts (DOC) with special reference to maximizing liquefaction and minimizing viscosity of product oil was studied A number of companies were contacted to collect samples of ores and ore concentrates containing cobalt, molybdenum, nickel and other metals considered to posses catalytic activity and a commercial Co-Mo catalyst (0402T) are reported These data are to be used as a base for evaluating the catalytic effects of the ores and minerals collected DOE

N82-10155# Physical Sciences, Inc, Woburn, Mass
SYNTHETIC-FUEL COMBUSTION: POLLUTANT FORMATION. SOOT-INITIATION MECHANISMS IN BURNING AROMATICS Quarterly Report, 1 Apr. - 30 Jun. 1981
T Tanzawa, S P Schertzer, and W T Rawlins 1981 21 p refs
(Contract DE-AC22-80PC-30292)
(DE81-029480, DOE/PC-30292/3, PSI-TR-284, QR-3) Avail NTIS HC A02/MF A01

Toluene pyrolysis experiments were performed using He-Ne laser beam attenuation to monitor soot The experimental results were consistent with those of previous investigators, however, the laser beam attenuation records showed an anomalously large absorption at the higher temperatures where soot formation should be minimal This effect could be due to some light-absorbing *gas-phase species such as PCAH and/or radicals of PCAH* Diagnostics employed show ambiguous late-time behavior of the pressure, density, and beam attenuation profiles DOE

N82-10156# Argonne National Lab, Ill
***CYCLONE PERFORMANCE ESTIMATES FOR PRESSURIZED* FLUIDIZED-BED COMBUSTION**
R F Henry and W F Podolski Jul 1981 33 p refs
(Contract W-31-109-eng-38)
(DE81-028504, ANL/CEN/FE-81-4) Avail NTIS HC A03/MF A01

Hot pressurized flue gas from pressurized fluidized-bed combustion must be cleaned up prior to its expansion in a gas turbine as part of the combined-cycle electric power generation concept The performance of conventional cyclones in experimental tests has been compared with theory, with reasonable agreement Prediction of the performance of a larger cyclone system shows that three stages should provide the cleanup required on the basis of current estimates of turbine tolerance of particulate matter Advances in hot gas cleanup - optimized cyclones, augmented cyclones, and alternative devices should provide future improvement in cycle efficiencies and costs, but simple cyclones are planned for first-generation PFB/CC pilot and demonstration plants DOE

N82-10157# Spectron Development Labs, Inc, Costa Mesa, Calif
PARTICULATE PROCESSES IN PULVERIZED-COAL FLAMES Quarterly Technical Progress Report, Jan. - Mar. 1981
Apr 1981 65 p refs
(Contract DE-AC22-80PC-30300)
(DE81-025153, DOE/PC-30300/T3) Avail NTIS HC A04/MF A01

The design of the entire apparatus for the dilute particle reaction experiment was completed This includes two reactor heads, a fluidized bed feeder, the tube reactor, and the reactor traverse mechanism Experimental observations of ignition and *devolatilization of Pittsburgh Seam HVA bituminous coal were* initiated Observations using both front and back light pulsed laser holography and particle sizing interferometry were made Preliminary analysis of the data indicate that high quality results can be obtained DOE

N82-10158# Physical Sciences, Inc, Woburn, Mass
PULVERIZED-FUEL COMBUSTION: MODELING AND SCALEUP METHODOLOGIES Quarterly Report, 1 Apr. - 30 Jun. 1981
Paul F Lewis, Evan R Pugh, Nelson H Kemp, Alan Gelb, and Thomas Wolf Aug 1981 30 p refs
(Contract DE-AC22-80PC-30294, QR-3)
(DE81-026546, DOE/PC-30294/3, PSI-TR-280) Avail NTIS HC A03/MF A01

Effort this quarter has continued on model improvements, and the data analysis task has begun Specific work reported includes model of the heterogeneous reactions of coal chars, work on particle-particle collisions, improvements in the computer code to handle the stiff nature of the particle momentum and energy equations, and identification of a set of experiments with which to start the data analysis Results of these efforts are a model for heterogeneous carbon reactions including OH and O reactions, a model for collisional drag effects, improved numerical stability of the code, and beginning of data analysis DOE

N82-10201# Idaho National Engineering Lab, Idaho Falls
CORROSION TESTING OF CARBON STEEL IN AEREATED GEOTHERMAL BRINE
D F Suciu and P M Wikoff Idaho Falls, Idaho Edgerton, Germeshausen and Grier, Inc Feb 1981 55 p refs
(Contract DE-AC07-76ID-01570)
(DE81-028653, EGG-GTH-5474) Avail NTIS HC A04/MF A01

Two major problems are associated with the use of cooled geothermal water as coolant for the 5 MW(e) Pilot Power Plant and Raft River are a scaling potential owing to the chemical species present in solution, and the corrosive nature of the geothermal water on carbon steels A water treatment test program was established to reduce or eliminate these problems Data show that scale can be prevented by a combination of dispersants and controlling the concentration of scaling species in the circulating water Corrosion cannot be controlled without a pretreatment of tubing material With the pretreatment, a protective gamma iron oxide film is laid down on the tube surface, that with proper corrosion inhibitor additives, significantly reduces both general and pitting corrosion However, longer term testing is required to determine protection of pitting corrosion DOE

N82-10249# North Dakota Univ, Grand Forks
CHEMISTRY OF LIGNITE LIQUEFACTION Quarterly Report, Apr. - Jun. 1981
R J Baltisberger, Virgil I Stenberg, Kenneth J Klabunde, and Neil F Woolsey Jul 1981 55 p refs

(Contract DE-AB18-78FC-02101)
(DE81-030178, DOE/FC-02101/18) Avail NTIS HC A04/MF A01

Progress reports are presented for structural studies of lignite derived asphaltene and preasphaltenes and ether cleavage studies Reports of denitrogenation caused by CO and water reactions and of electron transfer catalysis studies are also presented Results indicate that the major differences between asphaltenes and preasphaltenes is that the molecular weight maximizes near 1500 g/mol for the preasphaltenes compared to 400 g/mol for the asphaltenes It is further indicated that asphaltenes have little or no aliphatic or aryl aliphatic ethers whereas preasphaltenes have significant amounts Other significant results are reported DOE

N82-10250# Department of Energy, Bartlesville, Okla Energy Technology Center
LIQUID FOSSIL FUEL TECHNOLOGY Quarterly Technical Progress Report, Oct. - Dec. 1980
May 1981 77 p refs
(DE81-029912, DOE/BETC/QPR-80/4) Avail NTIS HC A05/MF A01

Highlights of research activities at BETC during the past quarter are summarized Major research areas include liquid fossil fuel cycle, extraction (resource assessment and enhaned producton), processing (characterization, thermodynamics, and process technology), utilization, and product integration and technology transfer DOE

N82-10251# Rockwell International Corp, Canoga Park, Calif Energy Systems Group.
MOLTEN-SALT COAL-GASIFICATION PROCESS DEVELOPMENT UNIT, PHASE 2 Quarterly Technical Progress Report, Jan. - Mar. 1981
M. H Slater 20 Apr 1981 57 p refs
(Contract DE-AC21-77ET-10296)
(DE81-023585; DOE/ET-10296/T2, ESG-DOE-13363, QTPR-3) Avail NTIS HC A04/MF A01

Run 7, the second run of the Phase 2 program, was completed The gasification system was operated for a total of 169 h at pressures up to 90 psig Average product gas HHV values of 81 Btu/scf were recorded during 90-psig operation, while gasifying coal at a rate of 735 lb/h The run was terminated, as planned, after 7 full days of operation Prior to Run 7, an 80% cobalt-20% chromium alloy metal melt withdrawal orifice was installed as a replacement for a high-purity alumina orifice which had cracked during Run 6, and thus, it is suspected, contributed to the overflow system plug which prematurely terminated the test. The new metal orifice survived the entire Run 7 campaign virtually intact DOE

N82-10253# Westinghouse Electric Corp, Concordville, Pa
BASELINE DATA ON UTILIZATION OF LOW-GRADE FUELS IN GAS TURBINE APPLICATIONS. VOLUME 2: HOT COMPONENT CORROSION EVALUATION Final Report
J J Vitello and S T Scheirer Jun 1981 64 p Sponsored in part by Electric Power Research Inst
(EPRI Proj 1079-2)
(DE81-903760, EPRI-AP-1882-Vol-2) Avail NTIS HC A04/MF A01

The corrosion of turbine parts when operated with residual oil versus distillate oil was compared A metallographic evaluation of combustion turbine hot components, which showed partial residual versus total distillate fuel firing, revealed no discernable differences in component degradation (hot corrosion) Considering the time of operation, the degree of hot corrosion observed was somewhat greater than expected for oil-fired combustion turbines of similar designs and alloy selections This abnormality was attributed to the ingestion of high levels of sodium contaminated mist from the adjacent cooling tower hrough the turbine compressor inlet Corrosion due to vanadium compounds in the heavy fuel machines was practically nil, which indicates that residual fuel is satisfactory for use in combustion turbine plants DOE

N82-10255# Gulf Research and Development Co, Pittsburgh, Pa
UNDERGROUND GASIFICATION OF STEEPLY DIPPING BEDS. PHASE 2 REPORT: RESULTS OF RAWLINS TEST NO. 1 Final Report, 1 Mar. 1978 - 1 Mar. 1980
Jul 1981 271 p refs Prepared in cooperation with TRW Energy Systems Planning Div, McLean, Va
(Contract DE-AC03-77ET-13108)
(DE81-028581, DOE/ET-13108/T14) Avail NTIS HC A12/MF A01

A 23 ft thick coal bed dipping at 63 deg was used to test the feasibility of using underground coal gasification techniques to extract energy from steeply dipping coal beds (UCG-SDB) The coal was ignited at a vertical depth of 400 ft utilizing a directionally drilled process well pair The heating value of the product gas during the 21 day air injection phase initially climbed to approximately 180 Btu/SCF and gradually declined to the 120 to 130 Btu/SCF range Air injection rates of 1600 to 2000 SCFM were used, and wet product gas rates between 3000 and 4500 SCFM were obtained A 5 day steam/oxygen injection test was also conducted which increased the product gas heating value to the 220 to 260 Btu/SCF range The environmental studies concentrated on ground water quality, air quality, surface subsidence, and personnel industrial hygiene DOE

N82-10257# Bell Aerospace Co, Buffalo, N Y
HIGH-MASS-FLUX COAL GASIFIER Final Report
A J Simpkin May 1981 102 p refs
(Contract DE-AC01-79ET-14674)
(DE81-029807, DOE/ET-14674/16) Avail NTIS HC A06/MF A01

This report describes the design, analysis, construction, and test activities associated with bringing a short residence time, entrained flow gasifier process development unit (PDU) to operational status are described The basic high mass flux (HMF) gasifier, incorporated in the PDU, operates at a coal through-put of twelve tons per day, a pressure of fifteen atmospheres and processes coal, oxygen and steam to produce a synthesis When applied to the production of substitute natural gas, the option exists to add secondary coal to the basic HMF gasifier, for the purpose of enhancing the methane content of the product A secondary coal feed system was developed and its injection capability demonstrated in a cold flow test facility Operability and performance of the synthesis gas stage of the HMF gasifier were demonstrated with Pittsburgh seam coal and North Dakota Lignite Curtailment of testing precluded the conduct of any gasification tests with secondary coal injection Included in the main program was a task to evaluate the effects of slag fluxing additives upon viscosity/temperature relationships for Pittsburgh seal coal slags DOE

N82-10259# General Electric Co, St Petersburg, Fla Corporate Research and Development
EXPERIMENTAL EVALUATION OF THE STEADY-STATE AND DYNAMIC PERFORMANCE CHARACTERISTICS OF THE INTERACTIVE UNITS OF A COAL-GASIFICATION PROCESS Quarterly Report, 28 Dec. 1980 - 29 Mar. 1981
J C. Corman Apr 1981 75 p refs
(Contract DE-AC01-80ET-14928)
(DE81-028995; DOE/ET-14928/1) Avail. NTIS HC A04/MF A01

The technology base required to premit coal conversion systems to operate within the constraints imposed by end use applications was investigated A series of unfired dynamic tests along with fired steady state tests were defined. Thermal decomposition of ammonia was investigated High conversion rates were observed for binary NH3/H2 gas mixtures Conversion was found to be thermodynamically limited when substantial H2 and N2 concentrations are present The overall structure of the IGCC mathematical model has been developed and information flow reqirements associated with each component in the model were defined. The computer model for the gasifier and the first water quench were completed DOE

N82-10260# Hydrocarbon Research, Inc, Lawrenceville, N J.
H-COAL PROCESS IMPROVEMENT STUDY. BENCH UNIT BASELINE RUN WITH PREHEATER/REACTOR
May 1981 56 p
(Contract DE-AC05-77ET-10152)
(DE81-026022, DOE/ET-10152/T6, FE-10152-65) Avail NTIS HC A04/MF A01

The thermal dissolution of coal and its effects on the mechanism of coal liquefaction in an H-coal system is investigated The two-stage coal liquefaction system consists of a coal slurry preheater which is essentially a short residence time reactor and a liquefaction reactor which can be regarded as a catalytic-hydrogenation-reactor. The preheater design and unit modifications

are discussed Results of the run to obtain baseline data with the preheater integrated in the bench unit system are compared with those of previous bench runs at similar operating conditions without a preheater, and also to previous PDU operations at similar conditions These comparisons were made to determine what effect a preheater has on product yields and product quality It is concluded that a preheater tends to increase heavy liquid yields with more residual oil and a higher proportion of heavy distillates in the distillate product DOE

N82-10262# Aluminum Co of America, Pittsburgh, Pa
PULVERIZED-COAL FIRING OF ALUMINUM MELTING FURNACES Quarterly Technical Progress Report, 1 Oct. - 31 Dec. 1979
C E West Oct 1980 56 p refs
(Contract DE-AC01-78CS-40037)
(DOE/CS-40037/T2) Avail NTIS HC A04/MF A01

Progress is reported on the demonstration program of an efficient, environmentally acceptable coal firing process suitable for implementation on melting furnaces in the aluminum industry Specific tasks reported on are design of burner A, process equipment design and layout, purchase of process equipment, and fabrication of burner A The status report on phase I data deliverable and a cost summary are presented DOE

N82-10263# Midwest Research Inst, Golden, Colo Solar Energy Information Data Bank
ALCOHOL FUELS BIBLIOGRAPHY, 1901 - MARCH 1980
Apr 1981 468 p
(Contract DE-AC02-77CH-00178)
(DE81-025482, SERI/SP-751-902) Avail NTIS HC A20/MF A01

This annotated bibliography is subdivided by subjects, as follows general, feedstocks-sugar, feedstocks-starch, feedstocks-cellulose crops and residues, productions, coproducts, economics, use as vehicle fuel, government policies, and environmental effects and safety DOE

N82-10264# California Univ, Berkeley Lawrence Berkeley Lab Materials and Molecular Research Div
CHEMISTRY AND MORPHOLOGY OF COAL LIQUEFACTION Quarterly Report, 1 Jan. - 30 Mar. 1981
Heinz Heinemann Mar 1981 20 p
(Contract W-7405-eng-48)
(DE81-028899, LBL-12933) Avail NTIS HC A02/MF A01

A novel cobalt mediated, reversible cleavage of a vinyl-hydrogen bond was discovered All products from the thermal decomposition of tetralin were identified The stereochemistry of cis-1, 2 dihydrotetralin was determined In the utilization of the water gas shift reaction as a reducing agent for model coal compounds it was found that tributylphosphine ligands increase the life of transition metal hydride catalysts Rates of demetallation of high metal content gas oils over cobalt-molybdena-alumina catalysts were measured for vanadium and iron It is clearly shown that pore plugging of the catalyst occurs early and results in deposition of the metals on the external catalyst surface DOE

N82-10267# Argonne National Lab, Ill Energy and Environmental Systems Div
ENHANCEMENT OF METHANE GAS PRODUCTION USING AN INDUSTRIAL WASTE IN ANAEROBIC DIGESTION
L Fradkin and F Kremer (ESCOR, Inc) 1980 10 p refs Presented at the 3rd Miami Intern Conf on Alternative Energy Sources, Fla, 15-18 Dec 1980
(Contract W-31-109-eng-38)
(DE81-023819, CONF-801210-26) Avail NTIS HC A02/MF A01

Chromium can block enzymatic systems or interfere with essential cellular metabolites of most oxidizing bacteria In general, heavy metals coagulate and precipitate proteins, many of which are denatured by this action The effects on anaerobic digestion of chromium shavings from leather tanning were examined Leather chrome shavings (which contain proteins, nitrogen, and fats) were added to two of three digesters at various rates The methane gas production of the experimental units improved significantly compared to the control In addition, the presence of a toxic loading or change of feed had no harmful effect on the digester performance DOE

N82-10268# Mound Lab, Miamisburg, Ohio
PRICETOWN 1 UNDERGROUND COAL GASIFICATION FIELD TEST: OPERATIONS REPORT
A K Agarwal and R E Zielinski 1981 269 p refs
(Contract DE-AC04-76DP-00053)
(DE81-025162, MLM-MU-81-62-0007) Avail NTIS HC A12/MF A01

An Underground Coal Gasification (UCG) field test in bituminous coal was successfully completed near Pricetown, West Virginia The viability of the linked vertical well (LVV) technology to recover the 900 foot deep, 6 foot thick coal seam was determined A methane rich product gas with an average heating value of approximately 250 Btu/SCF was produced at low air injection flow rates during the reverse combustion linkage phase Heating value of the gas produced during linkage enhancement phase was 221 Btu/SCF with air injection The high methane formation was attributed to the thermal and hydrocracking of tars and oils along with hydropyrolysis and hydrogasification of coal char The high heating value of the gas was the combined effect of residence time, flow pattern, injection flow rate, injection pressure, and back pressure During the gasification phase, a gas with an average heating value of 125 Btu/SCF was produced with only air injection, which resulted in an average energy production of 362 MBtu/day DOE

N82-10269# Aerojet Energy Conservation Co, Sacramento, Calif
STUDY OF GELLED LNG Final Technical Report
M I Rudnicki, J A Cabeal, L C Hoffman, R A Newton, R K Schaplowsky, and E M VanderWall May 1981 110 p
(Contract DE-AC03-80SF-10846)
(DE81-023259, DOE/TIC-11452) Avail NTIS HC A06/MF A01

Progress is reported in the following areas characterization of gelled LNG (GELNG) rheological properties, assessment of the relative leakage of GELNG vs LNG through a perforated wall, relative spread and vaporization rates of unconfined spills on water, and relative spread and vaporization rates of unconfined spills on land Shear stress vs strain rate was determined for a range of gelant concentrations The shear diagram was extended to cover shear rates in the range of 13 to 14,800 inverse seconds, expanding previous results at both low and high shear rates Leakage tests of GELNG through a known geometry perforation were conducted along with comparative testing with LNG Rapid cessation of flow through the perforated plate was observed for all tested concentrations of GELNG and at all driving pressures Land spills were found to give inconclusive results due to difficulties in measuring transient weight changes during the spill Gelatin increases total vaporization time significantly in water spills DOE

N82-10271# Council for Scientific and Industrial Research, Pretoria (South Africa) Chemical Engineering Group
SELECTIVITY IN FISCHER-TROPSCH SYNTHESIS: REVIEW AND RECOMMENDATIONS FOR FURTHER WORK
L Caldwell Jun 1980 42 p refs
(PB81-223596, CSIR-SR-CHNG-330) Avail NTIS HC A03/MF A01 CSCL 21D

A broad product spectrum is obtained from the Fischer-Tropsch synthesis aimed at the production of gasoline and diesel fuels This is a consequence of the carbon atom by carbon atom mechanism of chain growth There is potential for narrowing the product spectrum by use of dual-function catalysts or transient process conditions GRA

N82-10272# Battelle Pacific Northwest Labs, Richland, Wash
KINETICS AND CATALYSIS OF PRODUCING SYNTHETIC GASES FROM BIOMASS Annual Report, 7 Dec. 1979 - 6 Dec. 1980
L J Sealock, Jr, D C Elliott, S L Weber, and R J Robertus Jan 1981 129 p refs
(Contract GRI-5014-361-0242)
(PB81-217614, GRI-79-0100) Avail NTIS HC A07/MF A01 CSCL 21D

The kinetics, reaction sequences, and pathways involved in pyrolysis and catalytic steam gasification of wood and wood components were investigated An autoclave and a batch reactor were used to study gasification at low temperature and high temperature regimes Kinetic studies of the carbon steam reaction relative to cellulose and lightning gasification were completed Reaction rate constants and activation energies were determined for three catalyzed cases and for a noncatalyzed case The formation of specific compounds during gasification in the presence and absence of catalyst was investigated in both reactor systems Results of the experiments demonstrate dramatic effects on the

kinetics and gas composition as a function of the various catalyst and catalyst concentrations tested GRA

N82-10275# Air Products and Chemicals, Inc., Trexlertown, Pa
LOAD-CHANGE TESTING OF A LARGE COMMERCIAL OXYGEN PLANT Final Report
N Chatterjee, J C Sorensen, and A J Patrylak Apr 1981 46 p refs
(EPRI Proj 2806-1)
(EPRI-NP-1824) Avail NTIS HC A03/MF A01

A series of transient response tests were successfully conducted on one of three 1,000 T/D oxygen production plants operated under computer control These tests involved a series of rapid rate changes in oxygen production specified to simulate the varying demand for oxygen of a coal gasifier in combined cycle power generation service Since the ability of the oxygen plant itself to rapidly change its gaseous production rate is an important element in the design and operation of gasification combined cycle) plants, a series of load following tests was arranged The actual oxygen plant rate changes easily exceeded the targeted response rate with minimal variation in product oxygen purity Oxygen production rate changes of +- 10 to +- 13% of design in 1 to 2 min were readily accomplished The production rate was also varied over the full range from 70% to 105% of design at a continuous ramp rate of approximately 2% of design production per minute DOE

N82-10279# Ruhrkohle A G, Essen (West Germany)
SAFETY AND TECHNICAL OPTIMIZATION OF BELT TRANSFER POINTS WITH SPECIAL CONSIDERATION FOR THE SUPPRESSION OF NOXIOUS AND EXPLOSIVE DUSTS Final Report
Albert Schade Bonn Bundesministerium fuer Forschung und Technologie Dec 1980 71 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-HA-80-048, ISSN-0171-7618) Avail NTIS HC A04/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 14,90

A dust suppression installation and a dust monitoring instrument were laboratory tested and installed at belt transfer points in a coal plant where noxious and explosive dust develops by air separation, leading to considerable increases of concentration in subsequent operational areas Usage of enclosed segment chutes is shown to reduce the dust load by 40% A digital scattered light photometer in connection with a signal-controlled sprinkler installation lead to further dust diminution along with a reduction of the spray water volume by 30 to 50% Generalization of usage of the present installation is advocated
Author (ESA)

N82-10366# Brown Univ, Providence, R I Div of Engineering
FLOW IN GEOTHERMAL WELLS. PART 4: TRANSITION CRITERIA FOR TWO-PHASE FLOW PATTERNS
Z Bilicki and J Kestin Dec 1980 22 p refs
(Contract DE-AC02-79ET-27225)
(DE81-028312, DOE/ET-27225/9) Avail NTIS HC A02/MF A01

Detailed considerations justifying the criteria for transitions between flow patterns are presented The following are covered transition from bubble to plug (or slug) flow, transition from plug flow to froth flow, transition from froth to annular mist flow, and model comparisons DOE

N82-10474# Department of Energy, Washington, D C Energy Information Administration
VENEZUELA, TRINIDAD AND TOBAGO: CRUDE OIL POTENTIAL FROM KNOWN DEPOSITS
William D Dietzman, Naim R Rafidi, and Arthur J Warner Jul 1981 127 p refs
(DE81-027023, DOE/EIA-0297) Avail NTIS HC A07/MF A01

Estimates of original oil in place ultimate recovery, remaining reserves, and projected supply patterns are presented A discussion of the methodology for projecting supply patterns is also presented. The Republic of Venezuela ranked 7th in 1979 in production among the oil producers of the world and is one of the leading exporters of crude oil About 1/3 of the country's exports are received by the United States, and it was the 5th and 3rd largest supplier of crude oil and refined products to the United States in 1978 and 1979, respectively DOE

N82-10475# Nevada Univ, Reno
LOW-TO-MODERATE TEMPERATURE GEOTHERMAL RESOURCE ASSESSMENT FOR NEVADA, AREA SPECIFIC STUDIES Final Report, 1 Jun. 1980 - 30 Aug. 1981
D T Trexler, B A Koenig, T Flynn, J L Bruce, and G Ghusn, Jr 1981 223 p refs
(Contract DE-AC08-79NV-10039)
(DE81-030487, DOE/NV-10039/3) Avail NTIS HC A10/MF A01

The Hawthorne study area encompasses approximately 310 sq km The energy needs of the military and the local population are substantial The techniques employed in the resource assessment are described Geological and geophysical methods were used and the results are reported TM

N82-10477# Texas Univ, Austin Dept of Petroleum Engineering
TERTIARY OIL RECOVERY PROCESSES RESEARCH AT THE UNIVERSITY OF TEXAS Final Report, Oct. 1979 - Sep. 1980
R S Schechter and W H Wade Jun 1981 135 p refs
(Contract DE-AC19-78BC-20001)
(DE81-025222, DOE/BC-20001/10) Avail NTIS HC A07/MF A01

Surfactant adsorption, phase behavior, interfacial tension, and solubilization were examined Focus is on solubilization, I F T, and phase behavior with the emphasis on the influence of branching for anionics and molecular weight for nonionics Phase behavior is related to emulsion stability, polymeric surfactants, and salinity tolerant surfactants were evaluated DOE

N82-10478# Oak Ridge National Lab, Tenn
ION EXCHANGE CHARACTERISTICS OF ENHANCED OIL RECOVERY SYSTEMS (MISCIBILITY STUDIES) Semiannual Report, 1 Apr. 1979 - 30 Sep. 1980
P C Ho, K A Kraus, T M Bender, and S B Ogden Jul 1981 59 p refs
(Contract W-7405-eng-26)
(DE81-769734, DOE/BETC/OR-19) Avail NTIS HC A04/MF A01

During the report period (1) studies of the hydrotropic properties of organic alkylbenzenesulfonates and particularly of alkylbenzenecarboxylates were extended, (2) the effects of several different alcohols on miscibility between aqueous protosurfactant solutions and aliphatic and aromatic alkanes were investigated, (3) hydrotropic properties of an alicylic carboxylate were determined, (4) the equivalent weight of the organic salts studied was extended into the surfactant range, (5) solubilities of protosurfactants and surfactants in salt solution were measured, and (6) investigations of the adsorption of protosurfactants on minerals as a function of salinity were started Measurements include establishment of the phase behavior in the limiting three-component systems, the effect of protosurfactant concentration in the four-component systems, and determination of the compositions in a limited number of cases of the coexisting phases DOE

N82-10479# Argonne National Lab, Ill Land Reclamation Program
FRACTURE FLOW OF GROUNDWATER IN COAL-BEARING STRATA
Jeffrey P Schubert 1980 15 p refs Presented at 1980 Symp on Surface Mining Hydro, Sedimentology and Reclamation, Lexington, Ky, 1-5 Dec 1980
(Contract W-31-109-eng-38)
(DE81-023810, CONF-801263-1) Avail NTIS HC A02/MF A01

Laboratory tests on core samples of sandstones, siltstones, shales, and claystones indicate extremely low intergranular hydraulic conductivities Various aquifer tests, using wells in the same locations, invariably showed hydraulic conductivities to be much greater than those estimated by laboratory techniques In addition the hydraulic conductivity of highly fractured rock can be 100 to 1,000 times greater than slightly fractured rock The greatest concentration of fractures usually occurs in faulted areas and in narrow fracture zones less than 100 m below ground surface The majority of large inflows through rock into surface and underground mines occur at the faults and fracture zones By studying and understanding more about the structural control

of fractures in coal basins the larger inflows possibly could be avoided DOE

N82-10480# Los Alamos Scientific Lab, N Mex
DEVELOPMENT OF MAN-MADE GEOTHERMAL RESERVOIRS
Roland A Pettitt 1981 9 p Presented at the Energy in the Man-Built Environment The Next Decade Specialty Conf, Vail, Colo 3-5 Aug 1981
(Contract W-7405-eng-36)
(LA-UR-81-852) Avail NTIS HC A02/MF A01

The technology used to create and extract heat from a geothermal reservoir in low porosity, granitic basement rock in at the Fenton Hill site in northern New Mexico is described Topics covered include drilling boreholes, injecting potable water as the working fluid, hydraulic fracture to provide the large surface area need for heat exchange the mechanics of reservoir growth, make-up water requirements, geofluid chemistry, electrical generation, operational constraints, and effects on the environment A R H

N82-10482# Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (West Germany)
DEVELOPMENT OF ORGANIC GEOCHEMICAL AND ISOTOPE TECHNIQUES FOR HYDROCARBON EXPLORATION Final Report
Eckhard Faber, Heinz Hufnagel, Helmut Jacob, Joachim Kock, Wolfgang Stahl, Manfred Teschener, and Hermann Wehner Bonn Bundesministerium fuer Forschung und Technologie Oct 1980 55 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-076, ISSN-0340-7608) Avail NTIS HC A04/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 11,55

Sedimentary organic matters was characterized by correlating microscopic and chemical data Techniques for oil-oil and oil-source rock correlations were developed using the distribution of polycyclic aromatic hydrocarbons It is shown that the carbon isotopic composition of oils, extracts and kerogens The C12/C13 ratios of methane from different natural gases were correllated with the maturity of their source rocks The C13/C12 ratios of methane from cuttings were also determined Results show that pyrolysis chromatograms reflect the type of organic matter Fluorescence of dinoflagellates is directly related to maturity Bitumens are classified by fluorescence microscopy Correlation of crude oils is performed using chromatograms of the aromatic fraction of crudes Gas-source rock correlation is feasible by a systematic correlation of delta values of methane and the maturity of the source organic matter Isotope analyses of head-space gases are developed for active exploration Author (ESA)

N82-10560# Los Alamos Scientific Lab, N Mex
HOT DRY ROCK GEOTHERMAL ENERGY DEVELOPMENT PROGRAM Progress Report
Paul R Franke 1981 17 p refs Presented at the IECEC Conf, Atlanta, 19 Aug 1981
(Contract W-7405-eng-36)
(LA-UR-81-1265, CONF-810812-11) Avail NTIS HC A02/MF A01

A hot dry rock geothermal system was developed from a reservoir created by hydraulic fracturing A reservoir of sufficient size and capacity was confirmed and two extraction runs were made The thermal drawdown data indicate that the effective heat area is increased The reservoir enlargement is confirmed by gradual thermal drawdown, and the effective heat transfer area of the reservoir is increased E A K

N82-10655# Pacific Northwest Lab, Richland, Wash Atmospheric Sciences Dept
ANALYSIS OF DATA FROM THE US DEPARTMENT OF ENERGY'S METEOROLOGICAL VALIDATION PROGRAM
William F Sandusky and John W Buck Jun 1981 19 p refs Presented at the Pacific Div, Am Assoc for the Advan of Sci Ann Meeting, Richland, Wash, 15-18 Jun 1981
(Contract DE-AC06-76RL-01830)
(DE81-030100, PNL-SA-9411, CONF-8106152-1) Avail NTIS HC A02/MF A01

The history of the meteorological validation program (MVP) and its unique features of the summarized data for candidate sites are described Available wind power for each site and the projected power for a MOD-2 turbine at each site is provided Wind power data are compared to data from the resource assessment program to locate areas of high wind energy potential in the contiguous United States, Alaska and Puerto Rico The effect of data recording techniques and averaging period of the data on Weibull distribution parameters are included DOE

N82-10735# British Gas Corp, Newcastle-upon-Tyne (England) Engineering Research Station
MICROPROCESSOR APPLICATIONS FOR THE MONITORING AND CONTROL OF GAS SUPPLIES
R S Davidson and T M Sporton Nov 1980 11 p Presented at IMEKO/IFAC Symp on Appl of Microprocessors in Devices for Instrumentation and Automatic Control, London, 17-20 Nov 1980
(ERS-E-276) Avail NTIS HC A02/MF A01

The potential of the microprocessor to replace many established electromechanical and pneumatic systems and to solve problems which could be tackled previously only by main-frame computers is discussed Applications already in use and ideas under development are detailed These include telemetry systems used for controlling and monitoring gas supplies, controlling the monitoring of a reversible liquid natural gas process for meeting peak demand on a seasonal basis, a system incorporating a microprocessor for gas holder monitoring and control, and a prototype microprocessor control system for gas distribution governors Author (ESA)

N82-10938# Battelle Columbus Labs, Ohio
THERMOPHYSICAL PROPERTIES OF COAL LIQUIDS Quarterly Technical Status Report, 1 Apr. - 30 Jun. 1981
J W Droege, R Venkateswar, and S P Chauhan 17 Jul 1981 40 p
(Contract DE-AC22-79ET-14941)
(DE81-0279446, BMI-2086, QTSR-7) Avail NTIS HC A03/MF A01

The rheological properties of coarse coal which grind at relatively low temperature (450 K) showed a substantially lower viscosity It is also shown that coal and solvent from a plant give slurries of much higher viscosity than slurries from reference coal and solvent The same relationships are shown at higher temperatures The effect of solvent to coal ratio is also very great Differential scanning calorimetry give low reliability specific heat results and a probable heat effect at about 500 K is shown DOE

N82-10939# Colorado School of Mines, Golden
ENTHALPY MEASUREMENT OF COAL-DERIVED LIQUIDS Technical Progress Report, May - Jun. 1981
A J Kidnay and V F Yesavage 15 Jul 1981 14 p
(Contract DE-AC22-81PC-40787)
(DE81-029481, DOE/PC-40787/1) Avail NTIS HC A02/MF A01

Enthalpy for coal derived liquids on the model compound quinoline was measured Compounds over the pressure and temperature and temperature regions encountered in liquification and processing systems were modeled Preliminary results are presented for the temperature region 186 to 7320 F along isobars of 75, 100, and 200 psia DOE

N82-11144* National Aeronautics and Space Administration Pasadena Office, Calif
FLUIDIZED BED COAL COMBUSTION REACTOR Patent
Philip I Moynihan (JPL, California Inst of Technology, Pasadena) and Donald L Young, inventors (to NASA) (JPL, California Inst of Technology Pasadena) Issued 8 Sep 1981 7 p Filed 15 Dec 1978 Supersedes N79-14388 (17 - 05, 0601) Sponsored by NASA
(NASA-Case-NPO-14273-1, US-Patent-4,287,838, US-Patent-Appl-SN-969759, US-Patent-Class-110-234, US-Patent-Class-110-255, US-Patent-Class-110-266, US-Patent-Class-110-245, US-Patent-Class-122-4D) Avail US Patent and Trademark Office CSCL 21B

A fluidized bed coal reactor includes a combination nozzle-injector ash-removal unit formed by a grid of closely spaced open channels, each containing a worm screw conveyor, which function as continuous ash removal troughs A pressurized air-coal mixture is introduced below the unit and is injected through the elongated nozzles formed by the spaces between the channels The ash build-up in the troughs protects the worm screw conveyors as does the cooling action of the injected mixture The ash layer and the pressure from the injectors support a fluidized flame combustion zone above the grid which heats water in

boiler tubes disposed within and/or above the combustion zone and/or within the walls of the reactor
Official Gazette of the U S Patent and Trademark Office

N82-11145*# Jet Propulsion Lab, California Inst of Tech, Pasadena
COAL DESULFURIZATION BY LOW TEMPERATURE CHLORINOLYSIS, PHASE 3 Technical Report, 1 Mar. 1980 - 1 Mar. 1981
John Kalvinskas, Naresh Rohatgi, and John Ernest 1 Mar 1981 170 p refs Sponsored by NASA
(Contract DE-AI01-77ET-12547)
(NASA-CR-164957, JPL-Pub-81-82, DOE/ET-12547/1) Avail NTIS HC A08/MF A01 CSCL 07D

Laboratory scale, bench scale batch reactor, and minipilot plant tests were conducted on 22 bituminous, subbituminous, and lignite coals Chemical pretreatment and post treatment of coals relative to the chlorination were tried as a means of enhancing desulfurization by the chlorinolysis process Elevated temperature (500-700 C) hydrogen treatment of chlorinolysis-processed coal at atmospheric pressure was found to substantially increase coal desulfurization up to 90 percent Sulfur forms, proximate and ultimate analyses of the processed coal are included Minipilot plant operation indicates that the continuous flow reactor provides coal desulfurization results comparable to those obtained in the batch reactor Seven runs were conducted at coal feed rates of 1 5 to 8 8 kg per hour using water and methylchloroform solvents, gaseous chlorine feed of 3 to 31 4 SCFH at 21 to 70 C, and atmospheric pressure for retention times of 20 to 120 minutes Author

N82-11146*# Jet Propulsion Lab, California Inst of Tech, Pasadena
ASSESSMENT OF ADVANCED COAL GASIFICATION PROCESSES
John McCarthy, Joseph Ferrall, Thomas Charng, and John Houseman Jun 1981 200 p refs Sponsored in part by DOE and JPL
(Contracts NAS7-100, DE-AI21-77ET-13032, JPL Proj 5030-470)
(NASA-CR-164949, JPL-Pub-81-45, DOE/ET-13032/2) Avail NTIS HC A09/MF A01 CSCL 07D

A technical assessment of the following advanced coal gasification processes is presented high throughput gasification (HTG) process, single stage high mass flux (HMF) processes, (CS/R) hydrogasification process and the catalytic coal gasification (CCG) process Each process is evaluated for its potential to produce synthetic natural gas from a bituminous coal Key similarities, differences, strengths, weaknesses, and potential improvements to each process are identified The HTG and the HMF gasifiers share similarities with respect to short residence time (SRT), high throughput rate, slagging, and syngas as the initial raw product gas The CS/R hydrogasifier is also SRT, but is nonslagging and produces a raw gas high in methane content The CCG gasifier is a long residence time, catalytic, fluidbed reactor producing all of the raw product methane in the gasifier S L

N82-11148# Babcock and Wilcox Co, Alliance, Ohio Research and Development Div
COMPUTATIONAL TOOLS FOR PULVERIZED-COAL COMBUSTION Quarterly Report, Mar. - Jun. 1981
W J Oberjohn, W Fiveland, D K Cornelius, J H Wang, and R J Schnipke Jul 1981 144 p refs
(Contract DE-AC22-81PC-40265)
(DE81-028582, DOE/PC-40265/1, QR-1) Avail NTIS HC A07/MF A01

A computer code capable of modeling the major aspects of pulverized coal combustion was developed The combustion model (COMO) consists of a number relatively independent modules that represent the major processes involved in pulverized coal combustion Version one of COMO is used primarily to determine a satisfactory means of integrating the numerical models of the combustion processes into an overall combustion model Detailed task descriptions were prepared, literature searches conducted, and process models selected for version one The formulation and coding of the models was initiated and, in some cases, comparisons with data and other predictions were made Code development guidelines were prepared and reviewed The guidelines present the information required to allow process modules to be developed relatively independently, while providing for the subsequent integration of these modules into COMO DOE

N82-11149# Battelle Pacific Northwest Labs, Richland, Wash
TECHNIQUES FOR GEOTHERMAL LIQUID SAMPLING AND ANALYSIS
C H Kindle and E M Woodruff Jul 1981 102 p refs
(Contract DE-AC06-76RL-01830)
(DE81-030151, PNL-3801) Avail NTIS HC A06/MF A01

A methodology was developed that is particularly suited to liquid-dominated resources and adaptable to a variety of situations It is intended to be a base methodology upon which variations can be made to meet specific needs or situations The approach consists of recording flow conditions at the time of sampling, a specific insertable probe sampling system, a sample stabilization procedure, commercially available laboratory instruments, and data quality check procedures DOE

N82-11151# Oak Ridge National Lab, Tenn Engineering Div
TENNESSEE VALLEY AUTHORITY ATMOSPERIC FLUIDIZED-BED COMBUSTOR SIMULATION Interim Annual Report, 1 Jan. - 31 Dec. 1980
J W Wells, M H Culver (Georgia Inst of Technology), and R P Krishman Sep 1981 263 p refs
(Contract W-7405-eng-26)
(DE81-030262 ORNL/TM-7847) Avail NTIS HC A12/MF A01

The development of a steady-state mathematical model with the capability of predicting trends in bed performance under various feed and operating conditions is discussed Three additional predictive subcodes were developed the SO2 capture subcode, the NO/sub x/ emissions subcode, and the freeboard subcode The following subcodes were combined to form an overall simulation code of the AFBC bed (1) bubble growth subcode, (2) elutriation-attrition subcode, (3) coal combustion subcode, (4) SO2 capture subcode and (5) NO/sub x/ emissions subcode An energy balance routine was added to the combined code The resulting overall bed simulation is capable of predicting how some of the important operating variables affect AFBC's performance The freeboard model was combined with the overall bed simulation and is currently being debugged DOE

N82-11152# Illinois Univ at Chicago Circle, Chicago
VERTICAL COMBUSTOR FOR REFUSE COMBUSTION
Paul M Chung Jun 1981 64 p refs Prepared for Argonne National Lab, Ill
(Contract W-31-109-eng-38)
(DE81-030002, ANL/CNSV-TM-80) Avail NTIS HC A04/MF A01

A vertical combustor for refuse-particle combustion was analyzed for waste-to-energy recovery A one dimensional model was constructed that consisted of fuel particles, inert solid particles, and the gaseous mixture The gaseous mixture was divided further into six chemical species that are involved in combustion at temperatures below about 2000 F It was concluded that such combustors may be viable in the United States since US refuse contains large amounts of volatile matter Combuston of the relatively small char, however, may not be cost-effective in the present combustor where the fuel residence time is on the order of 2 s for a combustor height of 20 to 30 ft A computer solution was designed to optimized a given combustor system A simplified version of the solution was programmed for a TI-59 programmable hand calculator for field use DOE

N82-11153# Stanford Univ, Calif Petroleum Research Inst
ALGORITHM FOR COMPUTING IN-SITU COMBUSTION OIL RECOVERY PERFORMANCE
Mohammad R Fassihi, Brian D Gobran, and Henry J Ramey, Jr Oct 1981 29 p refs
(Contract DE-AC03-76ET-12056)
(DE81-030340, DOE/ET-12056/25 SU-SUPRI-TR-25) Avail NTIS HC A03/MF A01

An algorithm was developed to estimate the in-situ combustion performance in the field A calculator program was prepared using this algorithm The program is efficient, simple and accurate Given estimates of fuel concentration, air/fuel ratio, gas and oil saturations and injection rate, for each volume burned, oil recovery, air requirement, and time may be calculated DOE

N82-11154# Massachusetts Inst of Tech, Oak Ridge, Tenn School of Chemical Engineering Practice
ALUMINUM RECOVERY FROM FLY ASH AND SHALE-RETORT WASTES
J L Plawsky, R K Helling, and M E Tsui Jul 1981 72 p refs
(Contract W-7405-eng-26)
(DE81-027675, ORNL/MIT-331) Avail NTIS HC A04/MF A01

The sparge-crystallization step in a proposed process for aluminum recovery from fly ash was studied The effect of various feeds and HCl concentration on the solubility of six metal ions was investigated, and the yield and purity of the crystals obtained Significant improvements in data consistency were obtained over previous work on this system Multistage crystallization and washing will be necessary to achieve removal of K and Mg to meet product specification The replacement of ferric ion with ferrous ion produced an increase in Mg solubility, leading to the conclusion that more work is required with ferrous feeds and with multistage crystallizations Experiments with leachate from oil-shale-retort residues produced 99 87% aluminum purity A predictive correlation proposed by Meissner was used to predict solubilities of pure and mixed salts in hydrochloric acid solutions Modification of the correlation's parameters yielded excellent agreement with theory for the AlCl3-HCl system DOE

N82-11158# Polytechnic Inst of New York, Farmingdale Aerodynamics Labs
ONE-DIMENSIONAL EQUILIBRIUM-CHEMISTRY FLOW MODEL FOR COAL COMBUSTORS
P M Sforza, M Smorto, and W Peter May 1981 108 p refs
(Contracts DE-AC01-78ET-11056, ET-78-C-01-3084)
(DE81-027622, DOE/ET-11056/T5, POLY-M/AE-81-8) Avail NTIS HC A06/MF A01

A quasi one dimensional steady flow analysis for high temperature coal combustors was developed Results for the case of global heat release based on fuel heating value were compared to those obtained with a finite rate chemical reaction combustor analysis and reasonable agreement between the two was demonstrated An existing chemical equilibrium computer code was then coupled to the one dimensional gas dynamic code to improve the accuracy of the required thermodynamic and chemical input data, the coupled code is called COMBUSTOR The second stage or a coal fired MHD combustor designed for large scale operation was modeled by means of the COMBUSTOR code for cases with and without heat transfer, and for varying amounts of potassium carbonate seed injection Results for combustor exit temperature, composition, velocity, and electrical conductivity from the model are shown to agree well with those obtained in the operational combustor DOE

N82-11164# AeroChem Research Labs, Inc, Princeton, N J
SOOT FORMATION IN SYNFUELS Quarterly Report, 1 Jan. - 31 Mar. 1981
D B Olson Aug 1981 21 p refs Prepared in cooperation with the Pittsburgh Energy Technology Center, Pa
(Contract DE-AC22-80PC-30304)
(DE81-030273, DOE/PC-30304/2, QR-2) Avail NTIS HC A02/MF A01

An experimental program is underway to study the effects of molecular structure, pressure, and temperature on soot production in laboratory flames of selected synfuel component hydrocarbons The objective of Task I is to measure the Threshold Sooting Index, flame temperature, and soot concentration for some 50 fuels in premixed and diffusion flames During this reporting period a new liquid metered fuel vaporizer was built and tested to replace a boiler-type fuel system that failed to perform adequately The three wavelength optical probe for measuring emission temperatures and soot concentrations was built and calibrated against a tungsten lamp Sampling probes for the mass spectrometer being used in Task II for flame structure analysis were tested this period The 900 stainless steel sampling probes failed due to overheating to 1200 probes were built (with thicker walls and a higher temperature steel alloy) A new electrostatic lens system to focus the flame ions into the mass filter was also built and installed in the apparatus Author

N82-11165# Gulf Research and Development Co, Pittsburgh, Pa
INVESTIGATION OF MECHANISMS OF HYDROGEN TRANSFER IN COAL HYDROGENATION Annual Progress Report, Feb. 1980 - Feb. 1981
D C Cronauer, R I McNeil, D C Young, and R G Ruberto Jul 1981 72 p refs
(Contract DE-AC22-80PC-30080)
(DE81-030492, DOE/PC-30080/4) Avail NTIS HC A04/MF A01

Hydrogen transfer experiments using Powhatan No 5 bituminous coal (Pittsburgh Seam) and labeled solvents are complete The liquefaction runs with d4-tetrain were made at temperatures of 300 to 4500 C and at run times of 0, 10 and 30 min, additional runs were made with d12-tetralin at 400 and 4500 C Product samples were examined by (2)H-NMR to observe the site of deuterium transfer The relative distribution of deuterium was primarily influenced by reaction temperature and not run time in spite of a major change in the absolute amount of hydrogen transfer with run time Much of bituminous coal liquefaction occurs during the reactor heat-up time even though a low level of hydrogen transfer occurs Therefore, the subsequent hydrogen (deuterium) distribution is strongly influenced by up-grading type reactions that occur Hydrogen/deuterium exchange occurs to a sizable level at the severe conditions of coal liquefaction, this strongly affects the distribution of deuterium in the products This exchange is enhanced by the pressure of heavy aromatic species and by mineral matter and unconverted coal solids DOE

N82-11166# Virginia Polytechnic Inst and State Univ, Blacksburg
DEVELOPMENT AND APPLICATION OF ANALYTICAL TECHNIQUES TO CHEMISTRY OF DONOR SOLVENT LIQUEFACTION Quarterly Progress Report, Apr - Jun. 1981
H C Dorn and L T Taylor Aug 1981 19 p refs
(Contract DE-AC22-80PC-30041)
(DE81-029125, DOE/PC-30041/T6) Avail NTIS HC A02/MF A01

On-line IC-(h-1) nmr analysis of coal recycle solvents is presented This technique is also complimented with a gas chromography-mass spectroscopic analysis of off-line LC fractions DOE

N82-11167# Virginia Polytechnic Inst and State Univ, Blacksburg Dept of Chemistry
DEVELOPMENT AND APPLICATION OF ANALYTICAL TECHNIQUES TO CHEMISTRY OF DONOR SOLVENT LIQUEFACTION Quarterly Progress Report, Jan. - Mar. 1981
H C Dorn and L T Taylor Jul 1981 20 p refs
(Contract DE-AC22-80PC-30041)
(DE81-025961, DOE/PC-30041/T5) Avail NTIS HC A02/MF A01

The operation of modern superconducting magnet based spectrometers in the liquid chromatography-proton nuclear magnetic resonance spectroscopy (LC-(1)H) NMR mode is fairly simple In light of the considerable improvements made in this technique, LC-(1)H NMR has shown itself to be quite useful in fuel analysis The limits of detection are now sufficiently low to be near that of the refractive index detector Improvements in resolution (both chromatographic and spectroscopic) have made speciation within a class possible The LC-(1)H NMR technique increases the convenience and reliability of determining the average degree of substitution Results are reported of runs made on a jet fuel and a model mixture which was prepared by mixing n-butylbenene m-xylene, tetralin, naphthalene, dodecane, isooctane, n-hexane, nonane, hexadecane and n-pentane DOE

N82-11168# Air Products and Chemicals, Inc, Allentown, Pa
CATALYST AND REACTOR DEVELOPMENT FOR A LIQUID-PHASE FISCHER-TROPSCH PROCESS Quarterly Technical Progress Report, 1 Jan. - 31 Mar. 1981
J W Brockington, Paul N Dyer, Ronald Pierantozzi, Barry W Brian, and Jeffrey V Bauer Apr 1981 47 p refs
(Contract DE-AC22-80PC-30021)
(DE81-028209, DOE/PC-30021/T4) Avail NTIS HC A03/MF A01

The computerized literature search of Fischer-Tropsch literature was continued, refinements in analytical procedures were implemented, the first 300 mL slurry reactor was completed, and catalyst screening tests were begun in the 15 mL gas-phase tubular reactor Two of ten modified conventional slurry catalysts

were prepared Two batches of one of these catalysts, representing different pretreatment procedures, and a baseline Fischer-Tropsch catalyst were tested in the gas phase reactor Eight metal cluster catalysts were screened in a gas phase reactor Construction of the cold flow reactor simulator was completed and initial experiments begun The persistant foaming problem associated with the use of kerosene as a cold flow liquid was overcome by using a C (9)-C11 isoparaffin mixture instead of kerosene DOE

N82-11169# Argonne National Lab., Ill Fossil Energy Program Dept
MATERIALS TECHNOLOGY FOR COAL-CONVERSION PROCESSES Progress Report, Jan. - Mar. 1981
W A Ellingson Jun 1981 47 p refs
(Contract W-31-109-eng-38)
(DE81-028474, ANL-81-30) Avail NTIS HC A03/MF A01

Microprobe studies of reaction layers on refractories exposed to a high (20 wt percent) iron oxide acidic coal slag suggest that the amount of iron oxide in the reaction layer immediately adjacent to the slag increases significantly as the chromia content in the refractory increases Waveguides were installed at the SRC pilot plant to monitor erosive wear Installation of the ANL-designed erosion scanner at the Exxon Coal Liquefaction Pilot Plant was completed Nondestructive tests of the HYGAS high-pressure cyclone separator showed that the cyclone internal cone has eroded through in some areas Evaluation of wear of the METC tar-separator cyclones and solids-separator cyclone continued the addition of B4C hardfacing has reduced the wear rate in one of the tar cyclones Preliminary tests were conducted on the capability of an electromagnetic acoustic transducers to measure wall thickness Work on passive acoustic methods to detect leaks in block valves continued Work continued to evaluate the effect of combustion gas stoichiometry and deposits on the corrosion behavior of air and steam heat-exchanger tubes Results indicate that high-chromium alloys such as Type 310 stainless steel exhibit a protective Cr oxide layer in the absence of a deposit DOE

N82-11224*# Lockheed-California Co., Burbank
EXPERIMENTAL STUDY OF FUEL HEATING AT LOW TEMPERATURES IN A WING TANK MODEL, VOLUME 1 Final Report
Francis J Stockemer Aug 1981 75 p refs
(Contract NAS3-21977)
(NASA-CR-165391, LR-29935-Vol-1) Avail NTIS HC A04/MF A01 CSCL 21D

Scale model fuel heating systems for use with aviation hydrocarbon fuel at low temperatures were investigated The effectiveness of the heating systems in providing flowability and pumpability at extreme low temperature when some freezing of the fuel would otherwise occur is evaluated The test tank simulated a section of an outer wing tank, and was chilled on the upper and lower surfaces Turbine engine lubricating oil was heated, and recirculating fuel transferred the heat Fuels included a commercial Jet A, an intermediate freeze point distillate, a higher freeze point distillate blended according to Experimental Referee Broadened Specification guidelines, and a higher freeze point paraffinic distillate used in a preceding investigation Each fuel was chilled to selected temperature to evaluate unpumpable solid formation (holdup) Tests simulating extreme cold weather flight, without heating, provided baseline fuel holdup data Heating and recirculating fuel increased bulk temperature significantly, it had a relativley small effect on temperature near the bottom of the tank Methods which increased penetration of heated fuel into the lower boundary layer improved the capability for reducing holdup S L

N82-11228# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio Fuels and Lubrication Div
JET FUEL LOCKS TO SHALE OIL: THE 1980 TECHNOLOGY REVIEW
Herbert R Lander May 1981 156 p refs Proceedings of Conf held at Cincinnatti, 19-20 Nov 1980
(AF Proj 2480)
(AD-A104414, AFWAL-TR-81-2063) Avail NTIS HC A08/MF A01 CSCL 11/4

The progress of several Air Force shale oil related programs is reported Three shale oil processing studies evaluating the yield, cost, and quality of JP-4 and JP-8 turbine fuel produced from whole crude shale oil are discussed Details of a fourth program that produced 11,300 gallons of specification JP-4 from Geokinetics shale oil are reported Some of this jet fuel was tested in Air Force Fuel Mainburner/Turbine Effects Programs and was shown to behave very similar to petroleum derived JP-4 An additional study concentrated on developing hydrotreating catalysts that would more efficiently convert shale oil into aviation turbine fuel Author (GRA)

N82-11231# Naval Ship Research and Development Center, Annapolis, Md. Ship Materials Engineering Dept
OUTGASSING OF TWO SYNTHETIC FUELS Final Report
Peter Demas Sep 1981 25 p refs
(ZF43451001)
(AD-A104580, DTNSRDC/SME-80/46) Avail NTIS HC A02/MF A01 CSCL 21/4

The outgassing characteristics of two synthetic fuels proposed for Navy use were investigated to determine whether potentially toxic gases could be released into ships' atmospheres The synthetic fuels studied were (1) shale diesel fuel W-375 prepared to conform to MIL-F-16884G and (2) shale jet fuel W-383 prepared to conform to MIL-T-5624K These outgassing characteristics of the synthetic fuels were compared to the outgassing characteristics of a conventional petroleum fuel conforming to MIL-16884G obtained from USS PONCE (LPD 15) Single samples of each fuel were sequentially exposed to temperatures of 50, 150, and 250 C for 3 hours at each temperature, and the types and amounts of the outgassed products were determined Carbon monoxide, hydrocarbons, aldehydes, nitrogen oxides, and sulfur dioxide were outgassed Of these, only the amount of carbon monoxide produced by diesel fuel W-375 and the amount of aldehydes produced by the conventional diesel fuel were relatively significant since each exceeded the Threshold Limit Value for these constituents by a factor of about 13 Some decomposition was evidenced when fuel W-375 was heated up to 245 C It is recommended that similar studies be performed with more types of synthetic fuels as these develop and become available in order to establish a better comparison of outgassing between these fuels and the conventional fuels Author (GRA)

N82-11235# Agri Stills of America, Springfield, Ill
DEVELOPMENT OF A SMALL-SCALE COMMERCIAL ALCOHOL DEHYDRATION 190 TO 200 PROOF Final Report
1981 5 p refs
(Contract DE-FG02-81AF-92005)
(DE81-030158, DOE/AF-92005/T1) Avail NTIS HC A02/MF A01

A small scale farm sized commercial unit to produce anhydrous 200 proof ethanol from 190 proof source of locally produced grain alcohol (ETOH) was investigated The approach is to investigate a low pressure process to efficiently separate water from 190 proof alcohol, with and without the use of a third component to break the azeotrope of water and alcohol formed during atmospheric conditions Results from this experiment show that a vacuum shell is not sufficient in design to effect wet alcohol to the anhydrous state DOE

N82-11236# Cincinnati Univ., Ohio Dept of Chemistry
COAL HYDROGENATION VIA BONDING OF METALLIC COMPOUNDS TO COAL, PART 1. SOLUBILIZATION OF ILLINOIS BITUMINOUS COAL - THE CRITICAL IMPORTANCE OF METHYLENE GROUP CLEAVAGE, PART 2 Final Report
Milton Orchin 1981 23 p refs
(Contracts DE-AS01-76ET-10517, EF-76-01-2308-10)
(DE81-027562, DOE/ET-10517/T1) Avail NTIS HC A02/MF A01

Data for the hydrogenation of Elkhorn coal at 390 C with the initial pressure of 13 8 MPa hydrogen and with various catalysts (stannous chloride and complexes of cobalt and tin), and solvents (decalin and tetralin) are presented in tabular form and results are discussed Model compounds of coal, polystyrene beads were tin-bonded and tin-impregnated, then hydrogenated under various temperatures, pressures, and with either decalin or tetralin Results show both hydrogen and the tin catalyst are necessary for liquefaction at 390 C, and under comparable conditions, bonded tin gave greater liquefaction than impregnated tin but with considerably greater hydrogen consumption In the coal solubilization study, solubilization by hydroliquefaction and by chemical reduction with potassium in tetrahydrofuran seems to indicate that initial degradation of coal by both techniques

proceeds by ether cleavage and that further degradation is achieved in both cases by methylene bridge attack The nuclear magnetic resonance studies on hydroliquefaction products indicate that Illinois bituminous coal is structurally quiet homogeneous.
DOE

N82-11237# Northern Resources, Inc , Billings, Mont
FEASIBILITY AND ECONOMIC STUDY OF MEDIUM-BTU COAL GAS BLENDED WITH HIGH-BTU BY PRODUCT GAS AS AN INDUSTRIAL ENERGY SOURCE AT BILLINGS, MONTANA
May 1981 23 p
(Contract DE-FG01-79RA-20219)
(DE81-025166, DOE/FE-20219/1) Avail NTIS HC A02/MF A01

The technical and economic feasibility of blending a medium Btu gas (CMG) produced from coal by the Winkler fluidized bed gasification process with excess refinery fuel gas to be used as an industrial fuel in Billings, Montana is assessed The background of the project, the site selection process, the conceptual design of the process and supporting facilities, the retrofit requirements and other costs associated with burning the MBG, the environmental and permitting aspects of the project, the cost estimates and economic considerations, the contract provisions for MBG buy/sell agreements, the government's role in supporting the project and the market potential for the project in Billings and similar projects in other markets are discussed It is concluded that the project is technically feasible and economically viable today although parity with conventional fuels will not occur until 1985 DOE

N82-11238# AmeriGas, Inc , Valley Forge, Pa
CONCEPTUAL DESIGN FOR A MULTI-USER MEDIUM BTU COAL GASIFICATION COMPLEX. VOLUME 1: EXECUTIVE SUMMARY
Sep 1980 106 p
(Contract DE-FG01-80RA-50135)
(DE81-027139, DOE/FE-50135/2) Avail NTIS HC A06/MF A01

On the basis of fuel requirements, a gasifier to produce immediate Btu gas (250 Btu/SCF) at a scale of 8 3 million Btu/day was designed The basic conclusion, based upon the $6 45/MM Btu required selling price of IFG for this project, was that the facility, as designed, does not present a viable business opportunity Still existing are the customer's need for long term, stable supplies of clean energy with high fuel utilization load factors The failure to produce a viable business opportunity does not condemn the process or the project Even at $6 45/MM Btu, the economic attractiveness of the project was not so poor as originally perceived When the recent volatile energy price variations are coupled with current rates of inflation and proposed deregulation of natural gas, the long-term attractiveness of IFG is visible The hurdle here is convincing management that the risks of accepting a higher, yet secure cost of energy now is more than off-set by future savings Various financial incentives are considered DOE

N82-11240# New York State Energy Research and Development Authority, New York
LOW/MEDIUM-BTU COAL-GASIFICATION ASSESSMENT PROGRAM FOR SPECIFIC SITES OF TWO NEW YORK UTILITIES
Dec 1980 377 p
(Contract DE-FG01-79RA-20223)
(DE81-025518, DOE/RA-20223/T1) Avail NTIS HC A17/MF A01

The technical and economic aspects of coal gasification to supply low or medium Btu gas to two power plant boilers are investigated Coals from different regions of the country were investigated in terms of their availability, mode of transportation and delivered cost to each power plant site The effects of burning low and medium Btu gas in the selected power plant boilers on efficiency, rating and cost of modifications are also examined Both plants meet the federal, state and local environmental *requirements for air quality, wastewater liquid disposal, and ground* level disposal of byproduct solids of the synthetic gas alternative result in bus bar cost savings on a yearly basis within a few years of start up because the cost of gas is assumed to escalate at a lower rate than that of fuel oil, approximately 4 to 5%
DOE

N82-11242# Gulf Science and Technology Co , Pittsburgh, Pa Chemical and Minerals Div

EFFECTS OF COMPONENTS OF SYNFUELS ON SOOT FORMATION Quarterly Technical Progress Report, 1 Apr. - 30 Jun. 1981
J E Haebig and P M Goldberg Aug 1981 16 p refs
(Contract DE-AC22-80PC-30307)
(DE81-027961, DOE/PC-30307/3, Gulf-627RM073, QTPR-3)
Avail NTIS HC A02/MF A01

The development of an experimental system for the study of the relationships between the rate and amount of soot formation in the combustion of coal derived synfuels and the chemical composition and molecular constituents of those fuels was completed A burner and pressure vessel were fabricated and assembled along with a flow control panel for seven gas streams The optical components for laser light scattering were used Future experimental features were identified Data on coal liquid properties and composition are discussed DOE

N82-11243# Minnesota Gas Co , Minneapolis
PEAT BIOGASIFICATION DEVELOPMENT PROGRAM
Cambridge, Mass Dynatech R/D Co 21 Apr 1981 240 p refs
(Contract DE-AC01-79ET-14696, Dynatech Proj MGC-2)
(DE81-028299, DOE/ET-14696/T6, Dynatech-2115) Avail NTIS HC A11/MF A01

The advantage of the biogasification method is it can use the peat in a high moisture state, thereby eliminating the need to provide energy for drying peat A preliminary investigation (Appendix B) of the peat biogasification process (funded by Minnesota Gas Company) Showed potential technical and economic feasibility of the process, sufficient to carry out the present program Based on the results of the present program the solubilization, oxidation, and digestion steps have been defined sufficiently to lead to a more reliable process design and preliminary estimate of the fuel gas production costs This present program was initiated to develop an experimental data base for the solubilization, oxidation, and fermentation reactions, and to use this data base to develop a conceptual preliminary process design and thus enable a preliminary estimation of the economics (capital and operating costs and unit gas costs) for process DOE

N82-11244# Argonne National Lab , Ill Energy and Environmental Systems Div
ADVANCED SYSTEM EXPERIMENTAL FACILITY: SOLID WASTE TO METHANE GAS. BACKGROUND AND PROCESS DESCRIPTION
R Isaacson and J Pfeiffer Mar 1981 15 p refs
(Contract W-31-109-eng-38)
(DE81-030198, ANL/CNSV-22) Avail NTIS HC A02/MF A01

The Refuse Conversion to Methane Facility in Pompano Beach, Florida, a 100-ton/day experimental plant to convert municipal solid waste (MSW) to methane for fuel was designed to assess the technical merit of anaerobic digestion of the MSW process Approximately 40 ton/day of volatile solids are fed to the digesters, of this, about 25 ton/day will be converted to gases For each pound of volatile solids destroyed, 6 6 std cu ft of methane gas and 6 6 std cu ft of CO2 will be produced Thus, the plant will yield approximately 330,000 std cu ft/day each of methane and CO2 The most important process variables are to be tested allowing judgments to be made on scale up considerations DOE

N82-11246# Battelle Pacific Northwest Labs , Richland, Wash
PRODUCTION AND UTILIZATION OF METHANE FROM ANAEROBIC SLUDGE DIGESTION IN U S. WASTEWATER-TREATMENT PLANTS
Jul 1981 109 p refs
(Contract DE-AC01-76CS-20300)
(DE81-029958, DOE/CS-20300/3) Avail NTIS HC A06/MF A01

Three generic onsite uses were selected for energy and cost accounting analysis heat generation, mechanical energy generation, and electrical energy generation Of the gas utilization methods analyzed, the most energy efficient and cost effective was found to be the direct production of mechanical energy to drive aerators and pumps Between 50 and 80 percent of the mechanical energy required for wastewater treatment can be provided by digester gas In addition, waste heat can be recovered from the engines to aid in heating the digesters and buildings Total energy costs for the mechanical energy generation scheme averaged around $30/million gallons treated, compared to

$34/million gallons and $45/million gallons for the electrical energy generation and heat generation schemes, respectively DOE

N82-11248# California Univ., Livermore Lawrence Livermore Lab
CONTROLLED RETRACTING INJECTION POINT (CRIP) SYSTEM: A MODIFIED-STREAM METHOD FOR IN SITU COAL GASIFICATION
R W Hill and M J Shannon 15 Apr 1981 10 p refs Presented at the 7th Underground Coal Conversion Symp., Fallen Leaf Lake, Calif., 8-11 Sep 1981
(Contract W-7405-eng-48)
(DE81-026477, UCRL-85852, CONF-810923-2) Avail NTIS HC A02/MF A01

The principle of moving the injection point (where the combustion-supporting air or oxygen from the surface is fed into the coal seam) to new areas of unburned coal as the burn progresses in coal gasification is investigated The controlled retracting injection joint or CRIP system is designed to keep the injection point on the bottom of the coal seam and to move it backwards away from the collapse zone into fresh, solid coal The principle of controlled retraction allows the operator to choose the optimum time and distance to move the injection point, and consequently the burn zone, to get the best possible performance from the gasifier Although this system will work with coal seams of any thickness, it is particularly well suited to thick coal seams where the cavity grows by coal collapse as well as combustion Placement of the production channel at the top of the seam, above the injection well ensures isolation from the effects of collapse and reduces the risk of plugging the production well DOE

N82-11251# Department of Energy, Morgantown, W Va Energy Technology Center
ATMOSPHERIC FLUIDIZED-BED PROJECTS TECHNOLOGY OVERVIEW
Feb 1981 66 p refs
(DE81-027143, DOE/METC-SP-108) Avail NTIS HC A04/MF A01

The methodology by which DOE-funded projects achieved program goals and objectives is examined The status of the technology is reviewed, and areas where further development or research is required and projects where this is being addressed are identified Current program issues include feed systems, heat transfer, recycle, air-distributor grid design, ignition characteristics, output control, particulate emissions, reliability, and fuel flexibility DOE

N82-11253# Department of Energy, Morgantown, W Va Energy Research Center
SURFACE COAL GASIFICATION
Oct 1980 48 p refs
(DE81-030183, DOE/METC-SP-110) Avail NTIS HC A03/MF A01

The successful commercial application of surface gasification of coal could enable the United States to use from its vast deposits of coal to produce a wide variety of energy products and chemical feedstocks The technology base is well developed and extremely flexible for converting coal into alternate products suitable for the demands of a broad and heterogeneous market and a wide array of users/owners To meet the defined program objectives, several pilot plant and process-development operations are being conducted Four of these operations are described (1) combustion engineering low-Btu entrained-bed gasifier, (2) bi-gas high-Btu entrained-bed gasifier; (3) ash-agglomerating fluid-bed gasifier, and (4) the short-residence time high-Btu hydrogasifier Gasification technology-crosscut conclusions and results of technical problems and issues common to the four pilot plants are discussed DOE

N82-11254# Department of Energy, Morgantown, W Va.
ADVANCED-GASIFICATION PROCESSES
Dec 1980 66 p refs
(DE81-030184, DOE/METC-SP-183) Avail. NTIS HC A04/MF A01

An analysis of the needs for commercial gasification reveals the following principal categories of information gaps that can be filled by programs already in progress or those readily initiated The gaps are technology base need required for successful commercialization of both currently available and advanced-gasification processes. The needs are defined further in Table 2-1, which shows the current status of the technology data base The need areas are classified as follows Coal Preparation/Feeding/Fins Management, Reactor Design/Performance, Gas Cleaning/Cooling, Acid Gas Removal/Gas Shift and Conversion Data Base on State-of-the-Art and Advaced Technologies, Components/Materials/Instrument Development, Health/Environmental/Safety, and General It is anticipated that solutions to many of the problems associated with the demonstration plants, the alternative fuel plants, and the Synthetic Fuel Corporation endeavors will not be available during the design and construction phases However, during the operating and optimization phases of most of these projects prior to commercialization, where additional will have provided the additional data base needed to correct deficiencies and/or to advance the state of the art DOE

N82-11258# Battelle Pacific Northwest Labs., Richland, Wash Biomass Program Office
TRANSPORTATION FUELS FROM SYNTHETIC GAS
E G. Baker and R Cuello Aug 1981 25 p refs
(Contract DE-AC06-76RL-01830)
(DE81-029614, PNL-3951) Avail NTIS HC A02/MF A01

Twenty-five experimental Fischer-Tropsch synthesis runs were made with 14 different catalysts or combinations of catalysts using a Berty reactor system Two catalysts showed increased selectivity to transportation fuels compared to typical Fischer-Tropsch catalysts With a catalyst consisting of 5 wt percent ruthenium impregnated on a Y zeolite (run number 24), 63 to 70 wt percent of the hydrocarbon product was in the gasoline boiling range Using a 0 5 wt percent ruthenium on alumina catalyst (run number 22), 64 to 78 wt percent of the hydrocarbon product was in the diesel fuel boiling range Not enough sample was produced to determine the octane number of the gasoline from run number 24, but it is probably somewhat better than typical Fischer-Tropsch gasoline (approx 50) and less than unleaded gasoline (approx 88) The diesel fuel produced in run number 22 consisted of mostly straight chained paraffins and should be an excellent transportation fuel without further refining The yield of transportation fuels from biomass via gasification and the Fischer-Tropsch synthesis with the ruthenium catalysts is somewhat less, on a Btu basis, than methanol (via gasification) and wood oil (PERC and LBL processes) yields from biomass DOE

N82-11259# Utah Univ., Salt Lake City Dept of Mining and Fuels Engineering
CHEMISTRY AND CATALYSIS OF COAL LIQUEFACTION: CATALYTIC AND THERMAL UPGRADING OF COAL LIQUID AND HYDROGENATION OF CO TO PRODUCE FUELS
Quarterly Progress Report, Oct. - Dec. 1979
W H Wiser Aug 1980 73 p refs
(Contract DE-AC01-79ET-14700)
(DOE/ET-14700/1) Avail NTIS HC A04/MF A01

Studies of the chemistry and catalysis of coal hydrogenation have been initiated with the construction of a flow reactor for extraction of coal and the development of analytical techniques Work was initiated on the design of a rotor for (13)C nuclear magnetic resonance of solid coal and extracted coal Studies on momentum, heat and mass transfer in a fluidized bed simulated conditions for coal hydrogenation and were used to investigate effects of particle size and solids loading The catalytic upgrading of coal-derived liquids is investigated by studies of the catalytic denitrogenation, desulfurization, deoxygenation and cracking of model compounds Aging of Co-Mo catalysts was found to reduce the number of active sites but not the nature of the sites A Raney catalyst is being developed for the hydrogenation of carbon monoxide Temperature programmed desorption was used to study the properties of an iron manganese oxide catalyst previously shown to give high yields of C2-C10 hydrocarbons DOE

N82-11260# Utah Univ., Salt Lake City Dept of Mining and Fuels Engineering
CHEMISTRY AND CATALYSIS OF COAL LIQUEFACTION: CATALYTIC AND THERMAL UPGRADING OF COAL LIQUID AND HYDROGENATION OF CO TO PRODUCE FUELS
Quarterly Progress Report, Jan. - Mar. 1980
Wendell H Wiser Aug 1980 70 p refs
(Contract DE-AC22-70ET-14700)
(DOE/ET-14700/2) Avail NTIS HC A04/MF A01

Analysis of a group of coal liquids produced by catalytic hydrogenation of Utah coals with ZnCl2 catalyst was begun Carbon-13 nuclear magnetic resonance and liquid chromatography

techniques will be used to correlate chemical properties with hydrogenation reactivity Equipment previously used for downflow measurements of heat and momentum transfer in a gas-coal suspension was modified for upflow measurements The catalytic hydrodeoxygenation of methyl benzoate has been studied to elucidate the reactions of ester during upgrading of coal-derived liquids The kinetics of hydrogenation of phenanthrene have also been determined The catalytic cracking mechanism of octahydroanthracene is reported in detail Studies of the hydrodesulfurization of thiophene indicate that some thiophene is strongly adsorbed as a hydrogen-deficient polymer on cobalt-molybdate catalyst Part of the polymer can be desorbed as thiophene by hydrogenation Poisoning of the catalyst inhibits the hydrosulfurization activity to a greater degree than the hydrogenation activity Iron-manganese catalysts for carbon monoxide hydrogenation is studied to determine the role of iron carbide formation on selectivity Pure iron catalyst forms a Hagg iron carbide phase unde reaction conditions DOE

N82-11261# COECORP, Mountain View, Calif
WORKSHOP PROCEEDINGS: COMBUSTION TURBINE RESIDUAL OIL
May 1981 291 p Workshop held at Atlanta, 17-18 Jul 1980 Sponsored by EPRI
(EPRI-WS-80-132, CONF-8007109) Avail NTIS HC A13/MF A01

Technology developed for the reliable and efficient operation of gas turbines using heavy fuel oils or alternative to petroleum distillates is described Topics covered include combustion system design, turbine gas path design, corrosion resistant materials, turbine deposits, fuel treatment, fuel processing, and additives Turbine operating conditions and performance are also discussed A R H

N82-11267# California Univ, Livermore Lawrence Livermore Lab
LLNL UNDERGROUND COAL GASIFICATION PROJECT Quarterly Progress Report, Jan. - Mar. 1981
D U Olness, ed and Wallace Clements, ed 27 Apr 1981 42 p refs
(Contract W-7405-eng-48)
(DE81-030634, UCRL-50026-81-1) Avail NTIS HC A02/MF A01

Laboratory studies of forward gasification through drilled holes in small blocks of coal, approximately 1 foot on a side were conducted Such studies give insight into cavity growth mechanisms and particulate production However, because of the small dimensions involved, the information these tests provide is necessarily limited to aspects of cavity growth at very early times The preliminary process design of the Tono No 1 field experiment in Washington was completed The experimental plan and operational strategy was developed to ensure that the injection point remains near the bottom of the coal seam and that the experiment continues at least until a period of stable operation is reached and sustained for a time A mathematical model for the small coal block experiments in order to further our understanding of the physical and chemical processes governing the burning of the coal and the growth of the cavity within the block is being developed Groundwater samples from wells located at distances of a few feet to several hundred feet from the gasification cavities were collected before, during, and after each of the Hoe Creek tests The analysis of the groundwater contamination data pertinent to the Hoe Creek No 3 test was completed DOE

N82-11269# Water Resources Council, Washington, D C
COAL LIQUEFACTION DEMONSTRATION PLANT NEAR MORGANTOWN, WEST VIRGINIA; WATER ASSESSMENT REPORT SECTION 13(b) Final Report
Nov 1980 40 p refs Prepared in cooperation Ohio River Basin Commission
(PB81-216095) Avail NTIS HC A03/MF A01 CSCL 08H

Water requirements and water supply availability were assessed for a proposed coal liquefaction demonstration project at Fort Martin near Morganown, WV A policy for consumptive use makeup and the impact on other offstream uses, navigation, and water quality are also examined GRA

N82-11271# TRW, Inc, McLean, Va Energy Engineering Div
GAS RECOVERY FROM COAL DEPOSITS Final Report
A A Lee, C R Skillern, and D R Watkins Jan 1981 113 p refs
(Contract GRI-5011-321-0101)
(PB81-222291, GRI-80/0033) Avail NTIS HC A06/MF A01 CSCL 08I

The production potential of coalbeds at depth below 2500 feet was assessed and the effectiveness of hydraulic fracturing in deep coalbeds was determined Two deep tests were performed, one in the Greater Green River Area and one in the Piceance Basin, both in Colorado GRA

N82-11397*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
LEWIS RESEARCH CENTER'S COAL-FIRED, PRESSURIZED, FLUIDIZED-BED REACTOR TEST FACILITY
John A Kobak and R James Rollbuhler Oct 1981 35 p refs
(NASA-TM-81616, E-621) Avail NTIS HC A03/MF A01 CSCL 20D

A 200-kilowatt-thermal, pressurized, fluidized-bed (PFB) reactor, research test facility was designed, constructed, and operated as part of a NASA-funded project to assess and evaluate the effect of PFB hot-gas effluent on aircraft turbine engine materials that might have applications in stationary-power-plant turbogenerators Some of the techniques and components developed for this PFB system are described One of the more important items was the development of a two-in-one, gas-solids separator that removed 95+ percent of the solids in 1600 F to 1900 F gases Another was a coal and sorbent feed and mixing system for injecting the fuel into the pressurized combustor Also important were the controls and data-acquisition systems that enabled one person to operate the entire facility The solid, liquid, and gas sub-systems all had problems that were solved over the 2-year operating time of the facility, which culminated in a 400-hour, hot-gas, turbine test A R H

N82-11404# Denver Research Inst, Colo
TWO-PHASE FLOW IN GEOTHERMAL ENERGY SOURCES Final Technical Report
Jul 1981 240 p refs Prepared jointly with Coury and Associates, Lakewood, Colo and Houston Univ
(Contract De-AC02-76ET-28359)
(DE81-029037, DOE/ET-28359/T1) Avail NTIS Hc A11/MF A01

A geothermal well consisting of single and two-phase flow sections was modeled in order to explore the variables important to the process For this purpose a computer program was developed in a versatile form in order to be able to incorporate a variety of two phase flow void fraction and friction correlations A parameteric study indicated that the most significant variables controlling the production rate are hydrostatic pressure drop or void fraction in the two-phase mixture and heat transfer from the wellbore to the surrounding earth Downhole instrumentation was developed and applied in two flowing wells to provide experimental data for the computer program The wells (East Mesa 8-1, and a private well) behaved differently Well 8-1 did not flash and numerous shakedown problems in the probe were encountered The private well did flash and the instrumentation detected the onset of flashing A Users Manual was developed and presented in a workshop held in conjunction with the Geothermal Resources Council DOE

N82-11405# Oak Ridge National Lab, Tenn Energy Div
CYCLE AND PERFORMANCE ANALYSIS OF ABSORPTION HEAT PUMPS FOR WASTE HEAT UTILIZATION
Horacio Perez-Blanco and Gershon Grossman Sep 1981 56 p refs
(Contract W-7405-eng-26)
(DE81-030705, ORNL/TM-7852) Avail NTIS HC A04/MF A01

A heat pump was designed to upgrade low-temperature waste heat by boosting its temperature typically from 600 C (1400 F) to 1200 C (2500 F) The system uses part of the low-temperature heat as its energy source and does not need outside power, except for running small auxiliary equipment The heat pump employs a desorber/evaporator combination in which some hot water from the heat source is evaporated and the vapor is absorbed in a concentrated absorbent solution The heat of absorption serves to raise the temperature of the rest of the hot water stream Two stages of the system are used in series to provide the desired temperature boost Both are served by one desorber which uses part of the waste heat to concentrate the solution

Both open- and closed-cycle regeneration of the solution was studied The operation of the system is described and its performance criteria defined Results of a computer study show the variation in performance with different design variables Two working materials, LiBr-water and LiCl-water, are considered
DOE

N82-11474# California Univ., Berkeley Lawrence Berkeley Lab
NOVEL DESIGN OF PRESSURE VESSELS AND THERMAL SHIELDS IN COAL GASIFIERS
B W Loo Jun 1981 11 p refs Presented at the Symp on Instr and Control for Fossil Energy Processes, San Francisco, 7-10 Jun 1981
(Contract W-7405-eng-48)
(DE81-025828, LBL-12807) Avail NTIS HC A02/MF A01

Two outstanding problems in commercial sized coal gasifiers, namely, detecting and locating any deterioration in the refractory thermal barrier and the construction of a safe pressure vessel utilizing advanced carbon fiber composite technology are described Design considerations are given for a typical gasifier some 30 feet in diameter by 150 feet tall with a maximum internal temperature and pressure of 2500 F and 1500 psi respectively A system of computer controlled cooling circuits is deployed between the refractory barrier and the external lightweight pressure vessel Multiple levels of redundancy are built in to guard against any component failure Through the sensing of coolant temperature and the modulation of coolant flow, a map of heat flux distribution over the gasifier wall may be generated with a spatial resolution of about 5 feet Results indicate that the coolant temperature rise can be maintained by no more than 90 F with only a modest amount of coolant flow
DOE

N82-11516*# Jet Propulsion Lab., California Inst of Tech., Pasadena
GEOLOGIC CONSIDERATIONS IN UNDERGROUND COAL MINING SYSTEM DESIGN
Frank A Camilli, David P Maynard, Arnis Mangolds, and Jack Harris 1 Oct 1981 52 p refs
(Contracts NAS7-100, DE-AI01-76ET-12548)
(NASA-CR-164961, JPL-Pub-81-74, DOE/ET-12548/9) Avail NTIS HC A04/MF A01 CSCL 08I

Geologic characteristics of coal resources which may impact new extraction technologies are identified and described to aid system designers and planners in their task of designing advanced coal extraction systems for the central Appalachian region These geologic conditions are then organized into a matrix identified as the baseline mine concept A sample region, eastern Kentucy is analyzed using both the developed baseline mine concept and the traditional geologic investigative approach A R H

N82-11518# Argonne National Lab., Ill Energy and Environmental Systems Div
PETROLEUM GEOLOGY AND RESOURCE ASSESSMENT OF THE MIDDLE CASPIAN BASIN, USSR, WITH SPECIAL EMPHASIS ON THE UZEN FIELD
G Ulmishek and W Harrison May 1981 157 p refs
(Contract W-31-109-eng-38)
(DE81-029951, ANL/ES-116) Avail NTIS HC A08/MF A01

The Middle Caspian Basin contains up to 12 000 m (40,000 ft) of sedimentary rocks ranging in age from late Paleozoic to Quaternary and has over 100 oil and gas fields varying in size from small to supergiant The Soviet literature reviewed covers (1) tectonic zones of the basin, including details of the lower, intermediate, and upper structural complexes, (2) paleogeography, facies distribution, and conditions of organic matter accumulation in the major petroleum source rocks, (3) stages of oil and gas generation, (4) major hydrogeological features, and (5) producing regions of the basin Total initial petroleum resources of the basin are estimated at 22 5 x 10(9) t (166 x 10(9) bbl), of which 16 00 x 10(9) t (118 x 10 (9) bbl) are yet to be discovered Resources of the Offshore Caspian Sea area are estimated to be 12 1, 10(9) t (89 5 x 10(8) bbl)
DOE

N82-11519# Rhode Island Univ., Kingston
PLANNING A COMPREHENSIVE PROGRAM FOR EXPLORATION OF THE ANTHRACITE DEPOSITS OF THE NARRAGANSETT BASIN OF MASSACHUSETTS AND RHODE ISLAND, PHASE 1 AND 2 Final Report
J W Skehan Feb 1981 131 p refs
(Contract DE-AC01-79RA-2036)
(DE81-028490, DOE/FE-20036/1) Avail NTIS HC A07/MF A01

Coal deposits occur in a sporadic fashion throughout the Basin with little continuity as to the type of deposit and the quality of coal thus making it difficult, perhaps very expensive and risky, to base a drilling program soley on stepping out from known outcrops and coal occurrences The combination of understanding the original depositional environment, its subsequent deformation to stepping out from known coal occurrences, is believed to be the most efficient basis for developing a comprehensive drilling program plan for the Basin This limited exploration program produced resource estimates of 11 35 million tons of anthracite material in the eastern and 4 73 in the western part of Portsmouth, Rhode Islands, area and 4 2 million tons in Plainville, Machusetts These estimates are based on USGS recommended methods for resource determination The cost of finding this material, based on the cost of the contracts, comes out to be approximately 1 5 cents per ton DOE

N82-11520# Royal Norwegian Council for Scientific and Industrial Research, Oslo
PLAN FOR TECHNOLOGICAL RESEARCH AND DEVELOPMENT RELATED TO THE PETROLEUM ACTIVITIES ON THE NORWEGIAN CONTINENTAL SHELF. 1981-1985: APPENDIXES: 1. TECHNICAL CHALLENGES. 2. RESEARCH REQUIREMENTS. 3. HIGH PRIORITY PROGRAMS
10 May 1980 171 p
(DE81-904014, NP-1904014) Avail NTIS HC A08/MF A01

The environmental and geographical conditions on the Norwegian Continental Shelf (NCS) which may effect field exploration and development philosophy or the choice of technological solutions are identified Research requirements are described in the areas of physical environment, petroleum exploration, petroleum technology, production technology, sub-sea production systems, platforms and supporting equipment, storage and offshore loading, pipelines, underwater support functons; above-water support functions, automation in offshore production and transportation, communications and positioning, materials and corrosion protection, quality assurance, and regulations High priority programs were defined based on the general objectives of the national petroleum policy, resource management, safety, industrial development, and cost reduction DOE

N82-11523# Boston Coll., Weston, Mass Dept of Geology and Geophysics
EXPLORATION OF COAL AND ANTHRACITIC CARBONACEOUS SHALE RESOURCES, NARRAGANSETT BASIN, MASSACHUSETTS, AND RHODE ISLAND Final Report, 1 Oct. 1979 - 30 Arp. 1981
James W Skehan, Greta E Gill, Jonathan D Raben, Norman Schapiro, and Daniel P Murray May 1981 86 p refs
(Contract DE-AC01-79RA-20029)
(DE81-030895, DOE/RA-20029/T1) Avail NTIS HC A05/MF A01

Results of continuous core drilling primarily in two contiquous fields to evaluate the carbonaceous resource are presented Geological and analytical results, resource calculations, and evaluations of potential mining methods and conditions are included Results of fieldwork and drilling in the Portsmouth, Rhode Island area defined the coal-bearing structure as being a southerly plunging fold, with the western limb and the eastern holes penetrating the axial portion of the fold In the Plainville, Massachusetts area, an E-W trending anticline was defined by fieldwork and exploratory drilling The anthracitic carbonaceous shale seam folded by this structure varies in thickness and ash content along strike T M

N82-11571# Aerojet Energy Conservation Co., Sacramento, Calif
FLUID-BED HEAT-EXCHANGER OPTIMIZATION AND BED MATERIALS SELECTION Final Report
Feb 1981 127 p refs
(Contracts DE-AC22-78ET-11343, DE-AC03-79ET-11343, ET-78-C-03-2039)
(DOE/ET-11343/T2, Rept-8100-F8-0003) Avail NTIS HC A07/MF A01

The effect of material properties on heat exchanger costs for waste gas streams from 500 to 30000F was evaluated The cost of the major heat exchanger components was identified and related directly to bed material properties Two hundred materials were reviewed metals, alloys, oxides, minerals,

carbides, borides, intermetallics, and cermets It is shown that the oxides and minerals were the most cost effective at the lower bed temperatures and the metallic bed materials at the higher bed temperature DOE

N82-11573# Argonne National Lab , Ill Energy and Environmental Systems Div
PRELIMINARY EVALUATION OF ADVANCED COAL-BASED ELECTRICITY-GENERATING TECHNOLOGIES BY MEANS OF SYSTEM-INTEGRATION ANALYSIS
J L Gillette and K Hub Apr 1981 41 p refs
(Contract W-31-109-eng-38)
(DE81-029989, ANL/EES-TM-144) Avail NTIS HC A03/MF A01

The potential effects of coal fired cogeneration on production requirements were examined Two types of cogeneration designs, a backpressure turbine and an extraction turbine were studied It is found that some savings of oil can be realized with coal based cogeneration, and that the quantity of such is dependent on the purchase option, the demand growth rate, and the cogenerator design It is concluded that of the two designs the backpressure turbine type has an advantage due to its significantly lower heat rate DOE

N82-11588# Princeton Univ , N J
IS GEOTHERMAL SIMULATION A CATASTROPHE?
V V Nguyen and George F Pinder 1980 5 p refs Presented at 6th Ann Workshop on Geothermal Reservoir Engr , Stanford, Calif , 16-18 Dec 1980
(DE81-026750, CONF-801233-10) Avail NTIS HC A02/MF A01

All numerical simulators of geothermal reservoirs depend upon an accurate representation of the thermodynamics of steam-water systems These relationships are required to render tractable the system of balance equations derived from the physics of flow through porous media While it is generally recognized that steam-water system (i e , two phase) is not thermodynamic equilibrium, equilibrium thermodynamics are employed in its description An alternative view based on non-equilibrium thermodynamics is presented The underpinnings of this approach are found in a branch of topology generally referred to as catastrophe theory DOE

N82-11611# Midwest Research Inst , Golden, Colo Solar Energy Research Inst
OCEAN ENERGY-WAVES, CURRENTS, AND TIDES
J Miles and B Shelpuk May 1981 11 p refs Presented at Energy in the Man-Built Environ Urban Planning and Develop Div Spec Conf , Vail, Colo , 3-5 Aug 1981
(Contracts DE-AC02-77CH-00178, EG-77-C-01-4042)
(DE81-025708, SERI/TP-634-1195, CONF-81080808) Avail NTIS HC A02/MF A01

An overview is presented on the mechanical forms of ocean energy, i e , waves, currents, and tides Following an introductory section on wave mechanics, each of the three forms of ocean energy is considered under the headings of the resource, device types for energy extraction, and prognosis for practical implementation DOE

N82-11683 Colorado Univ at Boulder
GEOLOGY OF THE NAHCOLITE DEPOSITS AND ASSOCIATED OIL SHALES OF THE GREEN RIVER FORMATION IN THE PICEANCE CREEK BASIN, COLORADO Ph.D. Thesis
John Richard Dyni 1981 182 p
Avail Univ Microfilms Order No 8122279

Stratigraphic and lithologic studies of drill cores from 10 exploratory holes reveal that five eights of the nahcolite resource, occurs as crystalline aggregates in marlstone The remainder of the resource consists of laterally continuous zones of disseminated nahcolite in marlstone and beds of mixed nahcolite and halite Sedimentologic data indicate that the marlstones and associated sodium minerals were deposited by pelagic, turbiditic, and evaporitic processes in a permanent alkaline lake Lower lake waters and sediments favored high rates of bacterial reduction of sulfate and hydrolysis of fine grained detrital silicate minerals These processes resulted in production of bicarbonate and the formation of an authigenic suite of carbonate and silicate minerals devoid of clay and sulfate minerals Cyclic probably seasonal, stratification is recorded by the laminated marlstones and in some units of disseminated and bedded nahcolite and halite The vertical distribution of total sulfur in the marlstones is also cyclic and may be related to evaporative phases of the lake Dissert Abstr

N82-11715# Los Alamos Scientific Lab , N Mex
RELAXATION OF GEOTHERMAL-RESERVOIR STRESSES INDUCED BY HEAT PRODUCTION
H Murphy, ed , R Aamodt, H Fisher, T Grant, C Grigsby, R Hendron, H Keppler, C Pearson, R Potter, and G Suhr Aug 1981 34 p refs
(Contract W-7405-eng-36)
(DE81-032024, LA-8954-MS) Avail NTIS HC A03/MF A01

Fifteen million kWh of thermal energy were produced during 281 days of operation of the hot dry rock (HDR) geothermal reservoir at Fenton Hill, New Mexico Following this heat production the thermal stresses and strains so were partially released by a shot, 7-h pressurization of the reservoir above the local tectonic confining stress Following the partial stress release, it was found that the resistance to water flow through the reservoir was decreased by 37 percent, and that the reservoir volume, as measured by tracer studies, increased by 43 percent Microseismic events recorded with geophones in two deep wells at positions within a few hundred meters of the reservoir were concentrated in those regions of the reservoir most affected by thermal depletion These events define a reservoir region and size in qualitative agreement with estimates based upon heat production modeling DOE

N82-12156 Arizona Univ , Tucson
FUEL NITROGEN CONVERSION DURING FUEL RICH COMBUSTION OF PULVERIZED COAL AND CHAR Ph.D. Thesis
James William Glass 1981 334 p
Avail Univ Microfilms Order No 8121921

The conversion of coal and char nitrogen is investigated during fuel rich combustion The roles of NO, HCN, and NH3, and char nitrogen in the post combustion gases in the first, fuel rich stage of a staged combustor are clarified The fuel rich conversion of char nitrogen show that at all stoichiometries, the concentrations of HCN and NH3 in the post time gases are small compared to the concentration of NO Char nitrogen conversion is stoichiometric or greater Destruction of NO is found to be controlled by a heterogeneous mechanism involving the char carbon surface The mechanism is deactivated by oxygen Dissert Abstr

N82-12182# Georgetown Univ , Washington, D C
INDUSTRIAL APPLICATION OF FLUIDIZED-BED COMBUSTION Quarterly Technical Progress Report, Jan. - Mar 1981
1981 123 p
(Contract DE-AC21-76ET-10381)
(DE81-030272, DOE/ET-10381/197) Avail: NTIS HC A06/MF A01

An atmospheric fluidized bed boiler using high sulfur coal functioning as a source of steam was constructed and is operated as a demonstration plant Operations since start up are summarized Boiler thermal efficiency is low Factors affecting efficiency are discussed. S L

N82-12187# Energy and Environmental Research Corp., Santa Ana, Calif
ASSESSMENT OF PULVERIZED-COAL-FIRED COMBUSTOR PERFORMANCE Quarterly Progress Report, 1 Apr. - 30 Jun. 1981
W Richter, W Clark, and R Payne Jul 1981 28 p refs
(Contract DE-AC22-80PC-30297)
(DE81-030860; DOE/PC-30297/T4, QPR-3) Avail NTIS HC A03/MF A01

This program is concerned with the provision of a technology base to expedite the conversion of industrial processes from oil and gas to coal and other pulverized fuels It addresses primarily the impact of fuel type on the thermal performance of a combustor The program incorporates two experimental tasks and is constructed around an analytical task (Task 1) which will identify and upgrade a family of computer programs required to undertake thermal performance analysis studies These anaytical tools will thus be used to predict the effects of parameters such as fuel type and furnace variables on combustor performance, and to identify those properties which have a major impact on thermal performance The second task uses a combustion reactor to screen the key variable identified in Task I and to provide

data on the properties of coal particulate matter which affect heat transfer performance Verification of the engineering analytical approach will be provided by measurements made in a pilot-scale furnace in the third task Progress is reported. DOE

N82-12194# Wisconsin Univ, Madison Dept of Mechanical Engineering
COAL COMBUSTION IN HIGH CONVECTIVE FLOWS Progress Report, 1 Mar. - 31 Aug. 1981
Kenneth W Ragland 8 Sep 1981 6 p
(Contract DE-FG22-80PC-30213)
(DE81-030391, DOE/PC-30213/T1) Avail NTIS HC A02/MF A01

Fundamental data on ignition delay, volatile burn time, volatile reactivity, char burn time, char reactivity, aerodynamic drag, particle surface temperature, and internal porosity of burning coal particle are being obtained as a function of coal type, particle size, gas temperature, gas velocity and oxygen concentration Simulation of conditions inside a furnace has been achieved in two test rigs which have been constructed In the first rig single coal particle 3 to 12 mm diameter are suspended on a 0 02 mm diameter stainless steel wire which extends from an electronic balance into a 5 mm diameter tube containing flowing electrically heated gas This setup extends the traditional thermogravimetric analysis to flowing systems In the second rig coal particles are levitated freely in a 50 mm diameter diverging insulated quartz nozzle To data 16 fixed particle test runs have been made-7 with a Kentucky bituminous coal, 3 with a Montana sub-bituminous and 6 with a Texas lignite Gas temperture ranged from 760 to 11400K, flow rates 2 to 11 scfm, gas-particle velocities from 1 8 to 10 4 m/s, and Reynolds numbers from 100 to 1150 DOE

N82-12196# Cornell Univ, Ithaca, N Y
PYROLYSIS OF COAL-DRIVED FUELS USING THE LASER-POWERED HOMOGENEOUS PYROLYSIS TECHNIQUE Technical Progress Report, 5 Aug. 1980 - 31 Jul. 1981
P C T deBoer 31 Jul 1981 19 p refs
(Contract DE-FG22-80PC-30217)
(DE82-000251, DOE/PC-30217/T2) Avail. NTIS HC A02/MF A01

The progress made can be divided into two areas theoretical work leading to an accurate computation of the temperature and velocity fields in the sample cell, and experimental work studying various chemical reactions involving hydrocarbons The laser-powered homogeneous pyrolysis (LPHP) technique was applied to the unimolecular decomposition of 1,4-cyclohexandiene to benzene and hydrogen and of 1-chloropropane (n-propylchloride) to propene and hydrogen chloride as well as to the isomerization of cis-2-butene to trans-2-butent These reactions proceed in different temperature ranges, with reaction rates that are well known The temperature range covered is 575 to 8500K The objective of this investigation was to establish proper operation of the LHLP technique over the temperature range of interest for the pyrolysis of coal-derived hydrocarbons A set of equations was derived describing the motion of the strongly heated gas in the sample cell The equations take account of the variations of viscosity and thermal conductivity with temperature, as well as of the dependence of the radiation absorption coefficient on temperature and density DOE

N82-12197# Pittsburg and Midway Coal Mining Co, Englewood, Colo
SOLVENT-REFINED COAL (SRC) PROCESS Final Report
Aug 1981 87 p refs
(Contract DE-AC05-76ET-10104)
(DE81-031937, DOE/ET-10104/12) Avail NTIS HC A05/MF A01

In late 1979 the Pittsburgh and Midway Coal Mining Co, recommended to the Department of Energy that certain areas of the SRC Pilot Plant should be modified to represent the SRC-II Demonstration Plant design The proposed modifications were for design confirmation, start-up, transient and other operational guidance studies, and training of operator and professional personnel The pilot plant facilities proposed for modification were Coal Slurry Mixing - Area 01, Dissolver Effluent Cooling and Separation - Area 02, and Vacuum Flash/Residue Pump Testing - Area 04 A summary justification assessment for the modifications is included A preliminary engineering study by Badger Energy, Inc was completed in late 1980 A proposed to begin detailed engineering had been submitted to DOE for approval when all work was discontinued at the direction of the DOE in April 1981 DOE

N82-12198# Montana State Univ, Missoula
CATALYTIC HYDROGENATION OF COAL-DERIVED LIQUIDS Interim Report, Mar. - May 1981
Lloyd Berg and F P McCandless Jul 1981 50 p
(Contracts EX-76-C-01-2034; DE-AC22-76ET-10495)
(DE81-030485, DOE/ET-10495/T2, FE-2034-23) Avail NTIS HC A03/MF A01

Two runs of more than 100 hours of catalyst life were completed using SRC-I and SRC-II as the feeds One run had catalyst regeneration every three hours, the other every eight hours The catalyst, 4% CoO, 8% MoO3, 1% NiO and 8% WO3 on NALCO-78-6008C alumina base, reduced the nitrogen content to less than 0 3% showed no signs of deterioration in activity Regeneration after the three or eight hour periods was by burnoff with oxygen in nitrogen followed by re-sulfiding with H2S in hydrogen The liquid yield from SRC was 90% of which 30% was 50 to 2040C boiling range gasoline It appears that a viable process to convert SRC into a feedstock acceptable to a petroleum refinery was discovered A study of the effect of carbon laydown on pore volume and subsequent deactivation of the catalyst was carried out in a pressurized batch reactor Little reduction in pore volume was noted Three commerical catalysts, Harshaw HT400, NALCO MO477 and NALCO MN502, were evaluated with SRC-II DOE

N82-12199# California Univ, Berkeley Lawrence Berkeley Lab Energy and Environment Div
OXYDESULFURIZATION OF COAL BY ACIDIC IRON SULFATE SOLUTIONS M.S. Thesis
David A Mixon and Theodore Vermeulen Aug 1981 161 p refs
(Contract W-7405-eng-48)
(DE82-000464, LBL-9963-Rev) Avail NTIS HC A08/MF A01

To facilitate by-product recovery and eliminate elemental sulfur formation in coal oxydesulfurization, high-sulfur bituminous coal has been treated with aqueous ferric sulfate/sulfuric acid and oxygen at 100 to 1500C The rate of pyrite oxidation increases with oxygen partial pressure, temperature, and fitness of grinding This reaction rate is relatively insensitive to sulfuric acid and ferric sulfate concentrations, so that pyrite removal may be satisfactorily performed in solutions containing 25% H2SO4 and 12% Fe2(SO4)3 (weight percentages relative to total H2O plus HsSO4), preliminary data suggest that such a leaching solution is only mildly corrosive to T316 stainless steel, at 1500C or below, in the presence of oxygen To provide an accurate assessment of coal oxydesulfurization stoichiometry, and analytical technique based on uv spectrophotometry has been developed for the determination of elemental sulfur in coal Prepared coal samples are extracted for 24 hours with cyclohexane Other exploratory oxydesulfurization runs have shown that vanadium oxides are not effective catalysts at 1000C, with oxygen DOE

N82-12200# Utah Univ, Salt Lake City College of Mines and Mineral Industries
INVESTIGATION OF FACTORS AFFECTING THE IN-SITU COMBUSTION RETORTING OF OIL SHALE Final Report
H Y Sohn, C H Pitt, and A G Oblad 29 May 1981 166 p refs
(Contracts DE-AS03-78ET-13095, ET-77-S-03-1760, EF-77-S-04-3909)
(DE82-000482, DOE/ET-13095/T1) Avail NTIS HC A08/MF A01

Subprocess taking place during an in situ combustion retorting of oil shale were investigated Some of these subprocesses also occur in a surface retorting process The specific topics of this research program include (1) experimental determination of the intrinsic kinetics of kerogen decomposition producing oil, (2) mathematical formulation of the retorting of a oil shale block in the presence of heat transfer effects, (3) experimental determination of the intrinsic kinetics of oil shale char oxidation, (4) mathematical modeling of the oxidation of oil shale char in a spent shale block in the presence of heat and mass transfer effects, (5) determination of ignition delay and energy requirements for the ignition of an oil shale bed, (6) determination of thermal expansion of oil shale, and (7) determination of heat capacities of oil shale and the heat of decomposition of kerogen The results of the investigation of these topics are presented Some

of the results have been published in journals which are readily available In such a case only a brief summary of the results are presented DOE

N82-12236 Dartmouth Coll , Hanover, N H
PARTIAL ACID HYDROLYSIS PRETREATMENT FOR ENZYMATIC HYDROLYSIS OF CELLULOSE: A PROCESS DEVELOPMENT STUDY OF ETHANOL PRODUCTION Ph.D. Thesis
Diane Ruth Knappert 1981 175 p
Avail Univ Microfilms Order No 8121523

Cellulosic substrates (poplar, corn stover and bagasse) were pretreated in a continuous, plug flow reactor at conditions of 160-220 C, 0-1 5% acid, and retention times up to 13 seconds The pretreated material was then hydrolyzed with Trichoderma reesei C30 cellulase, for 48 hours Glucose concentrations were measured during the 48 hours of hydrolysis, and results are compared to those from controls, hydrolysis of untreated material Results show a significant increase in glucose yields after pretreatment For example, after pretreatment, glucose yields from hydrolysis of poplar as high as 75% are obtained, compared to 20% yields from hydrolysis of untreated poplar Successful pretreatments are found to solubilize about 40% of the poplar hemicellulose The cost of producing ethanol using a 10 MM gal/yr plant size are evaluated, and the process is scaled up to a 50 MM gal/yr plant Dissert Abstr

N82-12238 Houston Univ , Tex
SOLID-SOLID REACTIONS IN COAL CONVERSION PROCESSES Ph.D. Thesis
Daniel Clark Baker 1981 198 p
Avail Univ Microfilms Order No 8120902

The thermal stability of calcium sulfate and sulfated coal ashes was studied as well as the catalytic effect of metal carbonates on coal char gasfication Five model reactions which could result in undesirable evolution of sulfur oxides are considered decomposition of pure CaSO4 between 950 C - 1130 C, decomposition of CaSO4 in the presence of thin film melts of KCl and NaCl at 1020 C, reactions of CaSO4 with metal oxides in binary systems at 1020 C, reactions of CaSO4 with aluminosilicates in multicomponent systems at 1020 C, and decomposition of sulfated coal and lignite ashes at 820 C and 1020 C Metal carbonates did not change the mechanism of char gasification when CO2 was the reactive gas It was noted that reactions of the solid-solid complex with silicates and aluminosilicates in the ash of the char can result in loss of catalytic activity and poor catalyst recovery Dissert Abstr

N82-12240*# National Aeronautics and Space Administration Pasadena Office, Calif
HYDRODESULFURIZATION OF CHLORINATED COAL Patent Application
John J Kalvinskas (JPL, California Inst of Technology, Pasadena) and Naresh K Rohatgi, inventors (to NASA) (JPL, California Inst of Technology, Pasadena) Filed 30 Oct 1981 24 p
(Contract NAS7-100)
(NASA-Case-NPO-15304-1, US-Patent-Appl-SN-315587) Avail NTIS HC A02/MF A01 CSCL 21D

A method of desulfurization is described in which high sulfur coals are desulfurized by low temperature chlorinolysis of coal in liquid media, preferably water, followed by hydrodesulfurization at a temperature above 500 C The coals are desulfurized to an extent of up to 90% by weight and simultaneously dechlorinated to a chlorine content below 0 1% by weight The product coals have lower volatile loss, lower oxygen and nitrogen content and higher fixed carbon than raw coals treated with hydrogen under the same conditions Heating the chlorinated coal to a temperature above 500 C in inert gas such as nitrogen results in significantly less desulfurization NASA

N82-12241*# National Aeronautics and Space Administration Pasadena Office, Calif
SUPERCRITICAL MULTICOMPONENT SOLVENT COAL EXTRACTION Patent Application
William H Corcoran, inventor (to NASA) (JPL, California Inst of Technology, Pasadena) Filed 30 Oct 1981 27 p
(Contract NAS7-100)
(NASA-Case-NPO-15767-1, US-Patent-Appl-SN-315584) Avail NTIS HC A03/MF A01 CSCL 21D

The yield of organic extract from the supercritical extraction of coal with larger diameter organic solvents such as toluene is increased by use of a minor amount of from 0 1 to 10% by weight of a second solvent such as methanol having a molecular diameter significantly smaller than the average pore diameter of the coal NASA

N82-12242# General Accounting Office, Washington, D C
STATUS OF THE GREAT PLAINS COAL GASIFICATION PLANT
16 Mar 1981 30 p
(EMD-81-64) Avail NTIS HC A03/MF A01

A coal gasification plant with a production capacity of 125 million cubic feet per day of high Btu gas, equivalent to about 22,000 barrels of oil per day, is proposed for Mercer County, N Dak This synthetic gas is a direct substitute for natural gas The process employed to convert the coal to gas is the Lurgi pressurized, fixed bed gasification process with Lurgi methanation S L

N82-12250# Aerospace Corp , El Segundo, Calif Mobile Systems Directorate
PROJECT FOR RELIABILITY FLEET TESTING OF ALCOHOL/GASOLINE BLENDS Technical Progress Report
Jul 1981 85 p refs
(DE82-000004, DOE/CS-50023/T15) Avail NTIS HC A05/MF A01

Progress is reported in reaching the near-term goal of bringing the end-use technology for formulated alcohol/gasoline blends to the point of commercial technical readiness, in support of the Alcohol Fuels Program element of the DOE Alternative Fuels Utilization Program (AFUP) Activities considered include acquiring data for proof-of-concept through engineering tests in a small controlled fleet using various formulated blends of ethanol/gasoline and methanol/gasoline as well as for statistical proof-of-performance through large-scale reliability fleet tests using selected blends Implementation of the 4-year plan is continuing in accordance with funding availability DOE

N82-12251# United Technologies Corp , South Windsor, Conn Power Systems Div
EVALUATION OF SHALE OIL AS A UTILITY GAS-TURBINE FUEL Final Report
A P Grasso, R A Sederquist, F G Sykes, J Frese, J McVey, G Lewis (Pratt and Whitney Aircraft, West Palm Beach, Florida), and J Mathason (Pratt and Whitney Aircraft, West Palm Beach, Florida) Aug 1981 139 p refs Sponsored by Electric Power Research Inst
(EPRI Proj 1691-2)
(DE81-904234, EPRI-AP-1975) Avail NTIS HC A07/MF A01

An FT4A-9 engine and a selected single-can combustor from an O engine were tested using No 2 petroleum distillate fuel and hydrotreated Paraho shale oil residual, with and without water injection The engine operated successfully with low smoke when running on shale oil residual and No 2 petroleum distillate fuel The use of hot water injection was successfully demonstrated with reduced No/sub x/ emissions when operating on both fuels Post-test engine inspection showed that all combustor components, including turbine inlet vanes, were in good condition No/sub x/ emissions from single-can combustor testing with both fuels exceeding engine levels Carbon monoxide and unburned hydrocarbons were slightly lower DOE

N82-12254# Boeing Engineering and Construction, Seattle, Wash Engineering and Construction Div
FEASIBILITY AND ECONOMIC STUDY OF MEDIUM-Btu COAL GAS BLENDED WITH HIGH-Btu BY-PRODUCT GAS AS AN INDUSTRIAL ENERGY SOURCE AT BILLINGS, MONTANA Final Report
May 1981 297 p refs Prepared in cooperation with Northern Resources, Inc , Billings, Mont.
(Contract DE-FG01-79RA-20219)
(DE81-030622, DOE/FE-20219/2) Avail NTIS HC A13/MF A01

The technical and economic feasibility of blending a medium Btu gas (MBG) produced from coal by the Winkler fluidized bed gasification process with excess refinery fuel gas to be used as an industrial fuel in Billings, Montana is assessed The background of the project, the site selection process, the conceptual design of the process and supporting facilities, the retrofit requirements and other costs associated with burning the MBG, the environmental and permitting aspects of the project, the cost estimates

and economic considerations, the contract provisions for MBG buy/sell agreements, the government's role in supporting the project, and the market potential for the project in Billings and similar projects in other markets are discussed The project is technically feasible and economically viable today although parity with conventional fuels will not occur until 1985 DOE

N82-12255# Brookhaven National Lab, Upton, N Y Catalyst Group
DEVELOPMENT OF CATALYTIC SYSTEMS FOR THE CONVERSION OF SYNGAS TO JET FUEL AND DIESEL FUEL AND HIGHER ALCOHOLS Annual Report
William A Slegeir Oct 1980 18 p
(Contract DE-AC02-76CH-00016)
(DE82-000067, BNL-51423) Avail NTIS HC A02/MF A01

A highly active series of Fischer-Tropsch catalysts are developed on the basis of insights provided by the oxide theory The method of catalyst formulation is unique in Fischer-Tropsch chemistry, yet is simple and reproducible These catalysts are superior to ordinary catalysts for hydrocarbon synthesis with regard to rate, operating conditions, and, product selectivity and longevity The products of these catalysts are ideally suited for use as diesel and jet fuels Once formed, the catalysts display remarkable stability toward air Oxide interactions, the role of promoters, and the synergistic behavior of bimetallic catalysts systems are studied Bimetallic systems for hydrocarbon and alcohol synthesis are discussed DOE

N82-12259# Pittsburg Energy Technology Center, Pa
SYNTHESIS GAS CONVERSION TO LIQUID FUELS USING PROMOTED FUSED IRON CATALYSTS
Richard A Diffenbach, Richard R Schehl, and Daniel J Fauth Sep 1981 67 p refs
(DE81-030857, DOE/PETC/TR-81/3) Avail NTIS HC A04/MF A01

More active and stable nitrided iron catalysts were prepared for the conversion of synthesis gas to a proudct with a high alcohol content that could be used directly as an automotive fuel or converted to a gasoline-like product over a shape selective zeolite in a dual reactor unit The rational is given for the preparation of a molybdenum-promoted nitrided fused ion catalyst Catalyst characterization yielded equivocal results as to whether a mixed Fe-Mo nitride was formed Regardless of the nature of the Mo-containing species, these catalysts were significantly more active than unpromoted nitrided fused iron catalyst Characterization of fused iron catalysts using thermogravimetric analysis indicated the rates of reduction, carburization, and nitriding were strongly dependent on reaction temperature and particle size as well as the nature of the promoter X-ray diffraction measurements indicated the metal crystallite size of the reduced catalysts was strongly dependent on reduction temperature DOE

N82-12260# Institute of Gas Technology, Chicago, Ill
DEVELOPMENT OF HYDROCONVERSION OF BIOMASS TO SYNTHETIC FUELS Technical Progress Report, 1 Jan. - 31 Mar. 1981
Jul 1981 56 p refs
(Contract DE-AC02-80CS-83004)
(DE81-030954, DOE/CS-83004/3) Avail NTIS HC A04/MF A01

The physical and chemical characterization data for Douglas fir hog fuel, maple hardwood, and corn stover are presented for comparison Fluidization parameters were obtained for mixtures of char and hollow alumina spheres (-25 + 60 mesh) as the inert-bed material The driving characteristics of maple hardwood were measured isothermally in the range of 2000 to 4000 F Three distinct moisture content regions were observed with different characteristic drying behaviors Size reduction characteristics show that the throughput rate for various product screen sizes is lower for the moist, as-received feed than for the dried feed material The hydrodevolatilization data of maple hardwood from the rapid heat-up rate, free-fall apparatus were analyzed Comparison of the steam-char gasification rates of coal, peat, and maple hardwood chars shows that the reactivity level expected of the biomass char is significantly higher than that of coal and peat DOE

N82-12261# Department of Energy, Morgantown, W Va
FIXED-BED GASIFICATION
Jan. 1981 29 p refs
(DE82-000432, DOE/METC/SP-184) Avail NTIS HC A03/MF A01

Since the completion of construction in 1967, the METC Gasifier Pilot Plant has produced data and demonstrated operation on all major ranks of US coals In 1976, METC began an expansion program to include a novel gas-cleanup facility to evaluate the environmental problems associated with gasification plants and also to develop improved cleanup systems The construction and checkout of this full-scale cleanup system was completed within the past year and the pilot-plant facility now has the capability of gasifying all US coals and producing a relatively tar, oil, particulate, and sulfur free fuel gas The Department of Energy's (DOE) fixed-bed gasification evelopment program includes other facilities that provide DOE with a broad capability to address alternative and advanced gasification technologies In addition to utilizing these facilities to evaluate and improve gasification/cleanup configurations, the pilot plants are also being used to support a number of related projects DOE

N82-12262# Argonne National Lab, Ill
DENSITY-MEASUREMENT STUDIES AT THE BI-GAS PILOT PLANT
S H Sheen and A C Raptis Sep 1981 17 p refs
(Contract W-31-109-eng-38)
(DE82-000910, ANL/FE-81-57) Avail NTIS HC A02/MF A01

An acoustic flow/no-flow monitor for the char return line of the BI-GAS pilot plant was developed The indicator has operated successfully for the last three years It was observed that the strength of the microphone signal is related to the amount of char in the line In a recent experiment at BI-GAS this observation was further explored, and it was found that the signal is related to the char valve opening in the frequency range of 1 to 20 kHz This is a clear indication that the flow/no-flow indicator can be upgraded to a density meter and consequently to a true mass flowmeter This can be done by installing another flow/no-flow indicator upstream or downstream of the existing one and cross-correlating the two signals DOE

N82-12263# Oak Ridge National Lab, Tenn
SELECTIVE SEPARATION OF COAL FEEDSTOCKS FOR CONVERSION BY MAGNETIC SEPARATION TECHNIQUES
E C Hise and A S Holman 1981 8 p refs Presented at 91st Natl Meeting of the Am Inst of Chem Engr, Detroit 16 Aug 1981
(Contract W-7405-eng-26)
(DE81-028060, CONF-810814-6) Avail NTIS HC A02/MF A01

The Open-Gradient Magnetic Separation (OGMS) technique can separate particles on the basis of small differences in magnetic susceptibility The highly reactive coal macerals are diamagnetic while the minerals and less reactive macerals range from slightly diamagnetic to paramagnetic with the pyritic minerals exhibiting the greatest positive magnetic susceptibility OGMS can spread a falling stream of fine coal into a spectrum permitting the physical separation of these several maceral and mineral groups Several eastern bituminous coals were selectively separated into five to ten fractions Petrographic examination of these separated fractions shows a concentration of the maceral and mineral groups in the appropriate fractions It is proposed that the selective separation of the most reactive macerals, as well as of those minerals that exhibit a catalytic effect, can enhance the efficiency of coal conversion DOE

N82-12264# California Univ, Livermore Lawrence Livermore Lab
DESIGNING PROCESS WELLS FOR AN UNDERGROUND COAL-GASIFICATION ENVIRONMENT
D S Thompson Jun 1981 20 p refs Presented at 7th Underground Coal Conversion Symp, Fallen Leaf Lake, Calif, 8 Sep 1981
(Contract W-7405-eng-48)
(DE81-028434; UCRL-85839, CONF-810923-7) Avail NTIS HC A02/MF A01

The reasons why process well integrity is important are covered in a review and evaluation of significant data generated from various field tests, including identification of well failure mechanisms A close relationship is observed between process well behavior and process performance As a logical extension of this evaluaton, design and performance criteria for under-

ground coal gasification (UCG) process wells are developed Applications to the next generation of field tests are presented in the form of proposed design features for UCG process wells, features intended to prevent the failure modes that have occurred in past field experiments DOE

N82-12400# Oak Ridge National Lab, Tenn Chemical Technology Div
MEASUREMENT OF THERMAL CONDUCTIVITIES IN COAL FLUIDS
C S Chang, J B Bader, and J L Plawsky Sep 1981 52 p refs
(Contract W-7405-eng-26)
(DE82-000523, ORNL/MIT-334), Avail NTIS HC A04/MF A01

As a qualification of a transient hot wire, thermal conductivity cell for use on the Coal Liquids Flow System, the thermal conductivity of toluene was mesured between 25 and 850 C Static measurements over a 4-sec time span yielded a thermal conductivity at 250 C of 0 12607 W/m-K and a slope of thermal conductivity vs temperature of -272 8 W/m-K (squared) All results are within 2 to 5% of the most recent literature data An experimental error analysis showed all errors to be less than 1% Dynamic-mode measurements in which flow through the cell was interrupted only for the measurement period agreed within experimental accuracy with the static-mode measurements, demonstrating that the hot-wire cell is immediately applicable to coal-slurry thermal-conductivity measurements in the Coal Liquids Flow System Sedimentation experiments showed that settling should have a negligible effect on thermal-conductivity measurements over the time period envisioned for measurement Excellent agreement was obtained between previous measurements of thermal conductivities of coal slurries and the predictions of the Rayleigh equation for heterogeneous-mixture thermal conductivities DOE

N82-12514# University of Southern California, Los Angeles Dept of Petroleum Engineering
FORMATION EVALUATION IN LIQUID-DOMINATED GEOTHERMAL RESERVOIRS
Iraj Ershaghi, Elmer E Dougherty, and Lyman L Handy Apr 1981 106 p refs
(Contracts DE-AT03-76ET-28384, EY-76-S-03-0113)
(DOE/ET-28384/T1) Avail NTIS HC A06/MF A01

Studies relative to some formation evaluation aspects of geothermal reservoirs are reported The particular reservoirs considered were the liquid dominated type with a lithology of the sedimentary nature Specific problems of interest included the resistivity behavior of brines and rocks at elevated temperatures and studies on the feasibility of using the well log resistivity data to obtain estimates of reservoir permeability Brine viscosity data at elevated temperatures, effect of dissolved gases on brine resistivity, design of a modified API filter test apparatus, and modeling of filter cake buildup during drilling are discussed DOE

N82-12516# Union Oil Co of California, Los Angeles Geothermal Div
GEOTHERMAL RESERVOIR ASSESSMENT: NORTHERN BASIN AND RANGE PROVINCE STILLWATER PROSPECT, CHURCHILL COUNTY, NEVADA Final Report, Apr. 1979 - Jul. 1981
D L Ash, R F Dondanville, and M S Gulati Aug 1981 35 p
(Contract DE-AC08-79ET-27012)
(DE82-000529, DOE/ET-27012/1) Avail NTIS HC A03/MF A01

The two wells were drilled to total depths of 6946 ft and 10,014 ft with no significant drilling problems A maximum reservoir temperature of 353 F was measured at 9950 ft The most productive well flow tested at a rate of 152,000 lbs/hr with a wellhead temperature of 252 F and pressure of 20 psig Based upon current economics, the Stillwater geothermal prospect is considered to be subcommercial for the generation of electrical power This synopsis of the exploratory drilling activities and results contains summary drilling, geologic, and reservoir information from two exploratory geothermal wells DOE

N82-12517# California Dept of Conservation, Sacramento Div of Mines and Geology
GEOPHYSICAL SURVEY, PASO ROBLES GEOTHERMAL AREA, CALIFORNIA, PART OF THE RESOURCE ASSESSMENT OF LOW- AND MODERATE-TEMPERATURE GEOTHERMAL RESOURCE AREAS IN CALIFORNIA Progress Report, 1979 - 1980
R H Chapman, Gordon W Chase, and Les G Younds 10 Nov 1980 42 p refs
(Contract DE-FG03-79ET-37035)
(DE81-026038, DOE/ET-37035/T2) Avail NTIS HC A03/MF A01

Some general background information concerning the geology and geothermal occurrences in the Southern Coast Ranges is included, as well as the more detailed information dealing with the Paso Robles area proper Results from ground magnetic and gravity surveys, are discussed and interpreted There is possible correlation in some places with known and suspected faults There are also suggestions of local differences in the Tertiary rocks DOE

N82-12518# California Dept of Conservation, Sacramento Div of Mines and Geology
RESOURCE ASSESSMENT OF LOW AND MODERATE-TEMPERATURE GEOTHERMAL WATERS IN CALISTOGA, NAPA COUNTY, CALIFORNIA Progress Report, 1979 - 1980
Les G Youngs, C Forrest Bacon, Rodger H Chapman, Gordon W Chase, Chris T Higgins, Hasmukhrai H Majmundar, and Gary C Taylor 10 Nov 1980 394 p refs
(Contract DE-FG03-79ET-37035)
(DE81-025559, DOE/ET-37035/T1) Avail NTIS HC A17/MF A01

The USGS Geotherm file for California was updated and completed and the final data were compiled for a geothermal resources map of the State The methodology used to determine the depth, configuration, flow rate, capacity, water quality, and location of the hottest water in the reservoir at Calistoga is described The historical use of the resource is reviewed Other aspects considered include general geology, magnetic surveys, gravity surveys, seismic reflection, and electrica resistivity of the resource The hydrology and groundwater quality are related to the geological structure and formation as well as to resource assessment The development of models for volume and temperature, and explatory drilling are also discussed DOE

N82-12523# Office of Energy Resources, Augusta, Maine
PEAT RESOURCE EVALUATION: STATE OF MAINE Quarterly Report
Joel Davis and Walter Anderson 1981 7 p
(Contract DE-FG18-79FC-14690)
(DE82-000227, DOE/FC-14690/T1) Avail NTIS HC A05/MF A01

The amount and location of fuel-grade peat that may be harvested and utilized in an environmentally acceptable manner in Maine were surveyed The resources inventory provides a detailed evaluation of the peat deposits including maps showing areal extent, thickness, and distribution of peat, stratigraphic cross sections, and surficial mapping Many deposits were visited to accurately assess the physical characteristics of the deposits and to obtain laboratory samples Representative samples from surveyed deposits are obtained through standard field sampling techniques DOE

N82-12524# North Carolina Univ, Chapel Hill Dept of Geology
PEAT DEPOSITS OF DISMAL SWAMP POCOSINS: CAMDEN, CURRITUCK, GATES, PASQUOTANK, AND PERQUIMANS COUNTIES, NORTH CAROLINA
R L Ingram and Lee J Otte, (Kent State Univ, Ohio) Jul 1981 31 p refs
(Contract DE-AC01-79ET-14693)
(DE81-029642, DOE/ET-14693/T3) Avail NTIS HC A03/MF A01

The presence of peat is examined in the Dismal Swamp of northeastern North Carolina and southeastern Virginia The deposits in North Carolina occupy an area of 76,800 acres containing about 68 million tons of moisture free peat The deposits greater than 4 ft thick occupy an area of 34,700 acres containing about 43 million tons of peat The surface elevation of the peat ranges from 15 to 20 ft Two main types of peat are present (1) a brown, decomposed fibrous peat usually found at the base of the thicker peats, and (2) a black, fine grained,

highly decomposed peat that usually overlies the fibrous peat Both peat types contain large amounts of wood The moisture content ranges from 40 to 94% and usually increases with depth and total thickness of the peat It is found that heat values for moisture free, low ash peats range from 8700 to 10,900 Btu/lb and the sulfur content ranges from 0 2 to 0 7% DOE

N82-12584# Century Engineering, Inc , Towson, Md
EVALUATION OF LANDFILL GAS AS AN ENERGY SOURCE
Dec 1980 45 p refs
(Contract DE-FG02-78IR-05106)
(DE82-000116; DOE/IR-05106/T47) Avail NTIS HC A03/MF A01

The benefits and problems associated with landfill gas recovery were considered by the City of Baltimore, resulting in the structuring and testing of a realistic gas recovery evaluation procedure for use by local governments The Baltimore methodology is summarized and results of its application to a large landfill in the Baltimore area are presented The landfill gas generation process potential uses for the recovered gas, and treatment requirements are covered DOE

N82-12595# Mid-American Solar Energy Complex, Minneapolis, Minn
MASEC INDUSTRIAL FUEL-WOOD PROGRAM
M Hohmann Jul 1981 46 p refs
(Contract DE-AC02-79CS-30150)
(DE82-000461, MASEC/R-81-062, B-101-3) Avail. NTIS HC A03/MF A01

The program is designed not only to identify technical and institutional barriers to the use of wood for fuel, but to effectively reduce these barriers and the economic uncertainty they cause by providing business and industry with the type of information they need for preliminary planning purposes Information on resource availability, the types of equipment needed, sources of technical assistance, and the financial aspects of the potential investment are provided A listing of existing wood-fired systems is also included A key component of the program is a net-cash-flow analysis based upon a life-cycle economic model that is used to evaluate new and retrofit wood-fired boiler installations T M

N82-12596# Battelle Columbus Labs , Ohio
ENERGY RECOVERY FROM MUNICIPAL SOLID WASTE AND SEWAGE SLUDGE USING MULTI-SOLID FLUIDIZED BED COMBUSTION TECHNOLOGY
Jul 1981 210 p refs
(Contract DE-AC01-78CS-20424)
(DE82-001142, DOE/CS-20424/1) Avail. NTIS HC A10/MF A01

The concept is to recover energy as high and low pressure steam, simultaneously High pressure steam would be generated from flue gas using a conentional tubular boiler Low pressure steam would be generated by direct contact drying of DSS (as 4 percent solids) with hot sand in a fluidized bed that is an integral part of the MS-FBC process It is proposed that high pressure steam could be used for district heating or electricity generation The low pressure steam could be used for close proximity building heat The results of the investigation show that the MS-FBC process concept for the co-utilization of MSW and DSS is technically feasible and that the thermal efficiency of the process is 76 to 82 percent based on experiments conducted in a 70 to 85 lb/h pilot plant and calculations on three conceptual cases DOE

N82-12605# United Technologies Corp , South Windsor, Conn
DESIGN, CONSTRUCTION, AND OPERATION OF A FULL SCALE EXPERIMENTAL ANAEROBIC FERMENTATION FACILITY Final Report
Jun 1981 235 p
(Contract DE-AC01-77ET-20009)
(DE81-029028, DOE/ET-20009/T1) Avail NTIS HC A11/MF A01

A 25 ton per day anaerobic fermentation facility was designed to evaluate the technical and economic viability of producing fuel gas and an animal refeed product from the residues of an environmental beef cattle feedlot The system has been in continuous operation and has been producing between 3 to 5 cubic feet of methane per pound of volatile solids fed to the system Product gas is successfully utilized in (1) the system process boiler which maintains thermophilic operating temperature in the fermentors, (2) a meat packing plant process boiler, cofired with fuel oil, (3) and a 440 kW grid connected engine/generator system Feeding trials that will establish the value of the dewatered effluent were performed It is indicated from the initial operation of the system that it will be a technically and economically viable process DOE

N82-12620# Mid-American Solar Energy Complex, Minneapolis, Minn
INTERACTIVE MODEL TO ASSESS ECONOMICS OF ANAEROBIC DIGESTION OF THE FARM
Aug 1981 41 p
(Contract DE-AC02-79CS-30150)
(DE82-000452, MASEC/R-81-068) Avail NTIS HC A03/MF A01

An interactive computer model, to provide economic assessment for on the farm anaerobic digestion systems was designed The model is accessed as part of the MASEC Models Library It consists of two phases engineering analysis and economic analysis User inputs are stored in a data base and may be retained for future use Model outputs include a recap of user inputs, calculations for gas production, digester heat requirements, system revenues, yearly cash flow, and a graph of the net present value of the investment The model is generalized so that nonfarm applications may also be analyzed The program will work equally well for various digester designs such as continuously stirred reactors, plug flow systems, and fluidized bed columns DOE

N82-12633# Midwest Research Inst , Golden, Colo , Solar Energy Research Inst
COSTS FOR ALTERNATIVE GRAIN-RESIDUE-COLLECTION SYSTEMS
Silvio J Flaim, Bernie Neenan, Jan Dauve, and Harry P Mapp, Jr (Oklahoma State Univ., Stillwater) Jun 1981 55 p refs
(Contracts DE-AC02-77CH-00178, EG-77-C-01-4042)
(DE81-029072, SERI/TR-734-900) Avail NTIS HC A04/MF A01

The costs for systems for corn and soybean production in Iowa are examined All machinery field operations, fuel, other inputs, and labor requirements are identified for the base case with no residue harvest, and for residue harvest by stacks and large round bales, with the owner's equipment and for custom harvest These five cases were developed for corn and soybeans for conventional and reduced tillage practices Harvesting alternatives are compared on the basis of costs, fuel input requirements, and gross energy balances of residues collected less energy inputs The cost of collecting corn and soybean residues varies widely over the collection and tillage systems examined Other effects constant, the reduced tillage practice leads to a lower cost of harvest than conventional tillage, and stacks are always cheaper than large round bales, however, the former difference is greater than the latter DOE

N82-12684 Texas Univ at El Paso
HEAT FLOW STUDIES AND GEOTHERMAL EXPLORATION IN WESTERN TRANS-PECOS TEXAS Ph.D. Thesis
Bruce D G S Taylor 1981 339 p
Avail Univ Microfilms Order No 8121977

The definition of possible geothermal resources in Trans-Pecos Texas, and a geothermal gradient map of the region are presented, based on nearly 200 temperature and gradient measurements Several areas of high thermal gradient are located, notably in Presidio County, where several hot springs and wells exist Possible mechanisms for the high gradients (and heat flow) here are discussed A small high gradient area is also indicated in northeast El Paso County, and a geophysical investigation of this prospect is described The proximity to the city of El Paso made this a prime target for resource evaluation Geophysical methods employed include gravity, self-potential and electrical resistivity, the surveys culminating in a shallow drilling program to define the areal extent of the anomaly Dissert Abstr

N82-12693# Geological Survey, Washington, D C
BIOGEOCHEMICAL EVIDENCE FOR SUBSURFACE HYDROCARBON OCCURRENCE, RECLUSE OIL FIELD, WYOMING: PRELIMINARY RESULTS
Mary C Dalziel and Terrence J Donovan 1980 14 p refs
(USGS-CIRC-837) Avail NTIS HC A02/MF A01

Anomalously high manganese to iron ratios occurring in pine needles and sage leaves over the Recluse oil field, Wyoming,

suggest effects of petroleum microseepage on the plants This conclusion is supported by iron and manganese concentrations in soils and carbon and oxygen isotope ratios in rock samples Seeping hydrocarbons provided reducing conditions sufficient to enable divalent iron and manganese to be organically complexed or adsorbed on solids in the soils These bound or adsorped elements in the divalent state are essential to plants, and the plants readily assimilate them The magnitude of the plant anomalies, combined with the supportive isotopic and chemical evidence confirming petroleum leakage, makes a strong case for the use of plants as a biogeochemical prospecting tool Author

N82-12731# Geokinetics, Inc , Concord, Calif
METEOROLOGICAL AND CLIMATOLOGICAL INVESTIGATION: REVIEW OF JANUARY - JUNE 1980 INVESTIGATIVE PERIOD
D R Lundberg and H K L Spradlin Jul 1981 81 p refs
(Contract DE-FC20-78LC-10787)
(DE81-030740, DOE/LC-10787/80) Avail NTIS HC A05/MF A01

Since January 1979, a meteorological and climatological investigation for the purpose of establishing a microclimatic baseline has been continuously conducted at the Geokinetics oil shale research facility in eastern Utah This report, however, presents the findings for only a six month segment (January 1 - June 30, 1980) of that ongoing investigation Included in this report is a description of the program design, the handling and interpretation of the data, and program improvement considerations commended for inclusion into future segments of the investigation DOE

N82-12735# National Academy of Sciences - National Research Council, Washington, D C Maritime Transportation Research Board
MARITIME SUPPORT FOR OCEAN-RESOURCES DEVELOPMENT Final Report
Jun 1981 188 p refs
(Contract N00014-75-C-0711)
(AD-A104730) Avail NTIS HC A09/MF A01 CSCL 08/10

The issues associated with ocean development to determine their implication for the U S maritime industry have been examined The examination embraced ocean energy systems, offshore oil and gas activities, food from the sea, deep seabed mining, and the use of ocean space The requirements that ocean-resource development places on the maritime industry do not show sharp differences from one resource to the next. While the technological base on which the means of recovery and use of the resources can be built and deployed has been developed, more scientific work and technological development are needed However, it is the committee's opinion that the true factors pacing the effort to bring many of the resources into use and to achieve the many benefits are of an economic, legal, and public-policy nature Author (GRA)

N82-12921# Los Alamos Scientific Lab , N Mex
SPACE NUCLEAR SAFETY AND FUELS PROGRAM Progress Report
S E Bronisz, comp Jul 1981 14 p refs
(Contract W-7405-eng-36)
Avail NTIS HC A02/MF A01

The use of (238) PuC2 in radioisotope power systems are discussed Impact testing, module handling procedures, and nondestructive test data for encapsulated pellets are reported DOE

N82-12985# Oklahoma Univ , Norman School of Chemical Engineering and Materials Science
DEVELOPMENT OF A THERMODYNAMIC PROPERTIES CORRELATION FRAMEWORK FOR THE COAL CONVERSION INDUSTRY, PHASE 1A Annual Report, 1 Sep. 1980 - 31 Aug. 1981
K E Starling, L L Lee, K H Kumar, M R Brule, S Watanasiri, V Gupta, M H Li, R McFall, W Chang, C K So et al 1981 33 p ref
(Contract DE-FG22-80PC-30249)
(DE81-030363, DOE/PC-30249/T2, AR-1) Avail NTIS HC A03/MF A01

A three-parameter corresponding states framework developed originally for light hydrocarbons was modified to rapidly develop a practical thermodynamic properties prediction capability for the coal conversion industry The three-parameter corresponding states correlation describes the thermodynamic behavior of pure nonpolar and slightly polar nonassociating coal fluids and mixtures for which the mixture constituents are known Characterization techniques are outlined for converting distillation analysis of underfined mixtures (with composition available in terms of broad fractions) into representative pseudo components Empirical correlations are developed to estimate the three corresponding states characterization parameters for each fraction from measurements made on the fraction (boiling point, specific gravity, molecular weight) Results for one and two ring polar and associating coal fluids indicate that an extension of the corresponding states methodology to associating fluids using a five-parameter correlation is possible DOE

N82-13196# Occidental Research Corp , Irvine, Calif
CONTROLLED-FLASH PYROLYSIS Quarterly Technical Progress Report, Apr. - Jun. 1981
K Durai-Swamy, S C Che, C B Chen, R Jain, S S Kim, and H VonSchonfeldt Aug 1981 55 p refs
(Contract DE-AC22-80PC-30264)
(DE82-000284, DOE/PC-30264/09, QTPR-3) Avail NTIS HC A04/MF A01

Thirteen runs were made in the controlled flash pyrolysis unit with a coal feed rate of about 2 kg/hour Preliminary material balance for these tests is presented The laboratory scale (1 gm/min) pyrolysis reactor was used to evaluate several model compounds as quench solvents Free radical pyrolysis studies, using an electron spin resonance spectrometer, show that vapor phase radicals from coal pyrolysis resemble phenalenyl radical and that char placed on top of the pyrolyzing coal absorbs these vapor phase radicals effectively DOE

N82-13244# California Univ , Livermore Lawrence Livermore Lab
SOVIET UCG EXPERIENCE SPECIFICALLY RELATED TO FIELD EXPERIMENTS IN THE UNITED STATES
D U Olness 8 Jul 1981 6 p refs Presented at 7th Underground Coal Conversion Symp , Fallen Leaf Lake, Calif , 8 Sep 1981
(Contract W-7405-eng-48)
(DE81-028642, UCRL-85919, CONF-810923-6) Avail NTIS HC A02/MF A01

Soviet experiences with problems in underground coal gasification experiments reveal similarities to problems encountered in the United States Aerodynamic considerations and problems with hole failure, override, reverse burn links, and other coal conversion/extraction related difficulties are discussed M D K

N82-13245# Oak Ridge National Lab , Tenn
H-COAL PRODUCT PHYSICAL PROPERTIES MEASUREMENT Final Report
D D Lee Aug 1981 21 p refs
(Contract W-7405-eng-26)
(DE81-029095, ORNL/TM-7915) Avail NTIS HC A02/MF A01

Rheological and density measurements have been made on the H-Coal PDU reactor effluent samples, which used Wyodak coal Characterization was done in the ORNL Coal Liquids Flow System Apparent viscosities and shear rates were observed The rheological data were fitted to both power law and Bingham plastic models The apparent viscosities appeared to correlate to the amount of solids in the samples DOE

N82-13247# Burns and Roe Industrial Services Corp , Paramus, N J
LOW/MEDIUM BTU COAL GASIFICATION ASSESSMENT PROGRAM FOR POTENTIAL USERS IN NEW JERSEY: EXECUTIVE SUMMARY
May 1981 21 p refs
(Contract DE-AC01-79RA-20216)
(DE81-025475, DOE/FE-20216/1) Avail NTIS HC A02/MF A01

The production of medium Btu quality gas (MBG) for use as fuel for on-site power plant boilers or for distribution to industrial customers appeared to be economically attractive, dependent upon the proximity of sufficient numbers of industrial customers and upon high plant utilization The Texaco Coal Gasification Process (TCGP) was selected, being a pressurized process capable of supplying the gas without downstream compression The TCGP could handle the high sulfur eastern coals chosen as a feedstock All equipment downstream of the gasifier was commercially proven The integration of the gasification process

with a methanol synthesis plant, consuming up to 25% of the MBG produced, was desirable in order to allow storage of MBG during low demand and thereby increase the gasifier capacity factor and minimize its turndown requirements DOE

N82-13248# Combustion Engineering, Inc., Windsor, Conn
LOW-BTU GASIFICATION OF COAL FOR ELECTRIC POWER GENERATION, PHASE 1, 2, AND 3 Monthly Progress Report, 1 Apr. - 30 Apr. 1981
16 Aug 1981 46 p refs
(Contract DE-AC01-76ET-10204)
(DE81-029482, DOE/ET-10204/T1, FE-1545-89) Avail NTIS HC A03/MF A01

Oxygen-enriched operation of the Pressure Distribution Unit was initiated on April 1, 1981 Eleven oxygen enriched gasmaking tests were made during the month These tests were interrupted upon eight occasions by slag tap pluggage or imminent pluggage A 15 to 20 day opuations text was begun during the month, but not successfully completed owing to the tap hole pluaggage problems Iron reduced from the slag due to the low oxygen concentration in this region was the most obvious explanation for the tap hole pluggages DOE

N82-13252# Ultrasystems, Inc., Irvine, Calif
FEASIBILITY STUDY REPORT FOR THE IMPERIAL VALLEY ETHANOL REFINERY: A 14.9-MILLION-GALLON-PER-YEAR ETHANOL SYNFUEL REFINERY UTILIZING GEOTHERMAL ENERGY
Mar 1981 202 p Prepared in cooperation with U S Alcohol Fuels, East Mesa, Calif
(Contract DE-FG07-80RA-50308, Proj 1013)
(DE82-000288, DOE/RA-50308/1) Avail NTIS HC A10/MF A01

The construction and operation of a 14,980,000 gallon per year fuel ethanol from grain refinery is proposed The refinery will use hot geothermal fluid from geothermal resources as the source of process energy In order to evaluate the economic viability of the proposed project, exhaustive engineering, cost analysis, and financial studies were undertaken The results of feasibility studies undertaken in geothermal resource, engineering, marketing financing, management, environment, and permits and approvals are presented The project was found to be economically viable DOE

N82-13473# Los Alamos Scientific Lab., N Mex Dept of Meteorology
SPECTRA OVER COMPLEX TERRAIN
H A Panofsky, D Larko (Research and Data Systems, Inc.), R Lipschutz (NOAA, Boulder, Colo.), and G Stone 1981 18 p refs Presented at the 4th U S Natl Conf on Wind Eng Res., Seattle, 26-29 Jul 1981 Submitted for publication
(Contract W-7405-eng-36)
(DE81-028734, LA-UR-81-2380, CONF-810742-1) Avail NTIS HC A02/MF A01

Spectra were measured over land downwind of a water surface over hilltops escarpments, and over rolling farmland The following hypotheses are used to explain the differences between these spectra (1) wavelengths short compared to the fetch over the new terrain, spectral densities are in equilibrium with the new terrain, (2) wavelengths long compared to this fetch, spectral densities remain unchanged if the ground is horizontal If the flow is over a steep hill, the low frequency structure is modified by distortion of the mean flow, with the longitudinal component losing energy relative to the lateral and vertical components It is found that vertical velocity spectra contain relatively less low frequency energy than horizontal velocity spectra, energetic vertical velocity fluctuations tend to be in equilibrium with local terrain DOE

N82-13475# Minnesota Univ., Minneapolis Limnological Research Center
DEVELOPMENT OF PEATLANDS IN NORTHERN MINNESOTA Technical Progress Report
H E Wright, Jr Sep 1981 5 p refs
(Contract DE-AC02-80EV-10414)
(DE82-000873; DOE/EV-10414/T1) Avail NTIS HC A02/MF A01

The extensive peatlands in northern Minnesota, which are considered as an energy resource through the development of a gasification operation were studied Problems of peat mining, draining, reclamation, economic impact, wildlife, and vegetation are discussed The history of formation of the major peatlands in northern Minnesota, and their relationship distribution and composition, to the modern and past climate and to the various natural factors and processes prevailing in the region are investigated The following factors are considered the formation of vegetation patterns that seem to be unique for North American peatlands, regional differences from east to west that may reflect trends in postglacial climate and forest composition, rates of peat formation in different environmental settings, and the record of atmospheric pollution (industrial contaminations, agricultural dust) that may be contained in short cores of peat DOE

N82-13486# Pittsburg Univ., Pa Dept of Chemical and Petroleum Engineering.
WATER AND ENERGY USAGE IN COAL PREPARATION Final Report
S H Chiang and Robert E Douglas May 1981 575 p refs Sponsored by the Geological Survey
(PB81-238248) Avail NTIS HC A24/MF A01 CSCL 08I

The demand for water and energy by those industries physically beneficiating Eastern American coals was analyzed and predicted Both the method and equipment utilized in cleaning coarse and fine coals were evaluated for their respective water and energy requirements Five typical coal cleaning facilities employing various cleaning, comminution, screening, dewatering and drying equipment were simulated with a computer Seven characteristic eastern coals (with ash and sulfur concentrations of 19-36 percent and 0 5-8 5 percent, respectively) were systematically evaluated in the conceptual coal preparation plants GRA

N82-13488# Bureau of Mines, Pittsburgh, Pa
CREATING A SAFER ENVIRONMENT IN US COAL MINES: THE BUREAU OF MINES METHANE CONTROL PROGRAM, 1964-79
Milford L Skow, A G Kim, and M Deul May 1981 57 p refs
(PB81-233918 BM-SP-5-81) Avail NTIS HC A04/MF A01 CSCL 08I

The principal activities and results of 15 years of research on methane control in coal mines are summarized Fundamental factors regarding the occurrence and movement of methane in coalbeds, removal of methane prior to mining, and control of methane during mining were investigated Publications on methane control program, a section on methane recovery and use, a look at the upcoming Bureau of Mines research program, and a brief review of methane drainage practices in other coal producing countries are included GRA

N82-13518# Oregon State Univ., Corvallis Dept. of Atmospheric Science
NETWORK WIND POWER OVER THE PACIFIC NORTHWEST. APPENDIX 1: WIND STATISTICS SUMMARIES FOR THE WIND POWER DATA STATIONS Progress Report, Oct. 1979 - Sep. 1980
R. W. Baker and E W. Hewson Oct. 1980 122 p refs
(DE81-029291; DOE/BP-60) Avail: NTIS HC A06/MF A01

Tables and graphs are presented concerning monthly wind speed summaries, wind spectrum analyzer summaries; high wind speed summaries; and six hourly speed and direction plots for selected wind power sites Wind flow plots in the Goodnoe Hills MOD-2 wind turbine area and wind flow plots in the Goodnoe Hills and Juniper Point area are included DOE

N82-13520# Sandia Labs., Albuquerque, N Mex
GEOTHERMAL-RESOURCE VERIFICATION FOR AIR FORCE BASES
P. R. Grant, Jr Jun 1981 56 p refs
(Contract DE-AC04-76DP-00789)
(DE81-027482, SAND-81-7123) Avail NTIS HC A04/MF A01

The various tupe of geothermal energy and legal uncertainties of the resource are summarized A methodology to evaluate geothermal resources for applications to US Air Force bases is described Estimates suggest that exploration costs will be $50,000 to $300,000 which, if favorable, would lead to drilling a $500,000 exploration well Successful identification and development of a geothermal resource could provide all base, fixed system needs with an inexpensive, renewable energy source. T.M

N82-13538# Oak Ridge Associated Universities, Tenn Labor and Policy Studies Program
BIOMASS ENERGY SYSTEMS: DESCRIPTIONS AND EMPLOYMENT REQUIREMENTS FOR TYPICAL OPERATIONS
S E Bell and Joanna R Little Sep 1981 90 p
(Contract DE-AC05-76OR-00033)
(DE82-000236, ORAU-185) Avail NTIS HC A05/MF A01

Operations related to biomass energy feasibility studies, and expert opinion which as the basis for the typical facility description and employment estimates are reported Biomass energy facilities are small by comparison to other energy sector operations, they have a sizable impacts on the communities and regions in which they are located The employment and earnings generated during construction, operation, and maintenance provide an important stimulus to local economies The facility descriptions estimated employment and earnings implications provide a first approximation of what is expected as the use of biomass energy systems increases DOE

N82-13541# Dynatech Corp, Cambridge, Mass
BIOMETHANATION OF BIOMASS PYROLYSIS GASES Final Report
C A Tracy and E Ashare Aug 1981 130 p
(Contracts DE-AC02-77CH-00178, EG-77-C-01-4042)
(DE82-000238, SERI/TR-98356-1) Avail NTIS HC A07/MF A01

The development of the biological methanation process and conditions for maximum performane were studied Gasification processes have the potential to produce a synthesis gas from biomass The advantage of such processes is that all organic components of the biomass may be converted to synthesis gas However, this low Btu value gas is of limited use as a fuel gas To convert the synthesis gas into pipeline qulity methane, a methanation process is necessary A more economical alternative to catalytic methanation at high temperature and pressure is the utilization of a biological system to carry out the conversion of biomass pyrolysis gases to methane DOE

N82-13545# Pau Univ (France)
MICROEMULSIONS, EMULSIONS AND RELATED SYSTEMS: ENERGY APPLICATIONS [MICROEMULSIONS, EMULSIONS ET SYSTEMES CONNEXES: APPLICATIONS ENERGETIQUES]
1980 29 p refs In FRENCH Presented at Journee d'Etudes on Emulsions, Microemulsions et Systemes Connexes, Agents de Recuperation, de Stockage et de Transformation d'Energie, Pau, France, 25 Jan 1980
Avail NTIS HC A03/MF A01

Summaries of 16 lectures are presented Topics include oil recovery, thermodynamics of surface-active agents and microemulsions, interpretation of properties particular to alcohols in water-alcohol-oil ternary systems, phase diagrams and interfacial properties of the system water-dodecane-pentanol-sodium octlybenzene sulfonate, and modeling structural inversion in microemulsions Other subjects are numerical study of diphasic one and two dimensional flow in a porous medium, storage and transport of low temperature thermal energy as latent heat in dispersed systems, and the dynamics of nonNewtonian solutions Author (ESA)

N82-13578 West Virginia Univ, Morgantown
PYROLYTIC CHARACTERIZATION OF THE ORGANIC MATTER IN SELECTED COALS AND IN THE DEVONIAN SHALES OF SOUTHERN WEST VIRGINIA Ph.D. Thesis
Peter Alexander Kelley 1980 275 p
Avail Univ Microfilms Order No 8123953

Selected whole coal samples from the coal sequence in West Virginia and shale samples of the Devonian black shales collected throughout southern West Virginia were subjected to pyrolytic analysis Pyrograms characteristically showed two main groups of peaks, the first group of peaks representing the volume of hydrocarbons already present in the samples which are volatilized during the heating interval 40 C to 405 C, while the second group of peaks represents the hydrocarbons and related compounds generated during the 405 C to 700 C interval All coal pyrograms gave a maximum in the pyrolysis curve which occurred in 400 C to 600 C temperature range The degree of maturation of the organics in the Devonian shale samples was evaluated using the temperature of the maximum hydrocarbon generation during pyrolysis from 405 C to 700 C and the transformation ratio The peak area units and relative values were used to evaluate the organic richness genetic potential, and hydrocarbon proportions in the Devonian shale samples Dissert Abstr

N82-13619 Northwestern Univ, Evanston, Ill
APPLICATION OF BAYESIAN ANALYSIS FOR WIND ENERGY SITE EVALUATION Ph.D. Thesis
Harish Govinda Rao 1981 142 p
Avail Univ Microfilms Order No 8124987

Extensive research had indicated that the wind speed is well modelled by the single-parameter Rayleigh distribution The site mean wind speed is given a prior distribution obtained from historical National Weather Service data of sites in the region The prior distribution is updated to a posterior each time observed data become available The posterior distribution is combined with the Rayleigh distribution to obtain the Bayesian distribution of wind speed This distribution can be used in conjunction with the turbine power characteristics of different machines to make rational decisions, based on the expected maximum utility criterion, for selecting the best turbine for a given site or the best site for a given turbine Dissert Abstr

N82-13627# Pacific Northwest Lab, Richland, Wash
NUMERICAL WIND-SPEED SIMULATION MODEL
J V Ramsdell, G F Athey, and M Y Ballinger Sep 1981 88 p refs
(Contract DE-AC06-76RL-01830)
(DE82-000956, PNL-3864) Avail NTIS HC A05/MF A01

A stochastic model for simulating wind speed time series that can be used as an alternative to time series from representative locations is described The model incorporates systematic seasonal variation of the mean wind, its standard deviation, and the correlation speeds It also incorporates systematic diurnal variation of the mean speed and standard deviation Model capabilities, are simulated and results of analysis of simulated and actual data are compared DOE

N82-14317# Delaware Univ, Newark Center for Catalytic Science and Technology
DEVELOPMENT OF SUPERIOR DENITROGENATION AND ISOMERIZATION CATALYSTS FOR PROCESSING CRUDE OIL DERIVED FROM SHALE, PART 1 Final Interim Report
James R Katzer, Alvin B Stiles, and Harold Kwart 15 Aug 1981 23 p refs
(Contract N00019-80-K-0507)
(AD-A105667) Avail NTIS HC A02/MF A01 CSCL 08/7

For purposes of immediate application to shale oil, the most important conclusions derived from this preliminary work are the following (1) As with quinoline, total nitrogen removal in multiring condensed heterocycled amines involves hydrogenation of the aromatic rings followed by (an often slower) process of C-N bond scission (2) With multiring substrates of this nature the ring hydrogenation occurs more rapidly than the C-N bond scission reactions leading to the accumulation of considerable concentrations of hydrogenated nitrogen-containing species in the reaction mixture (3) The overall rates of N-removal do not vary significantly because the rates of C-N bond scission in these hydrogenated species are quite similar (4) The rates of these reactions would appear to be somewhat affected by steric hindrance to adsorption caused by the puckered cyclohexane rings and the similarity of rates must be due to the similarity of the steric effects GRA

N82-14323# Sandia Labs, Albuquerque, N Mex
CATALYTIC EFFECT OF IRON IN HYDROGASIFICATION OF COAL
T D Padrick, D D Dees, and T M Massis 1981 9 p refs Presented at the 11th North Am Thermal Analysis Soc Conf, New Orleans, 19 Oct 1981
(Contract DE-AC04-76DP-00789)
(DE81-023928, SAND-81-0715C, CONF-811014-2) Avail NTIS HC A02/MF A01

Results indicate that finely divided hematite enhances the production of methane, by a factor of fifteen, during char gasification at one atmosphere of hydrogen Gasification rates were measured by heating the samples in a thermal gravimetric analysis system to a fixed temperature and then monitoring the rate of weight loss versus time Product gas analysis indicates that during char gasification with hematite present, greater than 85 mole % of the gas is methane The catalytic form of the

hematite was identified as reduced iron The effect of the reduced iron as a catalyst is strongly dependent on particle size The catalytic activity is also dependent on precursor species with the following order observed Fe2O3, Fe3O4, FeS2, Fe DOE

N82-14371*# United Technologies Research Center, East Hartford, Conn
EXTERNAL FUEL VAPORIZATION STUDY Final Report
E. J Szetela and J A TeVelde Nov 1981 92 p refs
(NASA-CR-165513, UTRC-81-915326-15) HC A05/MF A01 CSCL 21D

The feasibility of external fuel vaporization in advanced aircraft gas turbine engines is addressed Experiments were run to determine key fuel properties including boiling points, dew points, critical temperature, critical pressure, heat transfer coefficients, deposit formation rates, and deposit removal in a flowing system Of particular concern were the heat transfer rate in the heat exchanger and the performance of the orifice used in the throttling process. Three fuels were utilized in the experiments including Jet-A, Experimental referee broad specification fuel, and a premium No 2 diesel fuel Engine conditions representing the NASA Energy Efficient Engine at sea level takeoff, cruise, and idle were simulated in the vaporization system and it was found that single phase flow was maintained in the heat exchanger and downstream of the throttle Deposits encountered in the heat exchanger represented a thermal resistance as high as 0013 sq M K/watt and a deposit formation rate as high as 800 micro-gC/sq cm hr These values are equivalent to a buildup of 0 055 cm of thickness in 36 hours resulting in a more severe fouling condition than originally anticipated It was found that the deposit can be removed by cleaning with air at a temperature of 720 K for 10 minutes R J F

N82-14374# Department of Energy, Laramie, Wyo Energy Technology Center
SIXTH UNDERGROUND COAL-CONVERSION SYMPOSIUM
1980 619 p refs Symp held in Shangri-la, Okla , 13-17 Jul 1980 Prepared in cooperation with Williams Bros Engineering Co , Tulsa, Okla
(DE81-027669, CONF-800716) Avail NTIS HC A99/MF A01

Department of Energy underground coal gasification (UCG) field programs at different sites are reviewed Private sector industrial activity in UCG is reported Mathematical modeling for UCG processes is discussed Laboratory studies concerning UCG are presented Environmental studies concerning specific UCG sites are examined The economics of UCG are addressed Instruments and controls are considered General topics relevant to UCG are included DOE

N82-14375# Lincoln Land Community Coll , Springfield, Ill
ALCOHOL FUELS GRANT PROGRAM AT LINCOLN LAND COMMUNITY COLLEGE, SPRINGFIELD, ILLINOIS Final Report
1981 14 p
(Contract DE-FG02-80IR-1855)
(DE82-000744, DOE/IR-10855/T1) Avail NTIS HC A02/MF A01

Progress in the development of alcohol fuels is reported A tristar still was produced during demonstrations and workshops Two cars were converted to run on the fuel produced from the still Preliminary trials of a converted tractor using ethanol and water are reported Information on the curriculum developed as part of this program is presented DOE

N82-14377# Andco Environmental Processes, Inc , Buffalo, N Y
FEASIBILITY STUDY FOR AN ALCOHOL-FUELS PLANT FOR BUFFALO, NEW YORK
Nov 1980 369 p refs
(Contract DE-FG01-80RA-50357)
(DE82-000032; DOE/RA-50357/T1) Avail NTIS HC A16/MF A01

A feasibility study was conducted of a 15,000,000 gal per year anhydrous ethanol plant to be located in the Buffalo area All major aspects of the construction and operation of the plant were investigated It is concluded that (1) the volatile energy situation presents too much of a risk for bankers and investors unless the Department of Energy guarantees that they will purchase any alcohol not sold on the open market at a guaranteed price formula, (2) the complete plant design was prepared and it appears that there is very little technological risk in the process, (3) a suitable plant site is available with all necessary utilities and the plant equipment has been laid out for this site, (4) the plant easily complies with environmental, health, safety and socioeconomic requirements, (5) raw materials consisting of corn and coal are readily available in adequate quantity and at reasonable prices in the Buffalo area, (6) the distillers dried grains and the carbon dioxide can both be sold in their entirety at reasonable prices, and (7) capital cost and operating cost are such that the alcohol plant makes an attractive investment with reasonable payout and profit potential DOE

N82-14379# Brookhaven National Lab , Upton, N Y Dept of Energy and Environment
COAL-OIL MIXTURES: AN ALTERNATIVE FUEL FOR THE COMMERCIAL MARKETS AND LARGE RESIDENTIAL MARKETS
Thomas A Butcher and Robert J Isler 1981 29 p refs Presented at the Intern Conf on Residential Solid Fuels, Portland, Oreg , 1 Jun 1981
(Contract DE-AC02-76CH-00016)
(DE81-028335, BNL-29773, CONF-810674-2) Avail NTIS HC A03/MF A01

Results are presented of a program aimed at promoting wide-spread use of coal-oil mixtures in large residential and commercial sector size oil-fired heating equipment Fuel properties are discussed including viscosity, heating values, and effect of coal particle size On-site mixing of COM is not considered practical for users in this size range and a number of central preparation plant projects are in progress Options for on-site storage including the addition of paddle agitators, recirculation agitation systems, auxiliary tanks, and stable slurries are discussed Fuel pump, controls, and atomizer modifications will be required as well Special problems of sootblowers, cyclones, baghouses, and scrubbers are considered DOE

N82-14380# Kerr-McGee Corp , Oklahoma City
PROCESS DEVELOPMENT FOR IMPROVED SRC OPTIONS. KERR-MCGEE CRITICAL SOLVENT DEASHING AND FRACTIONATION STUDIES Final Report
R A Baldwin, R E Davis, L D Gillham, R C Janka, R E Leonard, and D E Rhodes Jul 1981 108 p refs Sponsored by EPRI
(EPRI Proj 1134-2)
(DE81-903785, EPRI-AP-1932) Avail NTIS HC A06/MF A01

The solvent refined coal 1/2 process, a coal liquefaction process which includes Kerr-McGee critical solvent deashing (CSD), was demonstrated in a blocked-out fashion in continuous bench-scale units It was demonstrated that conventional SRC-I as well as short-residence-time vacuum bottoms could be successfully deashed and fractionated and that the fractionated portion of the soluble coal product, light SRC, could be added to the liquefaction solvent to improve its quality An amount of light SRC equivalent to that which was initially added to the liquefaction solvent was recovered in the CSD process in most cases to maintain light SRC recycle It was found that soluble coal product recovery was inversely proportional to the first-stage CSD temperature and that the fractionation step was sensitive to deashing solvent to feed ratio The SRC-1/2 process was not, however, fully integrated and therefore these results are not necessarily indicative of steady-state conditions DOE

N82-14381# Brookhaven National Lab , Upton, N Y Dept of Energy and Environment
POTENTIAL SUPPLY OF SYNTHETIC FUELS FROM ALASKAN HYDROELECTRIC POWER AND COAL
Meyer Steinberg and James R Powell 1981 15 p refs Presented at the IGRC 1981 Conf , Chicago, 28 Sep 1981
(Contract DE-AC02-76CH-00016)
(DE81-025743, BNL-29764, CONF-810933-1) Avail NTIS HC A02/MF A01

It is proposed to develop and utilize the large potential hydroelectric power resources in Alaska to produce hydrogen by the electrolytic decomposition of water and to combine the hydrogen with the large Alaskan coal reserves to produce synthetic liquid and gaseous fuels It is estimated that in this manner, as much as 1 8 million bbls/day of gasoline or 6 2 billion SCF/day of substitute natural gas can be produced The existing and projected Alaskan pipelines would provide the means of transporting the fuels to energy consuming load centers in the

U S This development would move the US a considerable way towards energy independence as well as employing the material resources in Alaska in an efficient manner DOE

N82-14383# Battelle Pacific Northwest Labs, Richland, Wash
BIOMASS ENERGY UTILIZATION IN THE PACIFIC NORTHWEST. IMPACTS ASSOCIATED WITH RESIDENTIAL USE OF SOLID FUELS
P Petty, W Hopp, and A Chockie May 1981 23 p refs Presented at the 1981 Intern Conf on Residential Solid Fuels, Portland, Oreg, 1 Jun 1981
(Contract DE-AC06-76RL-01830)
(DE81-029137, PNL-SA-9618, CONF-810674-3) Avail NTIS HC A02/MF A01

The Pacific Northwest Region, including Washington, Oregon, and Idaho, is the geographic area for which an impact assessment of the residential use of solid fuels is performed An estimate of the potential energy contained in the fuelwood burned annually and an estimate of the mean conversion efficiency of the regional capital stock of woodburning appliances leads to a reasoned assessment of the contribution of wood energy to the residenital energy use in the region The use of solid fuels was associated with an increase in the incidence of residential fires nationally An estimate is made of the economic costs attributable to this source of fire incidence An additional area of concern relates to the harvesting practices of hundreds of individuals, cutting fuelwood for their own use Statistics describing injuries and death per Btu in the commercial logging industry are used as a basis for an estimate of injuries and deaths resulting from the increased collection of forest residues and fuelwood by private woodcutters DOE

N82-14385# Punjab Agriculture Univ, Ludhiana (India) Coll of Agricultural Engineering
ENERGY BALANCE AND UTILIZATION OF AGRICULTURAL WASTE ON A FARM Final Report
B S Pathak, A P Bhatnagar, Daljit Singh, and K S Salariya 1980 90 p refs Sponsored in part by Tata Energy Research Inst
(PB81-229262) Avail NTIS HC A05/MF A01 CSCL 21D

The possibility of using crop residues and other agricultural works as a renewable energy source is investigated Some conclusions drawn are energy requirements of tractor operated farms are only marginally higher than bullock operated farms, the use of commercial fuels for cooking in rural areas is very limited, most crop residues except paddy straw is used for fodder or fuel, farmers use dung as fuels although they know its use as a fertilizer, all energy required by farms could be self-generated, and paddy straw should be burned to produce electricity GRA

N82-14386# Punjab Agriculture Univ, Ludhiana (India) Coll of Agricultural Engineering
STUDIES ON SUGARCANE AS AN ENERGY CROP FOR PUNJAB Final Report
B S Pathak, A P Bhatnagar, Daljit Singh, and K S Salariya 1980 25 p refs Sponsored in part by Tata Energy Research Inst
(PB81-232308) Avail NTIS HC A02/MF A01 CSCL 21D

The energy costs and returns in the production of sugar cane and its conversion to alcohol, based on data collected from a sugar mill and a brewery, are presented Author (GRA)

N82-14522# Petro-Lewis Corp, Denver, Colo
FIELD DEMONSTRATION OF THE CONVENTIONAL STEAM DRIVE PROCESS WITH ANCILLARY MATERIALS Quarterly Report, Jul. - Sep. 1980
David R Alden and Rod L Eson (Chemical Oil Recovery Co, Bakersfield, Calif) 7 Oct 1980 13 p
(Contract DE-FC03-79SF-10762)
(DE81-026849, DOE/SF-10762/T2) Avail NTIS HC A02/MF A01

This field test demonstrates an improved oil recovery process through the use of ancillary materials to steam drive injectors The ancillary materials are used to reduce injection in steam channels and thus force the injected steam to enter alternate flow paths Evaluation of the injection well production curves shows that currently there is over 125 incremental barrels of oil per day being produced by the four patterns receiving ancillary materials and that the incremental oil rate has been steadily increasing since the initial treatment in January, 1980 Preliminary work began on the evaluation of the producing temperatures, steam injection profiles, chemical tracer surveys, casing vent gas emissions and residual oil saturations in the six observation wells drilled DOE

N82-14523# Chemical Oil Recovery Co, Bakersfield, Calif
FIELD DEMONSTRATION OF THE CONVENTIONAL STEAM DRIVE PROCESS WITH ANCILLARY MATERIALS Quarterly Report, Oct. - Dec. 1980
Rod L Eson and A M Shannon (Petro-Lewis Corp, Denver) Jan 1981 28 p
(Contract DE-FC03-79SF-10762)
(DE81-026962, DOE/SF-10762/T1) Avail NTIS HC A03/MF A01

This field test demonstrates an improved oil recovery process through the use of ancillary materials to steam drive injectors The ancillary materials are used to reduce injection in steam channels and thus force the injected steam to enter alternate flow paths During the first two months of this quarter up to 190 incremental barrels of oil per day were produced by the four patterns receiving ancillary materials The evaluation of the producing temperatures, steam injection profiles, chemical tracer surveys, casing vent gas emissions and residual oil saturations in the six observation wells drilled is addressed DOE

N82-14561# Jet Propulsion Lab, California Inst of Tech, Pasadena
THE SEASAT COMMERCIAL DEMONSTRATION PROGRAM
S W McCandless (User Systems Engineering, Annandale, Va), B P Miller (Econ, Inc, Princeton, N J), and D. R Montgomery *In* ESA Appl of Remote Sensing Data on the Continental Shelf Jul 1981 p 59-72 refs (For primary document see N82-14553 05-43)
Avail NTIS HC A13/MF A01, ESA, Paris FF 125

The background and development of the Seasat commercial demonstration program are reviewed and the Seasat spacecraft and its sensors (altimeter, wind field scatterometer, synthetic aperture radar, and scanning multichannel microwave radiometer) are described The satellite data distribution system allows for selected sets of data, reformatted or tailored to specific needs and geographical regions, to be available to commercial users Products include sea level and upper atmospheric pressure, sea surface temperature, marine winds, significant wave heights, primary wave direction and period, and spectral wave data The results of a set of retrospective case studies performed for the commercial demonstration program are described These are in areas of application such as marine weather and ocean condition forecasting, offshore resource exploration and development, commercial fishing, and marine transportation Author (ESA)

N82-14583# Bergen Univ (Norway) Dept of Chemistry
OIL SPILL IDENTIFICATION BY CHEMICAL ANALYSIS
O Grahl-Nielsen and S Wilhelmsen (Inst of Marine Research, Bergen) *In* ESA Appl of Remote Sensing Data on the Continental Shelf Jul 1981 p 243-244 refs (For primary document see N82-14553 05-43)
Avail NTIS HC A13/MF A01, ESA, Paris FF 125

Gas chromatographic analyses of the relative amounts of phenanthrene and dibenzothiophene and their alkylated derivatives are shown to distinguish crude oils from different parts of the world and crude oils from different fields in the North Sea Ekofisk area These aromatic hydrocarbons are relatively unaffected by weathering and can be used for matching oils from oil spills with unweathered samples from the suspected source The method was used to identify the source of an oil spill in Bergen harbor It is shown that analysis of the relative amounts of dibenzothiophenes is sufficient to discriminate between crude oils in most cases Author (ESA)

N82-14594# Department of Energy, Laramie, Wyo
BIBLIOGRAPHY OF PUBLICATIONS DEALING WITH TAR SANDS
Sep 1981 296 p
(DE81-026146, DOE/LETC/RI-81/2) Avail NTIS HC A13/MF A01

A compilation of technical reports, patents, journal articles and books on the development of tar sands (oil sands) The emphasis is on the US resource and its development Included are articles on nondomestic tar sand and related heavy oil resources and their development The subjects include geology and resource evaluation, chemical and physical properties, in

situ recovery, upgrading and refining, history environmental, and miscellaneous (includes general survey papers, resource development, health and safety, economics, etc) DOE

N82-14595# Tetra Tech, Inc , Columbus, Ohio
EVALUATION OF DEVONIAN SHALE POTENTIAL IN EASTERN KENTUCKY/TENNESSEE
1981 104 p refs
(Contract DE-AC21-79MC-10389)
(DE82-001164, DOE/METC-121) Avail NTIS HC A06/MF A01

The US Department of Energy s Eastern Gas Shales Project is designed not only to identify the resource, but also to test improved methods of inducing permeability to facilitate gas drainage, collection, and production Results as they pertain to the Devonian gas shales of the Appalachian basin in eastern Kentucky and Tennessee are presented Geologic data and interpretations are summarized, and areas where the accumulation of gas may be large enough to justify commercial production are outlined DOE

N82-14612# Department of Energy, Pittsburgh, Pa Mining Technology Center
LONGWALL MINING OF THIN SEAMS
Ernest A Curth 1981 22 p refs Presented at the 1st Ann Conf on Ground Control in Mining, Morgantown, W Va , 27 Jul 1981
(DE81-028042, CONF-810714-2) Avail NTIS HC A02/MF A01

Thin seam operations pose a challenge to the ingenuity of mining engineers to overcome the factor of human inconvenience in the restricted environment and associated high cost production Suprisingly, low seam longwalls in the Federal Republic of Germany in an average thickness of 35 in and dipping less than 18 deg come close to achieving the average production rate of all German longwall operations They are all plow faces, and a consistent production of 3300 tons per dav and a productivity of 40 tons per man shift are reported from one of the thin seam longwalls These results were attained by reliable high capacity equipment and roof support by shields that can be collapsed to as low as 22 inches Maximum mining height *for plow operated faces lies at 31 5 inches Technology develop*ment for the future is discussed DOE

N82-14613# California Univ , Livermore Lawrence Livermore Lab
MATHEMATICAL MODELLING OF SOME CHEMICAL AND PHYSICAL PROCESSES IN UNDERGROUND COAL GASIFICATION
John R Creighton Aug 1981 5 p Presented at the Eastern Section The Combustion Inst Conf , Pittsburgh, 27-29 Oct 1981 Submitted for publication
(DE81-027941, UCRL-86518, CONF-811027-1) Avail NTIS HC A02/MF A01

The chemical and physical processes governing underground coal gasification were conducted on laboratory scale experiments accompanied by mathematical modelling Blocks of selected coal types are cut to fit 55 gallon oil drums and sealed in place with plaster A 1 cm diameter hole is drilled the length of the block and plumbing attached to provide a flow of air or oxygen/steam mixture After an instrumented burn the block is sawed open to examine the cavity Mathematical modelling is directed towards predicting the cavity shape Sub models and their impact on predicted cavity shapes are examined DOE

N82-14614# *Sandia Labs , Albuquerque, N Mex Geothermal* Technology Development Div
ACCESSING THE GEOTHERMAL RESOURCES
James R Kelsey 1981 6 p refs Presented at the Showcase for Technol Conf , Albuquerque, N Mex , 28 Oct 1981
(Contract DE-AC04-76DP-00789)
(DE81-025396, SAND-81-1384C, CONF-811018-1) Avail NTIS HC A02/MF A01

The technology development efforts in the areas of drilling, completion, and logging instrumentation are described These development efforts are aimed at solving the problems associated with the high temperatures, hard-fractured geological formations, and corrosive formation fluids DOE

N82-14639# Pope, Evans, and Robbins, Inc , New York
EVALUATION OF COAL GASIFICATION/COMBINED CYCLE POWER PLANT FEASIBILITY AT THE SEWELLS POINT NAVAL COMPLEX, NORFOLK, VIRGINIA Final Report
Jul 1981 235 p refs
(Contract N62470-80-C-3736)
(AD-A103674) Avail NTIS HC A11/MF A01 CSCL 10/2

The feasibility of installing a coal gasification/combined cycle cogeneration plant at Sewells Point Naval Complex, Norfolk, Virginia is evaluated Current gasification technology, combined cycle thermodynamics, environmental control requirements, and conventional coal fired cogeneration cycles are addressed The utility interface, site considerations, and economic analyses are also presented It is concluded that a coal gasification/combined cycle cogeneration plant supplying 50 MW of electric power and 290,000 lb/hr of steam is technically feasible M D K

N82-14680# Oak Ridge National Lab , Tenn
COAL CONVERSION SOLID WASTE DISPOSAL
C W Francis, W J Boegly, Jr , R R Turner, and E C Davis 1981 21 p refs Presented at the Am Soc of Civil Engr Ann Meeting, Vail, Colo , 3 Aug 1981
(Contract W-7405-eng-26)
(DE81-028567, CONF-81085-1) Avail NTIS HC A02/MF A01

The major solid waste produced at coal conversion facilities will be gasification slag or ash To evaluate the impact of this waste on the environment, extensive characterization and leaching studies were conducted on ash/slags that were generated in bench-scale operations, pilot plants, and/or process development units for the Cogas, British Gas/Lurgi, Grace/Texaco, U-Gas, Foster Wheeler/Stoic, SRC-I/Koppers-Totzek, SRC-II/Texaco, and Combustion Engineering gasification processes These studies, designed to assess the consequences of disposal in landfills, showed that none of the leachates from these eight wastes exceeded the US Environmental Protection Agency's toxicity limits established as a result of the Resource Conservation and Recovery Act of 1976 The major environmental impact associated with disposal of these solid wastes appears to be the dissolution of sulfate and the potential acidification of ground water DOE

N82-14711 Iowa Univ , Oakdale
STRATIGRAPHY AND DEPOSITIONAL HISTORY OF THE IOLA LIMESTONE UPPER PENNSYLVANIAN (MISSOURIAN), NORTHERN MIDCONTINENT U.S. Ph.D. Thesis
John Charles Mitchell 1981 379 p
Avail Univ Microfilms Order No 8123341

The Iola Limestone, one of the best developed and most laterally extensive, yet least studied Missourian cyclic carbonates in the Midcontinent Upper Pennsyvlanian, was studied Along with adjacent shales, five members constitute the Iola cyclothem, a typical Kansas cyclothem In ascending order these are Chanute Shale, Paola Limestone, Muncie Creek Shale, Raytown Limestone, and Lane/Bonner Springs Shale Although traditional interpretation of cyclothems regarded all shale as nearshore, shallow-water deposits, Iola lithology and stratigraphy support the more recent hypothesis that the cyclothem represents a single transgressive-regressive event, with maximum transgression occurring during deposition of the Muncie Creek Shale Distribution of conodonts reflects the depositional pattern of the Iola cyclothem Vertical variation far outweighs lateral variation in abundance and diversity Dissert Abstr

N82-15152# Oak Ridge National Lab , Tenn
THERMOLYSIS OF NAPHTHOLS
M L Poutsma and C W Dyer 1981 6 p refs Presented at the Intern Conf on Coal Sci , Dusseldorf, 7 Sep 1981
(Contract W-7405-eng-26)
(DE81-029684, CONF-810914-6) Avail NTIS HC A02/MF A01

A significant portion of the oxygen content of native coals and of the coal-derived liquids used as process solvents during hydroliquefaction of coal is present as phenolic hydroxyl groups Various reported phenomenological effects of the phenolic content of process solvents on liquefaction performance were reviewed Background data concerning the chemical behavior of phenols under conditions representative of liquefaction were found lacking The thermolysis of representative phenols under carefully defined conditions was studied The behavior of the isomeric naphthols at 400 C in the absence of any purposely added reagents or catalysts is described The results reveal a set of previously unrecognized thermal reactions by which phenols may be condensed to furans, be deoxygenated to arenes, and serve as

hydrogen donors These processes, the latter two generally desirable and the former one undesirable, are inherently related
M D K

N82-15165# National Bureau of Standards, Washington, D C High Temperature Processes Group
VAPORIZATION AND CHEMICAL TRANSPORT UNDER COAL GASIFICATION CONDITIONS
J W Hastie, D W Bonnell, E R Plante, and W S Horton Dec 1980 114 p refs
(Contract DOE-EA-77-A-01-6010)
(PB81-245839, NBSIR-80-2178-DOE) Avail NTIS HC A06/MF A01 CSCL 07D

Transpiration mass spectrometry for the quantitative analysis of high vapor temperature gases and vapors is described This technique was applied to vapor transport and thermodynamic activity determinations for real and synthetic coal slag samples in reactive coal gas components at atmospheric pressure A highly nonideal and nonmonotonic (with temperature and composition variables) behavior for alkali metal vapor transport was indicated. Thus a priori predictions of alkali metal transport in coal gasifiers without actual activity data are virtually impossible at the present time Surface segregation and diffusion limitations of alkali species in slags are also possible complicating effects Author

N82-15221# Oak Ridge National Lab, Tenn Engineering Technology Div
FAILURE MODES AND EFFECTS ANALYSIS OF A COAL-SLURRY PREHEATER
H A Mitchell, L F Parsly, and A N Smith Sep 1981 33 p refs
(Contract W-7405-eng-26)
(DE81-030425, ORNL/TM-7664) Avail NTIS HC A03/MF A01

Some 55 potential failure modes were identified in a coal slurry preheater, a critical component in a typical coal direct liquefaction plant. Fourteen of these events, if they should occur, would result in losses of sufficient magnitude to require special consideration in the design or operating phase to assure control of risk at an acceptable level It is concluded that the failure modes and effects analysis technique (FMEA) could be a valuable tool in the identification of critical components for coal conversion systems For maximum effect, FMEA needs to be used during the initial design phase Its principal value is to determine high-risk failure modes, which could have unacceptable impacts on system safety and reliability/availability The usefulness of FMEA can be improved if it is supplemented by the development of a failure data base, this data base could also be of value in selected cases as input to a more detailed technique such as a fault-free analysis DOE

N82-15222# Oak Ridge National Lab, Tenn Engineering Technology Div
COAL AND LIMESTONE FEED TESTING FOR ATMOSPHERIC FLUIDIZED BED COMBUSTION
C S Daw, J F Thomas, and M E Lackey Sep 1981 78 p
(Contract W-7405-eng-36)
(DE81-030629, ORNL/TM-7724) Avail NTIS HC A05/MF A01

Pneumatic conveying tests of coal and coal limestone mixtures were performed on a conveying system designed to represent the branch feed lines in the TVA 20 MW(e) atmospheric fluidized bed combustor pilot plant Test conditions were chosen to cover the operating ranges anticipated for the pilot plant These tests led to a basic understanding of the design and operating problems associated with coal surface moisture, air velocity, fines content, solids loading, and limestone to coal ratio Coal surface moisture was found to be the most important parameter affecting handling properties Above a critical level of about six %, surface moisture caused severe compaction problems in the feed hopper and impact plugging in the conveyor line When surface moisture was less than six %, conveyor line plugging resulted only from saltation and filling DOE

N82-15224# Department of Energy, Bartlesville, Okla
MOTOR GASOLINES, WINTER 1980-81
E M Shelton Jul 1981 67 p refs
(DE81-030845, DOE/BETC/PPS-81/3) Avail: NTIS HC A04/MF A01

A compilation of analytical data for 546 samples of motor gasoline produced by 23 manufacturers is presented The data are tabulated by groups according to brands (unlabeled) and grades for 17 marketing districts into which the country is divided A map showing marketing areas, districts, and sampling locations is induced Trends of selected properties of motor fuels since 1959 are charted Octane distribution percent charts for areas 1, 2, 3, and 4 for unleaded antiknock index (R + M)/2 below 90 0, unleaded antiknock index (R + M)/2 below 93 0, and leaded antiknock index (R + M)/2 93 0 and above grades of gasoline are presented The antiknock (octane) index (R + M)/2 averages of gasoline sold in this country were 87 6 unleaded below 90 0, 91 4 unleaded 90 0 and above, 89.1 leaded below 93 0, and 93 3 leaded 93 0 and above grades of gasoline DOE

N82-15225# Texas Univ, Austin Bureau of Economic Geology
ASSESSMENT OF IN-PLACE SOLUTION METHANE IN TERTIARY SANDSTONES: TEXAS GULF COAST
A R Gregory, M M Dodge, J S Posey, and R A Morton 1981 8 p refs Presented at the 5th Geopressured-geothermal Energy Conf, Baton Rouge, La, 13 Oct 1981
(Contract DE-AC08-78ET-11397)
(DE81-029772, CONF-811026-5) Avail: NTIS HC A02/MF A01

The total volume of in place methane dissolved in formation waters of deep sandstone reservoirs of the onshore Texas Gulf Coast within the stratigraphic section extending from the base of significant hydrocarbon production (8000 ft) to the deepest significant sandstone occurrence is appraised Reservoir bulk volume, porosity, and methane solubility were evaluated The latter is controlled by the temperature, pressure, and salinity of formation waters Regional assessment of the volume and distribution of potential sandstone reservoirs was made from a data base of 880 electrical well logs, from which a grid of 24 structural dip cross sections and 4 strike cross sections was constructed These cross sections extend from near the Wilcox outcrop to the coastline The structural and stratigraphic framework of Tertiary sandstone units was mapped Structual and stratigraphic frame-boundaries were used to divide the Texas Gulf Coast into 24 subdivisions Methane content in each of nine formations or divisions of formations was determined for each subdivision. The total in place methane for Tertiary sandstones below 8000 ft in the Texas Gulf Coast was found to be 690 TCF The total in place methane for effective Tertiary sandstones (sandstone units greater than 30 ft thick) below 8000 ft was 325 TCF DOE

N82-15226# Battelle Pacific Northwest Labs, Richland, Wash
THERMOCHEMICAL PRODUCTION OF LIQUIDS FROM BIOMASS
D C Elliott 1981 8 p refs Presented at Solar World Forum, Brighton, England, 23 Aug 1981
(Contract DE-AC06-76RL-01830)
(DE81-030085, PNL-SA-9246, CONF-810865-1) Avail NTIS HC A02/MF A01

The chemistry of this process is essentially that of the CO-steam process wherein carbon monoxide and water, catalyzed by sodium carbonate, are the reducing agents for the biomass A water slurry process involving a prehydrolysis step for wood chips has been used to produce the first biomass-derived oil on a large scale A second variation which requires recycle of a portion of the product for use as the carrier vehicle for wood flour has also been developed to the point of producing multi-barrel quantities of product An extensive amount of product analysis has been completed on both types of product They are similar, being highly phenolic and approximately 10% by weight of oxygen Utilization of the product as a boiler fuel has been tested and other uses of the product are now being investigated Analytical results and product application tests are discussed DOE

N82-15227# California Univ, Livermore Lawrence Livermore Lab
HIGH-PRESSURE SOLVENT EXTRACTION OF METHANE FROM GEOPRESSURED FLUIDS
R Quong, H H Otuski, F E Locke, and R Netherton Aug 1981 6 p refs Presented at the 5th Geopressured-Geothermal Energy Conf, Baton Rouge, La, 13-15 Oct 1981 Submitted for publication
(Contract W-7405-eng-48)
(DE81-027713, UCRL-86515, CONF-811026-2) Avail NTIS HC A02/MF A01

Technical and economic aspects of solvent extraction as a

means of recovering dissolved methane from geopressured-geothermal brines at high pressures are considered Economic assessment shows that additional investment in a high pressure solvent extraction plant preceding direct injection disposal of brines into isolated aquifers can be profitable Solvent extraction is compared with other injection methods The contributions of hydraulic (pressure) energy recovery and geothermal power production are also assessed. The solubilities of a promising solvent, n-hexadecane, and a potential low cost solvent, No 2 Diesel fuel, were measured in 15 wt percent NaCl solutions at temperatures up to 150 C Preliminary results of initial extraction tests at 150 C and 1000 psi in sub-pilot scale equipment are also presented DOE

N82-15232# Massachusetts Inst of Tech , Cambridge LNG Research Center
LIQUID NATURAL GAS RAPID PHASE TRANSITIONS Topical Report, Sep. 1979 - Sep. 1980
George A Corbin and Robert C Reid Jan 1981 99 p refs Prepared for Gas Research Inst
(PB81-244774, GRI-80/0031) Avail. NTIS HC A05/MF A01 CSCL 21D

An apparatus was constructed to test the concept of initiating a rapid phase transition (RPT) in methane-rich LNG on water by collapsing the vapor film with a shock wave Helium overpressures were achieved by breaking a diaphragm in a high-pressure helium chamber Pressure transducers recorded subsequent events NORPT were noted for liquid nitrogen, liquid ethane, liquid methane or methane-rich LNG even with helium driver pressures up to 62 bar The helium did, however, greatly enhance the boiling rate of the cryogen on water On the basis of analytical modelling, it was concluded that a RPT would be very improbable for a methane-rich LNG contacting ambient water in a mode where the surface pressures were high In the course of the project, a new thermodynamic model was developed as a possible explanation for a RPT in cases where the hot liquid temperature would exceed the critical temperature of the cryogen GRA

N82-15233# Southwest Research Inst , San Antonio, Tex
CHARACTERIZATION OF DIESEL EMISSIONS AS A FUNCTION OF FUEL VARIABLES Final Report, Sep. 1979 - Mar. 1981
Bruce B Bykowski Mar 1981 288 p refs
(Contract EPA-68-03-2707)
(PB81-244048, EPA/460-3-81-015) Avail NTIS HC A11/MF A01 CSCL 21D

Several properties of a refinery 'straight run kerosene', which have a narrow boiling range approximating the middle of a No 1 diesel fuel, were altered to study their effects on regulated and unregulated exhaust emissions Eleven fuel blends, representing changes in nitrogen content, aromatic level, boiling point distribution, olefin content, and cetane number, were evaluated Statistical analysis, including regression, was performed using selected fuel properties as independent variables Higher aromatic levels are generally associated with increased emissions, while increased olefin levels are generally associated with decrease emissions GRA

N82-15452# Ricardo & Co , Engineers (1927) Ltd , Shoreham-by-Sea (England)
THE UTILISATION OF ALCOHOL IN LIGHT DUTY DIESEL ENGINES Final Report
28 May 1981 41 p refs Sponsored by EPA
(PB81-244469, EPA-460/3-81-010, DP-81/935) Avail NTIS HC A03/MF A01 CSCL 21G

Various approaches employed to facilitate the utilization of alcohols, methanol and ethanol, in light duty diesel engines were reviewed The choice of which system to employ is most heavily influenced by the proportion of alcohol substitution which is required and the resulting engine first cost penalty which is deemed to be acceptable Alcohol utilization by more or less conventional spark ignited engines appears to be far less problematical than conversion of diesel engines GRA

N82-15489*# Geological Survey, Denver, Colo.
GEOLOGIC APPLICATIONS OF THERMAL-INERTIA MAPPING FROM SATELLITE Final Report
Terry W Offield, Principal Investigator, Kenneth Watson, and Susanne Hummer-Miller Jul 1981 109 p refs Original contains imagery Original imagery may be purchased from NASA Goddard Space Flight Center, (Code 601), Greenbelt, Md 20771 Domestic users send orders to 'Attn National Space Science Data Center', non-domestic users send orders to 'Attn. World Data Center A for Rockets and Satellites' HCMM
(NASA Order S-40256-B)
(E82-10011, NASA-CR-164818) Avail. NTIS HC A06/MF A01 CSCL 08B

In the Powder River Basin, Wyo , narrow geologic units having thermal inertias which contrast with their surroundings can be discriminated in optimal images. A few subtle thermal inertia anomalies coincide with areas of helium leakage believed to be associated with deep oil and gas concentrations. The most important results involved delineation of tectonic framework elements some of which were not previously recognized Thermal and thermal inertia images also permit mapping of geomorphic textural domains. A thermal lineament appears to reveal a basement discontinuity which involves the Homestake Mine in the Black Hill, a zone of Tertiary igneous activity and facies control in oil producing horizons Applications of these data to the Cabeza Prieta, Ariz , area illustrate their potential for igneous rock type discrimination Extension to Yellowstone National Park resulted in the detection of additional structural information but surface hydrothermal features could not be distinguished with any confidence A thermal inertia mapping algorithm, a fast and accurate image registration technique, and an efficient topographic slope and elevation correction method were developed Author

N82-15505# Texas Univ , Austin Bureau of Economic Geology
STRUCTURAL EVOLUTION OF THREE GEOPRESSURED-GEOTHERMAL AREAS IN THE TEXAS GULF COAST
Charles D Winker, Robert A Morton, and Deborah D Garcia 1981 13 p refs Presented at the 5th Geopressured-Geothermal Energy Conf , Baton Rouge, La , 13 Oct 1981
(Contract DE-AC08-79ET-27111)
(DE81-029799, CONF-811026-9) Avail NTIS HC A02/MF A01

Detailed analysis of geological and seismic data from several geopressured geothermal areas (Cuero, Blessing, Pleasant Bayou) reveals similarities in structural-stratigraphic relationships that form geopressured aquifers as well as differences in structural complexity and evolution that characterize the different areas In these examples, geopressured sandstones are isolated on the updip side by downfaulting against shelf-slope shales, and on the downdip side by unfaulting against transgressive marine shales Moreover, they are isolated above and below by thick sequences of transgressive shale or interbedded sandstone and shale Prospective reservoirs are found where delatic and associated sandstones (distributary channel, delta front, barrie-strandplain) were deposited seaward of major growth faults and near the shelf margin DOE

N82-15508# Gulf Universities Research Consortium, Bellaire, Tex.
RELATIONAL METHODOLOGY FOR INTEGRATING AND ANALYZING FIELD TEST AND RESEARCH DATA DESCRIBING ENHANCED OIL RECOVERY
Bill A. Bavinger, Scott Callaway, Donna Tice Goodbread, and James L Gumnick Oct 1981 154 p refs
(Contract DE-AC01-76ET-10145)
(DE81-030441; DOE/ET-10145/72) Avail: NTIS HC A08/MF A01

The application of concepts of relational analysis for the integration of two experimental data bases was demonstrated The following data bases are created: the enhanced oil recovery field test data base; and the enhanced oil recovery research data base DOE

N82-15509# University of Southern Mississippi, Hattiesburg Dept of Polymer Science
IMPROVED POLYMERS FOR ENHANCED OIL RECOVERY SYNTHESIS AND RHEOLOGY Annual Report, Oct. 1979 - Sep. 1980
C. L. McCormick, R D Hester, H. H Neidinger, and G C Wildman Apr. 1981 300 p refs
(Contracts DE-AS05-77ET-12038, EF-77-S-05-5603)
(DE81-030194; DOE/ET-12038/T3; AR-3) Avail: NTIS HC A13/MF A01

The synthesis, characterization, and rheological studies of random and graft copolymers which are used as models for mobility control agents in enhanced oil recovery are reported. The following procedures are studied. macromolecular syntheses

of model polymers, dilute solution viscosity, aqueous size exclusion chromatography, and laser light scattering DOE

N82-15546# Sandia Labs., Albuquerque, N Mex
SANDIA PROGRAM IN GEOTHERMAL TECHNOLOGY DEVELOPMENT
J R Kelsey and B C Caskey 1981 4 p refs Presented at the Geothermal Resources Council Ann Meeting, Houston, Tex., 25 Oct 1981
(Contract DE-AC04-76DP-00789)
(DE81-025394, SAND-81-1490C, CONF-811015-4) Avail NTIS HC A02/MF A01

The accomplishments of the geothermal research program, the status of current projects, and plans for future activities are presented The program includes R and D in high temperature rock penetration mechanics, drilling fluids borehole mechanics, and diagnostics technology DOE

N82-15552# SRI International Corp., Menlo Park, Calif
EXPLORATORY STUDY OF COAL-CONVERSION CHEMISTRY Quarterly Report, 20 Jun. 1980 - 19 Sep. 1981
4 Mar. 1981 35 p refs
(DE81-016136, DOE/ET-14855/12) Avail NTIS HC A03/MF A01

The mechanism of cleavage of key bond types present in coals, and catalysis of conversion in CO-H2O systems are described. Catalytic carbon-carbon and carbon-oxygen bond cleavage in coal related diphenylmethane and diphenyl ether structures were measured The homogeneous scission of carbon-oxygen bonds in diphenyl ether structure was also studied The CO-H2O conversion level is obtained with aqueous solutions either at a starting pH above 12 6 or in neutral solutions with water soluble catalysts present Catalysts, including the potassium or sodium salts of molybdate, chromate, manganate, and tungstate was studied and it is found that all are effective in the 3000 to 6000 ppM range. The nitrate was converted to ammonium ion and formate was detected in the product aqueous phase It is found that catalytic quantities of sodium formate in CO/H2O at pH 7 are effective in the conversion DOE

N82-15559# Los Alamos Scientific Lab., N Mex
HOT DRY ROCK GEOTHERMAL PROSPECTS, 1981
F. Goff, A W Laughlin, J Aldrich, M E Ander, B H Arney, E Decker, J Gardner, G. Heiken, A J Kron, C M. LaDelfe et al 1981 5 p refs Presented at the Geothermal Resources Council Ann Meeting, Houston, Tex. 25-29 Oct 1981
(Contract W-7405-eng-36)
(DE81-025305; LA-UR-81-1807, CONF-811015-8) Avail: NTIS HC A02/MF A01

Sites within the USA as candidates for development of a second hot dry rock (HDR) geothermal system were assessed Potential sites examined fall broadly into three categories according to the nature of their thermal anomalies. (1) quaternary magmahydrothermal (volcanic or igneous) systems, (2) regional thermal anomalies of tectonic origin, and (3) prequaternary plutonic and metamorphic complexes Sites with both electrical generation and direct use potential were considered however, efforts were concentrated on electrical sites. DOE

N82-15560# Pacific Northwest Lab., Richland, Wash
WIND SPEED SIMULATION FOR ECONOMIC EVALUATION OF WIND ENERGY CONVERSION SYSTEMS
J V. *Ramsdell, G F Athey, and M Y Ballinger* Jul. 1981 14 p refs Presented at the 4th U S Natl Conf of Wind Eng. Res., Seattle, 26-29 Jul 1981 Submitted for publication
(Contract DE-AC06-76RL-01830)
(DE81-030077, PNL-SA-9149; CONF-810742-3) Avail. NTIS HC A02/MF A01

A time series model was developed for the simulation of wind speeds The model provides for the incorporation of systematic seasonal variation of the mean speed, standard deviation, and correlation of speeds. It also provides for incorporation of the systematic diurnal variation of the mean speed and the standard deviation. As a demonstration of the model capabilities, a number of simulations were using model parameters derived from data previously collected. The results of analyses of both sets of data, the simulated set and the real data, were compared In general the major features found in the analyses of the real data are identifiable in the corresponding analyses of the simulated data The primary difference between the two data sets is in the frequency of high wind speeds The frequencies of hourly and daily average wind speeds greater than two standard deviations above the mean are underestimated slightly by the model DOE

N82-15593# *TRW Energy Systems, Redondo Beach, Calif*
SAMPLING AND ANALYSIS OF POTENTIAL GEOTHERMAL SITES Final Report, Apr. 1978 - Apr. 1979
R Sung, G Houser, D Strehler, and K Scheyer Aug 1981 205 p refs
(Contract EPA-68-03-2560)
(PB81-240061, EPA-600/7-81-138) Avail NTIS HC A10/MF A01 CSCL 08I

Information on the physical, chemical and radiochemical data of geothermal manifestations (wells and springs) in areas with the most probable potential for development was documented The information can be used to evaluate control technologies and to ultimately establish emission/discharge standards for the emerging geothermal industry GRA

N82-15604# Brookhaven National Lab., Upton, N Y Dept of Energy and Environment
REAL-TIME COARSE-PARTICLE MASS MEASUREMENTS IN A HIGH-TEMPERATURE/PRESSURE COAL-GASIFIER PROCESS TREATMENT
J Wegrzyn, J Saunders, and W Marlow 1981 7 p Presented at the Conf on High Temp., High Pressure Particulate and Alkali Control in Coal Combust Process Streams, Morgantown, W Va., 3-5 Feb 1981
(Contract DE-AC02-76CH-00016)
(DE81-030039, BNL-29953, CONF-810261-1) Avail NTIS HC A02/MF A01

A sampling system that employs a probe appropriate for direct extracted sampling of erosive range particulate matter from a coal gasifier outlet or a high pressure fluidized bed combustor was constructed The sampling system consists of four modules (1) a null balance extractive probe with injection through a porous lined tube to minimize wall loss, (2) a stem type virtual impactor to separate coarse from fine particles, (3) a filter tape collector, and (4) a beta gauge total mass detector A stem type virtual impactor separates at ambient gas stream conditions the coarse particles from the sampling stream so that at filtration no condensible vapors, fine particles or reactive gases pass through the filter tape This system provides coarse particle mass flux data with a time resolution of 30 seconds or better Sampling requirements for high temperature, high pressure aerosols are defined and discussed DOE

N82-15656# Geettingen Univ (West Germany) Inst fuer Geophysik.
GEOMAGNETIC AND MAGNETOTELLURIC SOUNDINGS IN THE AREA OF THE CENTRAL EUROPEAN RIFT SYSTEM Final Report, Jun. 1980
Michael Lee Richards, Urich Schmucker, Erich Steveling, and Juergen Waterman Bonn Bundesministerum fuer Forschung und Technologie Aug 1981 76 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie and EEC
(BMFT-FB-T-81-111; ISSN-0340-7608) Avail. NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 16

The conductivity structure connected with the Central European rift system was investigated with regard to geothermal energy sources using methods of geomagnetic depth sounding *and magnetotelluric sounding Sensors, a data acquisition system,* and a software package for data handling and data analysis were developed During a test campaign in the Leinegraben area and two field campaigns in the Rheingraben area, geoelectric and geomagnetic variations in the period range from 6 seconds to 24 hours were registrated At base sites in the Rheingraben and the Black Forest, models of the vertical profile of the electrical conductivity were determined, while at sites in between the lateral conductivity variations were investigated The perturbation of magnetic field in the region of the Rheingraben is strong and frequency dependent The higher frequencies (low penetration depths) show the influence of the graben sedimentary structure, filling only the narrow graben area, and strong currents along the center of the graben The lower frequencies (deeper penetration depths) reflect the deeper, probably broader conductivity structure Author

N82-15661# Los Alamos Scientific Lab., N Mex
SCHLUMBERGER RESISTIVITY STUDY OF THE JEMEZ

SPRINGS REGION OF NORTHWESTERN NEW MEXICO
Chris Pearson and Fraser Goff 1981 5 p refs Presented at the Geothermal Resources Council Ann Meeting, Houston, Tex., 25-29 Oct 1981
(Contract W-7405-eng-36)
(DE81-025302; LA-UR-81-1806, CONF-811015-10) Avail: NTIS HC A02/MF A01

Schlumberger resistivity soundings made in the Jemez Mountains of northwestern New Mexico, near the village of Jemez Springs, are presented Three areas that have potential as low temperature geothermal reservoirs were identified The areas are characterized by a localized zone of very low resistivity which represents the extent of geothermal water and correlates with the location of hot springs or recent volcanic rocks Resistivities increase rapidly toward the margins of the anomalies, suggesting either variable porosities or variable temperatures and salinities in the reservoirs DOE

N82-15981# California Univ., Berkeley Lawrence Berkeley Lab Engineering and Technical Services Div
GRAD: A TOOL FOR PROGRAM ANALYSIS AND PROGRESS MONITORING
Winifred W S Yen and J Dennis Lawrence Jun 1981 5 p refs Presented at the Ann Meeting of the Geothermal Resources Council, Houston, Tex., 25-29 Oct 1981
(Contract W-7405-eng-48)
(DE81-028098, LBL-12820; CONF-811015-14) Avail NTIS HC A02/MF A01

The development and operation of the Geothermal Resource Areas Database (GRAD) is described The data base was created as part of the National Geothermal Progress Monitor System in 1979 The data base is organized around the concept of a geothermal area and provides broad coverage of geothermal development activities in the United States Sixteen records, covering pre-lease, lease, and post-lease activities are defined for each area Data collected in the various subject areas are critically evaluated, and then entered into an on-line interactive computer system The system is publicly available for retrieval and use DOE

05
ENERGY CONVERSION

Includes photovoltaic, thermoelectric, geothermal, ocean thermal, and wind energy conversion. Also includes nuclear reactors and magnetohydrodynamic generators

A82-10192 **Photoacoustic figure of merit for photothermal energy conversion efficiency.** D. Cahen (Weizmann Institute of Science, Rehovot, Israel) *Optics Communications*, vol. 39, Oct. 15, 1981, p. 243-246 15 refs

The photoacoustic signal detected near the non-illuminated back surface of a photothermal converter can be used for comparative studies of the conversion efficiency of the converter. The signal is caused not only by the thermal wave transmitted through the sample, but also by mechanical vibrations of the sample itself. While no absolute absorptance or emittance values can be obtained, the signal reflects the influences of both these quantities on the conversion efficiency Thus this kind of method may lend itself to quality control of such converters, although direct comparisons between absorbing surfaces on different substrates are still problematic. (Author)

A82-10450 **Waves of energy.** F. G. W Smith and R. H. Charlier. *Sea Frontiers*, vol. 27, May-June 1981, p. 139-149.

Possible means for harnessing the energy contained in ocean waves are considered Problems associated with the low-grade nature of wave energy and the rate at which wave crests approach are pointed out, and simple devices already in use for the supply of energy to bell buoys, whistle buoys and lighted buoys are noted. Attention is then given to wave energy conversion systems based on the focusing of waves onto a narrow ramp leading to a reservoir from which water is released to power a turbine generator, a slightly submerged circular shell which directs waves into its center cavity where waves act to turn a turbine (the Dam-Atoll), a long vertical pipe with an internal valve allowing water to move in an upward direction (the Isaacs wave-energy pump), a turbine located at the bottom of an open-topped pipe (the Masuda buoy), a completely submerged closed air chamber from which runs a large pipe open to the sea, a wave piston which acts by the compression of air to drive a turbine, a massive structure with upper and lower reservoirs (the Russel rectifier), and devices which consist of floating or submerged objects which transfer wave energy to pumps (the Salter duck and Cockerell raft) It is concluded that although wave-powered generators are not likely to become competitive in the near future or provide more than a small portion of world demand, they may be found useful under special conditions. A.L.W.

A82-10958 # **Correlation between results of zone method and experiment in radiative heat transfer.** A. J Sistino (Argonne National Laboratory, Argonne, IL). *American Society of Mechanical Engineers and American Institute of Chemical Engineers, National Heat Transfer Conference, 20th, Milwaukee, WI, Aug 2-5, 1981, ASME Paper 81-HT-71* 5 p 13 refs. Members, $2 00, nonmembers, $4.00. Research supported by the U S. Department of Energy

The zone method is used to simulate the radiative and conductive heat transfer characteristics of an engineering test facility. The results obtained with the zone method are compared to those measured in the subject facility, and it is found that the theoretical and experimental results agree within five percent when the effective wall emissivity is taken to be 0.25. This effective wall emissivity is the product of the actual wall emissivity times the self-absorption factor of the radiation in the cool boundary layer (Author)

A82-10978 # **Application of orthotropic plate theory to windmill blade design.** C Rubin (Vanderbilt University, Nashville, TN). *ASME, Transactions, Journal of Mechanical Design*, vol. 103, Oct. 1981, p. 892-894 5 refs

The windmill blade is treated as a semi-infinite orthotropic wedge with free-free boundary conditions. A closed form solution for the deflections and stresses is obtained as a function of the loading. The loading may be quite general. Results for three different materials which are commonly used for windmill blades (aluminum, sitka spruce, and fiberglass) are obtained. Applications also include ribbed, corrugated, and layered structures. In addition, other types of boundary conditions may be used to obtain solutions to a wide variety of other orthotropic plate problems. (Author)

A82-11131 ***The tilting mode in field-reversed configurations.*** R A Clemente and J L Milovich (Comisión Nacional de Energía Atómica, División Fusión Nuclear, Buenos Aires, Argentina) *Physics Letters*, vol 85A, Sept 21, 1981, p 148-150 5 refs

Analytical consideration is given to the problem of the stability of plasma equilibria in toroidal field-reversed configurations to the rotation of the symmetry axis inside the separatrix (the tilting mode) The energy principle is applied to an axisymmetric configuration of an ideal plasma in which the plasma reaches the separatrix in the form of a revolution ellipsoid, and for which the equilibrium is described by Hill's vortex solution to the poloidal flux function Analytic growth rates for the tilting mode are obtained as a function of the elongation of the separatrix, and it is found that the prolate field-reversed configurations are unstable to the tilting mode, while spherical configurations are neutrally stable and oblate configurations are stable Results confirm the studies of Rosenbluth and Bussac (1979) on the MHD stability of the spheromak A L W

A82-11389 **Net energy analysis of small wind energy conversion systems.** B N Haack (Ball State University, Muncie, IN) *Applied Energy*, vol 9, Nov 1981, p 193-200 15 refs

The net energy of a small wind electric conversion system is calculated and compared with the net energy of other electricity sources. Net energy is the amount of energy remaining for consumer use after deducting the energy required to find and upgrade the energy source and construct and maintain the electricity generating system A 3 kW rated wind electric system for residential use is examined The amount of energy obtained from this system is estimated by using a computer-operated simulation model which incorporates wind speeds, residential electricity demands and parameters from the generator, inverter and storage components The net energy gain for this wind system is better than that of other systems with which it is compared (Author)

A82-11701 **Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volumes 1, 2 & 3.** Conference sponsored by ACS, AIChE, AIAA, ANS, ASME, IEEE, and SAE New York, American Society of Mechanical Engineers, 1981. Vol. 1, 1038 p., vol. 2, 1072 p., vol. 3, 533 p. Price of three volumes, members, $145., nonmembers, $165.

Topics covered include advanced concept in energy conversion, advanced energy systems, and power systems for aircraft and spacecraft applications. Papers were presented on biomass, efficient building mechanical systems, efficient industrial systems, electrochemical energy conversion, and energy storage, in addition to fossil energy, geothermal power systems, and heat engines and technology applications. Studies on hydrogen, MHD power generation, nuclear power, photovoltaic and solar thermal systems, Sterling cycle engines and technology, thermionics and thermoelectric power generation, and wind power are provided. M.S.K.

A82-11702 # **The economic implications of the exergy and thermal efficiencies of energy conversion systems.** H E. Khalifa (United Technologies Research Center, East Hartford, CT). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1.

New York, American Society of Mechanical Engineers, 1981, p 3-8

The paper examines the concepts of first-law (thermal) and second-law (exergy) efficiencies of power generation systems and the manner in which these efficiencies affect the economics of such systems It is shown that, although the thermal efficiency may provide a preliminary indicator of the unit cost of the energy conversion equipment, it is generally a poor measure of the degree of success of the system in utilizing the input energy stream. It is also shown that the exergy efficiency, while not particularly suitable for

estimating the equipment cost, provides an excellent measure of the energy source utilization efficiency A simple methodology is given for combining the two efficiencies to provide some preliminary indications of the optimum design conditions for Rankine cycle energy conversion systems intended for the utilization of low-to-moderate-temperature energy streams such as those produced from geothermal and waste energy sources (Author)

A82-11720 # **A hidden advantage of permanent magnet electrical generating systems.** J. J O'Neill (General Electric Co., Binghamton, NY). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 136-139 7 refs. USAF-supported research.

The development of permanent magnet aircraft electrical generating systems heralds the beginning of a new era. This technique brings many advantages to the user in terms of size, weight and reliability. However, the most significant of these advantages is the extremely high efficiency which is characteristic of these systems This paper examines the effect of the higher system efficiency on the user, specifically in the area of aircraft fuel consumption. Driven by rising fuel costs, engine and aircraft manufacturers are striving for more efficient performance to minimize life cycle costs The results of a study which examines the effect of several permanent magnet ratings on different aircraft sizes are presented. (Author)

A82-11747 # **Development of space reactor core heat pipes.** K L Meier, H E. Martinez, and J. E Runyan (California, University, Los Alamos, NM). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 1 New York, American Society of Mechanical Engineers, 1981, p 296-301 6 refs

The Space Power Advanced Reactor (SPAR) core heat pipes are being developed to transport 15 kW of power at 1400 K. A straight, 2-m-long, 15 9-mm-diam heat pipe was fabricated of low-carbon arc-cast molybdenum and filled with sodium as the working fluid This nonconcetric, annular, screen-tube-wick pipe was tested successfully at 16-1 kW at 1310 K; at which point a boiling limit was encountered Follow-on work has produced an as yet untested heat pipe which has its wick centered in the evaporator by spacer wires to alleviate the boiling limit problem. A dual artery wick heat pipe is being fabricated to further improve on the boiling limit and increase redundancy. Because the heat pipe must bend around the radiation shield of the SPAR reactor, a series of bending experiments was performed Promising results were achieved by filling the pipe completely with sodium and bending at 365 K The solid sodium acted as a soft mandrel, allowing the wick to bend 90 deg on a 180-mm radius with neither large compression buckles nor tension tears (Author)

A82-11748 # **Heat pipes for NEP spacecraft radiators.** D. M. Ernst (Thermacore, Inc., Leola, PA). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 302-306

The evolution of the NEP spacecraft and radiator over the past two years is traced Radiator to energy conversion system interface designs are presented, as are radiator designs and the development of specific heat pipe hardware Laboratory test results of a 900 K sodium heat pipe demonstrate that difficult geometrical transitions can be accomplished with heat pipes with flexible arterial wicks. C.R.

A82-11749 # **A compact, efficient thermoelectric module for a space reactor.** G Fly (California, University, Los Alamos, NM). In. Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1 New York, American Society of Mechanical Engineers, 1981, p. 307-312. 13 refs

The thermoelectric module for the Space Reactor (SPAR) program is a compact annular unit that provides high heat fluxes with a minimum of heat losses. All interfaces are fully bonded to minimize extraneous temperature drops In order to reduce stresses within the module, the thermoelectric material is circumferentially segmented and a radial stress relief member is provided An enhanced silicon-germanium material allows high temperature operation and provides a high figure-of-merit. By using a titanium silicate sublimation coating, the hot junction temperature can be increased further Thus, a module with reasonably high thermoelectric efficiency, high reliability, and low weight is produced. Since 66 of these thermoelectric ring modules comprise a generator, and 90 generators make up the SPAR conversion system, adequate redundancy is also provided. (Author)

A82-11752 # **Engineering development testing of the GPHS-RTG converter.** R. D Cockfield (General Electric Co., Philadelphia, PA). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 321-325.

The GPHS-RTG will provide electrical power for the Galileo orbiter and for the two spacecraft of the International Solar Polar Mission. The RTG weighs 122 lb and deliver power for the duration of a four and one-half year mission, providing approximately 285 watts at the beginning of the mission, declining to approximately 250 watts at the end of the mission. The GPHS-RTG consists of two primary assemblies the General Purpose Heat Source, and the converter. This paper deals only with the converter, and highlights engineering tests that provide support for its design development Among the tests discussed are those of material characterization, component testing, and converter assembly testing. Engineering development testing culminates in performance and environmental testing of an electrically-heated converter. (Author)

A82-11753 # **Modular isotopic thermoelectric generator.** A. Schock (Fairchild Space and Electronics Co., Germantown, MD) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1.

New York, American Society of Mechanical Engineers, 1981, p. 327-342. 14 refs

A short history of the 10 Radioisotope Thermoelectric Generators (RTG) thus far flown in space, and design and fabrication of a new generation RTG for coupling with the General Purpose Heat Source is presented. The new RTG is modular and can be expanded in 24 W steps to whatever power levels are desired, requiring only modification of the cooling fin dimensions. Each module contains four Pu-238O2 fuel pellets and eight elements, and failure of any module requires only replacement of that unit, without disturbing the others. 5% GaP added to the SiGe thermoelectric material has lowered thermal conductivity and raised efficiency from 0.083 to 0.105, hot junctions are at 1000 C, cold at 300 C. Details of the module design and fabrication, the hot shoe, housing, fins, all components and assembly procedures are presented. The modules are designed for initial use on the Solar Polar mission and the Galileo probe, and it is noted that the iridium cladding around the heat source pellets will withstand a planetary crash without breaching. Each module weighs 59 87 lb, has a power density of 4.71 W/lb, and is designed for a seven year mission life. M.S.K.

A82-11755 * # **Advances in space power research and technology at the National Aeronautics and Space Administration.** J P Mullin, L P Randolph, W R Hudson, and J H Ambrus (NASA, Washington, DC) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 1 New York, American Society of Mechanical Engineers, 1981, p 355-361

Progress and plans in various areas of the NASA Space Power Program are discussed Solar cell research is narrowed to GaAs, multibandgap, and thin Si cells for arrays in planar and concentrator configurations, with further work to increase cell efficiency, radiation hardness, develop flexible encapsulants, and reduce cost Electrochemical research is concentrating on increasing energy and power density, cycle and wet stand life, reliability and cost reduction of batteries Further development of the Ni-H2 battery and O2-H2 fuel cell to multihundred kW with a 5 year life and 30,000 cycles is noted Basic research is ongoing for alkali metal anodes for high energy density secondary cells Nuclear thermoelectric propulsion is being developed for outer planets exploration propulsion systems, using Si-Ge generators, and studies with rare earth chalcogenides and sulfides are mentioned Power Systems Management seeks to harmonize increasing power supply levels with inner and outer

spacecraft environments, circuits, demands, and automatic monitoring. Concomitant development of bipolar transistors, an infrared rectenna, spacecraft charging measurement, and larger heat pipe transport capacity are noted M.S.K.

A82-11756 # **Nuclear electric power for space systems - Technology background and flight systems program.** G L. Bennett, J. J. Lombardo, and B J Rock (U S. Department of Energy, Space and Terrestrial Systems Div., Washington, DC) In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 362-368 7 refs

The paper discusses past and future uses of radioisotope thermoelectric generators (RTGs) and the dynamic isotope power system which was developed for power levels up to 2 kWe Advantages of using space nuclear electric power are presented, and the five functional parts of a generalized nuclear-reactor space power plant are given Radioisotope thermoelectric generators and the RTG flight system are also discussed. The compact size, light weight, and long life of nuclear powered generators enable the operation of sensing, analytical and communication systems of satellites and other communication systems for long periods of time. D.L.G.

A82-11777 # **Recent progress on the development of the Dow hollow fiber sodium-sulfur battery.** C A. Levine (Dow Chemical Co , Walnut Creek, CA). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1 New York, American Society of Mechanical Engineers, 1981, p 823-825.

Recent progress in understanding the chemical and electrochemical mechanisms taking place in the Dow sodium-sulfur cell is summarized. The cell is based on using Na ion-conducting glass as the electrolyte. The cell construction is based on thousands of hollow glass fibers in parallel, each filled with sodium and communicating to a common sodium reservoir The fibers are immersed in the sulfur-sulfide liquid catholyte, and a metal foil adjacent to the fibers acts as the cathode Research is being carried out on cell performance in lifetime and cell resistance. Some of the research being done on glass, cathode foil, impurities, and safety is presented. Two approaches that have been taken to prevent the internal temperature of the cell from rising above 600 C are described. The first employs a metering orifice to limit the sodium flow, even in the event of a massive failure of the tubesheet. The other uses a ceramic 'sponge' to contain the sodium C R

A82-11783 * # **The AGT101 technology - An automotive alternative.** R. A. Rackley and K. A. Davis (Garrett Turbine Engine Co., Phoenix, AZ). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2 New York, American Society of Mechanical Engineers, 1981, p 1403-1407. Contract No DEN3-167.

The Advanced Gas Turbine Powertrain System Development Project is oriented at providing the United States automotive industry the technology base necessary to produce gas turbine powertrains for automotive applications that will have. (1) reduced fuel consumption, (2) the ability to use a variety of fuels, (3) low emissions, and (4) competitive cost/performance. The AGT101 powertrain being developed consists of a regenerated single-shaft gas turbine engine flat rated at 74.6 kW (100 hp) coupled to a split-differential gearbox and a Ford automatic overdrive production transmission. Performance predictions for the AGT101 powertrain represent a 59-percent improvement in mileage estimates over a 1985 conventionally-powered automobile for the combined federal driving cycle. (Author)

A82-11805 # **Overview of DOE's large stationary Stirling engine development program.** K L Uherka, R. E Holtz (Argonne National Laboratory, Argonne, IL), and W. Bunker (U S Department of Energy, Washington, DC) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2. New York, American Society of Mechanical Engineers, 1981, p 1847-1853 8 refs

This paper summarizes the results to date of a program, sponsored by DOE's Office of Fossil Energy, to develop large stationary Stirling engine power systems Primary applications for such power plants include cogeneration and total energy systems, with a major advantage being their ability to employ solid coal and other non-scarce fuels in an environmentally acceptable manner. The major effort in the Stirling engine development program was an industry-based design competition, involving three independent contractual teams. Conceptual designs for state-of-the-art coal-fired Stirling engine systems were developed and all three design teams recommended development of 373 kW modules as base units, which can be coupled together to form individual Stirling engines up to 2238 kW in size Heat transport system design concepts were also developed for integrating engine hot-end sections with coal combustors (Author)

A82-11806 # **Conceptual design of a large coal-fired stationary Stirling engine.** M Schuetz, J Gerstmann (Advanced Mechanical Technology, Inc , Newton, MA), C Bratt, J Berntell (United Stirling AB, Malmo, Sweden), and D. Ernst (Thermacore, Inc , Leola, PA) In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 2 New York, American Society of Mechanical Engineers, 1981, p. 1854-1859 8 refs Contract No. DE-AC02-79ET-15207

A conceptual design is presented for a stationary coal-fired Stirling engine sized for power generation in the 400-2200 kW range, suitable for commercial/industrial cogeneration applications. The proposed power plant consists of one or more 500-hp Stirling engines, a coal combustion system and a heat transport system, along with an electric generator and waste heat recovery equipment of conventional design The U-form engine is placed on top of a fluidized bed combustor, with the crankshaft above the cylinders and heater head, and heat is conveyed from the combustor to the engine heater-head by a two-stage sodium heat pipe. Projections of system performance for the case of an engine heater head temperature of 720 C, engine mean helium pressure of 15 MPa and engine speed of 900 rpm with waste heat utilization result in an overall efficiency of 79%. Based on a system capital cost of $950-1500/kW(e), an electric power generation cost of $0 093/kWh is estimated which may be reduced by waste heat utilization A L W

A82-11807 # **Conceptual design of 500 to 3000 hp Stirling engines for stationary power generation.** W M Toscano, R. Chandrasekhar, A C Harvey, and K. Lee (Foster-Miller Associates, Inc., Waltham, MA) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 2 New York, American Society of Mechanical Engineers, 1981, p 1860-1865

Both near term and far term conceptual designs of a 373 kW (500 hp) to 2237 kW (3000 hp) Stirling engine for stationary power generation have been prepared The recommended near term conceptual design is modular, consisting of a basic Stirling engine cylinder of 100 kW that is easily adaptable to any type of heat input or machine output. The engine output configuration selected is the single crank, narrow V, multicylinder arrangement in which any number of cylinders, in groups of four or five, provide the desired power rating For clean fuel combustion, the prevaporized, premixed, combustion method with exhaust gas recirculation is employed For coal combustion a Wormser Grate two-stage atmospheric fluidized bed combustion system with a high pressure gas circulation loop system is recommended. The predicted overall fuel to electrical energy conversion efficiency varied between 25 and 34 percent, depending on the system configuration (Author)

A82-11808 # **Development free-piston Stirling test-bed engine.** G R Dochat, N G Vitale, and T M Moynihan (Mechanical Technology Inc , Latham, NY) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 2 New York, American Society of Mechanical Engineers, 1981, p 1866-1874.

The free-piston Stirling Technology Demonstrator Engine (TDE) designed and instrumented to provide data to aid in understanding free-piston Stirling engine operation and performance, is described It is noted that the system includes instrumentation to measure the internal thermodynamic operation and to permit calculation of system power flows. Near-term testing of the engine will assess three mechanisms for engine loss It is pointed out that recent testing has demonstrated that the power and efficiency are strong functions of heater head temperature. A maximum power output of 1,800 watts

and a thermodynamic efficiency of 30% have been demonstrated at 450 C and 40 bar C.R.

A82-11812 # **Modelling of the jet-stream Fluidyne.** G. T. Reader, G. Ivett, P. Gill (Royal Naval Engineering College, Plymouth, England), and P. D. Lewis (Delorean Motor Co., Northern Ireland). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2. New York, American Society of Mechanical Engineers, 1981, p. 1909-1915. 27 refs.

A summary of findings of a research program dealing with the Fluidyne, a liquid piston Stirling engine, is presented. The Fluidyne can operate in two modes: (1) 'wet', with a contiguous interface between the liquid piston and the working fluid, and (2) 'dry', in which the interface is sealed by a third fluid layer or mechanical float. Successful operation at temperatures below 550 K can only be achieved with a wet Fluidyne. Operation at only 80 deg C allows construction with unconventional heat engine materials such as plastics, glass and wood. The operational cycle of the Fluidyne is briefly described, and it is noted that the total system volume and relative volumes of the expansion, compression, and dead volumes do not remain constant, as they do in mechanical engines. A thermo-hydraulic model was therefore developed and results are listed, with further investigations still indicated for modelling the flows in the feedback zone, the relative contributions of the two superimposed thermodynamic cycles, and a modelling of the friction forces. M.S.K.

A82-11817 # **High temperature cogeneration with thermionic burners.** G O Fitzpatrick, E J Britt, and R S. Dick (Rasor Associates, Inc , Sunnyvale, CA) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 2 New York, American Society of Mechanical Engineers, 1981, p. 1951-1955. 7 refs. Contract No. DE-AC02-76ET-11293

The thermionic cogeneration combustor was conceived to meet industrial requirements for high-temperature direct heat, typically in the form of gas at temperatures from 800 to 1900 K, while at the same time supplying electricity. The thermionic combustor is entirely self-contained, with heat from the combustion region absorbed by the emitters of thermionic converters to be converted to electric power and the high-temperature reject heat from the converters used to preheat the air used for combustion. Depending on the temperature of the process gas produced, energy savings of around 10% with respect to that used to produce the same amount of electricity and heat without cogeneration are possible with present technology, and savings of up to 20% may be possible with advanced converters. Possible thermionic combustor designs currently under investigation include a configuration in which heat is collected by heat pipes lining the periphery of the combustion region, and a fire-tube converter in which combustion occurs within the cylindrical emitter of each converter Preliminary component tests of these designs have been encouraging A.L W

A82-11818 # **Thermionic combustor application to combined gas and steam turbine power plants.** G. Miskolczy, C. C. Wang, D P. Lieb (Thermo Electron Corp., Waltham, MA), A. E Margulies, L. J Fusegni (Stone and Webster Engineering Corp., Boston, MA), and B. J. Lovell (Brown Boveri Turbomachinery, St. Cloud, MN). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2.

New York, American Society of Mechanical Engineers, 1981, p. 1956-1961. 7 refs Contract No. DE-AC02-76ET-11292.

A design for the insertion of thermionic converters into the wall of a conventional combustor to produce electricity in a topping cycle is described, and a study for applications in gas and steam generators of 70 and 30 MW is evaluated for engineering and economic feasibility. Waste heat from the thermionic elements is used to preheat the combustor air, the heat absorbed by the elements plus further quenching of the exhaust gases with ammonia is projected to reduce NO(x) emissions to acceptable levels. Schematics, flow diagrams, and components of a computer model for cost projections are provided. It was found that temperatures around the emitters must be maintained above 1,600 K, with maximum efficiency and allowable temperature at 1,800 K, while collectors generate maximally at 950 K, with a corresponding work function of 1.5 eV. Cost sensitive studies indicate an installed price of $475/kW for the topping cycle, with improvements in thermionic converter characteristics bringing the cost to $375/kW at a busbar figure of 500 mills/kWh. M.S.K

A82-11820 # **The design of series-parallel connected thermionic converter arrays.** J B McVey, E. J. Britt, G O. Fitzpatrick, and R. S. Dick (Rasor Associates, Inc , Sunnyvale, CA) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2

New York, American Society of Mechanical Engineers, 1981, p. 1968-1973 9 refs Contract No. DE-AC02-76ET-11293

Thermionic converters are connected together in a series-parallel array in order to provide a useful output voltage A model is presented to predict the effects of a nonuniform distribution of input power on the performance of such an array Three cases are considered where (1) the heat flux is uniform, (2) the heat flux nonuniformity is in the direction of series connections in the array, (3) the heat flux nonuniformity is in the direction of parallel connections The effect of optimizing cesium pressure for the individual converters is also studied. Results show that the heat flux variation in the series direction can cause a 20-40% drop in array output power as compared to a uniform heat input, as well as an unacceptable variation in emitter temperatures Heat flux variation along the parallel connections without optimizing cesium pressure causes a 38% loss of array output power and very high emitter temperatures in some converters. Optimization of the cesium pressure in this case, however, reduces the output power loss to 12% and gives emitter temperatures which are all within an acceptable range. Thus, given a proper design, series-parallel arrays can be used to accommodate wide ranges of heat input while still delivering good performance J F.

A82-11821 # **Characteristics of CVD silicon carbide thermionic converters.** D. B Goodale, P Reagan, G Miskolczy, D Lieb, and F N Huffman (Thermo Electron Corp , Waltham, MA). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2

New York, American Society of Mechanical Engineers, 1981, p 1974-1978 5 refs Contract No. DE-AC02-76ET-11292

Development work has recently been undertaken on a thermionic converter for terrestrial applications which employs chemically vapor deposited (CVD) silicon carbide as a protective coating over the CVD tungsten emitter. A 1-in -diam hemispherical converter with an active emitting area of 6 sq cm has been constructed and has undergone over 7200 hours of life testing at an emitter temperature of 1730 K, collector temperature between 800 and 900 K and power output of 2 W/sq cm at 0.25 V A module using four 1-in. hemispherical converters was built to investigate the problems of operating converter arrays, revealing the importance of minimizing interconnecting lead loss. A 2-in.-diam prototype converter was constructed which has so far accumulated over 1700 hours of life tests at emitter temperatures of 1600 to 1700 K in a natural gas fired furnace. As a result of problems with emitter-collector spacing and temperature nonuniformities discovered during testing, a new converter is being designed with a torispherical hot shell-emitter configuration. Composite hot shell-emitter structures have successfully undergone a series of severe thermal and mechanical tests under conditions exceeding any the shell would experience in application. Results indicate that combustion-heated thermionic converters can operate stably at high temperatures for long periods at interesting efficiencies and power densities. S.C S.

A82-11822 # **Thermionic application for future air force space power systems.** T Mahefkey (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2 New York, American Society of Mechanical Engineers, 1981, p. 1979-1981. 5 refs.

This paper reviews some of the potential requirements for future military space power systems and summarizes some of the potential advantages of nuclear power for these missions. A brief comparison of solar and nuclear power system performance is presented, and results of recent NASA/DOE/Air Force programmatic planning efforts are described. It is concluded that a high performance (50W/lb), high power (10-100 kW) technology program should be included as an integral part of current DOE and/or future joint agency sponsored space nuclear reactor program. (Author)

A82-11823 * # **Advanced high temperature thermoelectrics for space power.** A. Lockwood, R. Ewell (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA), and C. Wood (Northern Illinois University, Dekalb, IL). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 2. New York, American Society of Mechanical Engineers, 1981, p. 1985-1990 7 refs

Preliminary results from a spacecraft system study show that an optimum hot junction temperature is in the range of 1500 K for advanced nuclear reactor technology combined with thermoelectric conversion. Advanced silicon germanium thermoelectric conversion is feasible if hot junction temperatures can be raised roughly 100 C or if gallium phosphide can be used to improve the figure of merit, but the performance is marginal. Two new classes of refractory materials, rare earth sulfides and boron-carbon alloys, are being investigated to improve the specific weight of the generator system Preliminary data on the sulfides have shown very high figures of merit over short temperature ranges. Both n- and p-type doping have been obtained. Pure boron-carbide may extrapolate to high figure of merit at temperatures well above 1500 K but not lower temperature, n-type conduction has been reported by others, but not yet observed in the JPL program. Inadvertant impurity doping may explain the divergence of results reported. (Author)

A82-11824 # **Applications of thermoelectrics to geothermal energy conversion.** T. S. Jayadev and D. J. Chou (Energy Conversion Devices, Inc., Troy, MI). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2. New York, American Society of Mechanical Engineers, 1981, p. 2004-2007.

The results of analytic studies of a geothermal power plant using thermoelectrics is presented, based on earlier studies of a thermoelectric OTEC system. The thermoelectric modules are sandwiched between the flow channels of a crossflow heat exchanger. All units were optimized for efficiency and net power was calculated considering all losses. A sensitivity analysis was performed to consider (1) the rate of geothermal to cooling water flow rates; (2) enhancement factor of the heat transfer surface, (3) the figure of merit of the thermoelectric material, and (4) the multiplier factor of the total cost including fabrication. Enhanced surfaces were found to decrease the specific material cost due to increased heat transfer area. Installation costs were calculated to be $500/kW, compared to $2,000 to $3,000/kW for Organic Rankine Cycle Engines. Charts are presented of various cost factors, efficiency ratios, and power extraction ratios for a 24 C cooling water, 62 C geothermal fluid power plant. M.S.K.

A82-11825 * # **Establishment of noise acceptance criteria for wind turbines.** D G. Stephens (NASA, Langley Research Center, Hampton, VA), K. P. Shepherd, and F. Grosveld (Bionetics Corp., Hampton, VA). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2 New York, American Society of Mechanical Engineers, 1981, p 2033-2036. 7 refs.

A program is being conducted to develop noise criteria for wind turbines which minimize annoyance and which can be used in design specifications for future machines. The approach consists of presenting wind turbine noise stimuli to test subjects in a laboratory listening chamber. The responses of the subjects are recorded for a range of stimuli which encompass the designs, operating conditions, and ambient noise levels of current and future installations. Results to date have established the threshold of detectability for a range of impulsive stimuli of the type associated with blade/tower-wake interactions The status of the ongoing psychoacoustic tests, the subjective data, and the approach to the development of noise acceptance criteria are described. (Author)

A82-11826 # **The effect of shielding on the aerodynamic performance of Savonius wind turbines.** S M. Morcos, M. G. Khalafallah (Cairo, University, Cairo, Egypt), and H. A. Heikel (Helwan University, Cairo, Egypt). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2. New York, American Society of Mechanical Engineers, 1981, p. 2037-2040. 7 refs.

The effect of the flat plate shield on the performance of two-bladed Savonius rotor has been experimentally determined. Tests were carried out in a low speed wind tunnel with a working section of 1 0 sq m. Flat plate shields with various values of plate width and inclination angle were tested in order to determine the optimum configuration. The maximum power coefficient of the Savonius rotor was increased from 0 22 for the case without shielding to 0.34 for the case with an optimum shielding configuration. The addition of a flat plate shield to the Savonius rotor can, therefore, enhance the power coefficient to values approaching the more elaborate wind turbines without affecting the simplicity of the Savonius rotor (Author)

A82-11827 # **Performance testing of a Savonius windmill rotor in shear flows.** O O Mojola and O E Onasanya (Ife, University, Ile-Ife, Nigeria). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2. New York, American Society of Mechanical Engineers, 1981, p. 2041-2046. 8 refs.

The effects of flow shear and/or unsteadiness on the power producing performance of a Savonius windmill rotor are studied. Measurements are made in two laboratory statistically-steady shear flows, and in the natural wind, which is both viscous and unsteady. The measurements were made of the speed, torque, and power of the rotor at a number of streamwise stations for each of four values of the bucket overlap ratio. Flow velocity profiles and graphs of wind shear variation are given. It is concluded that even in the presence of shear, the power coefficient of a Savonius windmill rotor is most strongly dependent on the tip speed ratio. As in inviscid flow, the power coefficient peaked at a tip speed ratio = 0.8. The major effect of shear was to reduce the power coefficient below the inviscid flow level, the magnitude of reduction depending on the magnitude of shear present. In field testing of the Savonius rotor, the unsteadiness of the wind proved to be a greater source of power loss than the wind shear J.F.

A82-11828 # **An overview of fatigue failures at the Rocky Flats Wind System Test Center.** C. A. Waldon (Rockwell International Corp., Golden, CO) In. Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2 New York, American Society of Mechanical Engineers, 1981, p 2047-2052.

Common mode structural failures discovered at the Rocky Flats Small Wind Energy Conversion System (WECS) Test Center are discussed. Each field tested system underwent at least one 80-125 mph wind storm, and a 40% failure rate is reported. Causes of fatigue failure were determined to be higher than expected loadings, vibrational loading excited within operational range (fundamental frequencies are equaled by operational frequencies), unsupported thin materials, stress risers caused by sharp edges and threads, poor quality assurance on fabrication, welding, and handling, and voids or cracks in cast parts (lack of X-rays). Numerous examples are listed for various wind systems. It is noted that although standard procedures are used for verifying individual components of a WECS, problems often occur when the individual parts are interfaced on a high speed machine in what is often a turbulent environment. Computer programs have been developed to aid in quality assurance testing, and can be used by manufacturers who cannot afford extensive testing procedures and apparatus. M.S.K.

A82-11829 # **A vertical axis cyclogiro type wind-turbine with freely-hinged blades.** D A. Bayly and J. A C. Kentfield (Calgary, University, Calgary, Alberta, Canada). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2. New York, American Society of Mechanical Engineers, 1981, p. 2053-2059. 13 refs. Research supported by the Algas Resources, Ltd.

A description is given of the design, construction and testing of a prototype vertical axis cycloturbine. The machine has straight vertical blades of symmetrical cross-section. Each blade is hinged, on a vertical axis, near its upper and lower extremities to the ends of radial arms projecting from a central, rotating, tower structure. What is believed to be a unique method is used for the control of blade articulation. The cyclic motion of each blade is derived solely from a combination of the centrifuging action of a mass attached to the blade and the aerodynamic load acting on the blade. Results of open-air tests of the small two-bladed prototype unit resulted in the achievement of a maximum power coefficient of 0.37 at a velocity

ratio of 3.6 with a runaway velocity ratio of 5.2. The machine was found to self-start easily. (Author)

A82-11831 # **Design considerations for small wind energy conversion and storage systems.** G. C. Chang (Cleveland State University, Cleveland, OH). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2. New York, American Society of Mechanical Engineers, 1981, p. 2070-2074. 6 refs.

A small wind turbine generator system capable of providing electricity to an all electric residence is considered. A host of major design considerations are examined. These include the characteristics of a wind turbine generator, the nature of the electric load demand, the available wind resources, siting considerations, and other related socioeconomic factors. The energy storage subsystem is singled out for detailed treatment because of its high cost and relative importance. Preliminary systems design for a 10-kilowatt wind turbine generator system with energy storage has been effected Performance analysis of such a system has been done using actual hour-by-hour wind data for three specific sites. Results from these analyses are presented to illustrate the importance associated with major design considerations. (Author)

A82-11832 # **Review of electrochemical energy conversion and storage for ocean thermal and wind energy systems.** A. R. Landgrebe (U.S Department of Energy, Washington, DC) and S. W. Donley (Aerospace Corp., Germantown, MD) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 2. New York, American Society of Mechanical Engineers, 1981, p. 2075-2080. 11 refs.

A literature review on electrochemical storage techniques related to ocean thermal (OTEC) and wind energy conversion systems (WECS) is presented. Battery use for WECS is foreseen because of siting size, variable capacity, quiet operation, and high efficiency, high cost and the necessity for further input voltage regulation is noted, as are prospects for technology transfer from existing programs for photovoltaic panel battery development. Fuel cells, which can run on hydrogen, ammonia, methanol, naphtha, etc., are encouraging because capacity increases are possible by simple addition of more fuel, and high thermal efficiency. Electrolytic use is seen as a cheap replacement source of electricity for metals refining and brine electrolysis Systems of energy 'bridges' for OTEC plants, to transmit power to users, are reviewed as redox-flow, lithium-water-air, and aluminum batteries, fuel cells, electrolytic hydrogen, methane, and ammonia production, and the use of OTECs as power sources for floating factories. Directions of future research are indicated, noting that WECS will be in commercial production by 1985, while OTEC is far term, around 2025 M S.K.

A82-11833 # **Regenerative pyroelectric heat engine.** R. B. Olsen and J. M. Briscoe (Power Conversion Technology, Inc., San Diego, CA). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 3. New York, American Society of Mechanical Engineers, 1981, p. 2081-2085. 12 refs. Research supported by the U.S. Department of Energy.

A single-stage regenerative pyroelectric heat engine has been built and tested. The pyroelectric engine converts heat directly into electrical energy. The efficiency of the conversion process was directly measured (the first such measurement for any pyroelectric conversion process). The measured 0.4% efficiency is 20 times larger than the so-called van der Ziel limit. Further improvements of efficiency are discussed. The engine's power density (at 0.13 Hz) was 17 Watt per liter of ferroelectric material. This early progress indicates that multi-staged pyroelectric engines operating at higher frequencies may achieve 2 kWe per liter with efficiencies of 10% to 20%. (Author)

A82-11840 # **Nuclear reactor closed Brayton cycle space power conversion systems.** J. P Layton In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 3. New York, American Society of Mechanical Engineers, 1981, p 2119-2121.

The history, status, and future prospects for use of nuclear reactor closed Brayton cycle (cBc) spacecraft power conversion systems is presented It is noted that the only working nuclear space power system presently in existence is used for thermoelectric power conversion in the 10-100 kWe output. Many missions have been identified that would require high power reactors, including civilian and military communications platforms, operational space and lunar stations, power and microwave relay stations, and eventual solar system and interstellar exploration. Nuclear cBc reactors are considered well suited to requirements over 100 kW to a few MW Noble gases (He and Ar) are circulated through heat exchangers to power electrical turbines, with all components in hermetically sealed casings and shafts rotating on hydrodynamic foil bearings Development of new, long-life high temperature materials is considered necessary for cBc employment in space applications An extensive design and software development program is recommended, to be compared on-line with progress of other systems being considered for the same missions M.S K

A82-11852 # **Brayton cycle using dissociating nitrosyl chloride.** K. Kesavan (Westinghouse Electric Corp., Advanced Reactors Div., Madison, PA) and J. F. Osterle (Carnegie-Mellon University, Pittsburgh, PA). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 3. New York, American Society of Mechanical Engineers, 1981, p. 2204-2209. 13 refs.

A study of the Brayton cycle with dissociating nitrosyl chloride (NOCl) as the working medium is reported. With the turbine inlet conditions of the gas in a highly dissociated state (a mixture of NOCl, NO, and Cl2) and the compressor inlet at the combined state (NOCl), the dissociating NOCl cycle shows superior overall performance when compared with the Brayton cycle based on inert gases such as helium. The results of the analysis show considerable potential for reduction in power generation costs through higher cycle efficiencies and smaller component sizes. (Author)

A82-11853 # **Advances in coal fired MHD generator research.** J. K. Koester (Stanford University, Stanford, CA). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 3. New York, American Society of Mechanical Engineers, 1981, p. 2210-2213. 13 refs. Research supported by the Electric Power Research Institute.

The results of a decade of research on direct coal-fired magnetohydrodynamic generator systems is summarized. Channel operation with thin molten slag deposits benefited from the resulting thermal barrier at the expense of electrical problems due to the ionic conduction behavior of molten slag. Slag induced anode corrosion problems have been reduced by both cold arc-mode electrodes and by high temperature diffuse mode electrodes. Axial shorting induced by cathodic slag polarization has been suppressed by careful insulator/electrode design. The successful operation time of MHD generators under coal-fired conditions has increased from 1/2 hour to over 500 hours. (Author)

A82-11854 # **Status report on MHD generator materials.** B. R. Rossing and L. H. Cadoff (Westinghouse Electric Corp., Pittsburgh, PA). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 3. New York, American Society of Mechanical Engineers, 1981, p. 2214-2216. 12 refs.

The development of materials for the MHD generator has historically been cited as a major technical obstacle in the development of commercial coal-fired MHD electrical power generation. Serious effort has been in progress over the last five years to develop and test coal fired MHD electrodes and materials. Two main approaches have been taken; first, the operation of 'cold' electrode walls that are coated with a thin coal slag layer and, secondly, the operation of 'super-hot' electrode walls that operate above the dew point of the slag. Progress using both of these approaches to MHD generator design and operation will be reviewed. (Author)

A82-11857 # **Semiconductor converters/inverters for photovoltaic power supply.** P. Longrigg (Solar Energy Research Institute, Golden, CO). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 3. New York, American Society of Mechanical Engineers, 1981, p. 2233-2238.

The two generic types of DC to AC inverters are discussed, considering inherent problems and prospects for solution. A current source converter uses reference current from the AC utility line to chop the DC into AC using four thyristors as switches. Difficulties exist in that DC current contains lagging quadrature currents and are harmonics rich Solutions are indicated in the form of tuned filters for controlling harmonics and a static VAR generator for the quadrature demand, except that solving the quadrature problem reintroduces further harmonics In the voltage-sourced converter, which performs much like a synchronous generator, harmonics are also present and can be eliminated with pulse-width modulation. However, at lower powers, switching accelerates beyond attainable switching speed levels. Finally, a current-fed, force commutated converter is described which commutates ahead of the AC voltage, it may need special filters or buffers in addition to harmonics filters Further studies are recommended in areas of cost reductions, interface overvoltage protection, harmonics, source stability, safety and code requirements, and utility system protection, all pertinent to photovoltaic power conditioning Circuitry diagrams and AC V-I graphs are provided M.S.K.

A82-11859 # **Variable speed wind turbine control system.** E. Conley (Michigan State University, East Lansing, MI). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, *Proceedings. Volume 3.*
New York, American Society of Mechanical Engineers, 1981, p. 2243-2247.

Variable speed wind turbine operation offers potential increased energy production if the turbine rotor is controlled to operate at constant blade tip speed to wind speed ratio Two variable speed control systems are compared to a constant speed control system during field tests of a 5m Darrieus type wind turbine generator. Data indicates that a simple variable speed control scheme using wind rotor RPM as the single input signal can control the Darrieus test machine to operate at roughly constant blade tip to wind speed ratio *and thus maximize energy production* (Author)

A82-12113 * # **Flow aerodynamics modeling of an MHD swirl combustor - Calculations and experimental verification.** A. K. Gupta, J. M. Beer, J. F. Louis (MIT, Cambridge, MA), A. A. Busnaina, and D. G. Lilley (Oklahoma State University, Stillwater, OK). In Fluid mechanics of combustion systems, Proceedings of the Fluids Engineering Conference, Boulder, CO, June 22, 23, 1981.
New York, American Society of Mechanical Engineers, 1981, p. 179-189. 19 refs. Contract No. DE-AC01-79ET-15518; Grant No. NA63-74.

The paper describes a computer code for calculating the flow dynamics of a constant-density flow in the second-stage trumpet shaped nozzle section of a two-stage MHD swirl combustor for application to a disk generator. The primitive pressure-velocity variable, finite-difference computer code has been developed for the computation of inert nonreacting turbulent swirling flows in an axisymmetric MHD model swirl combustor. The method and program involve a staggered grid system for axial and radial velocities, and a line relaxation technique for the efficient solution of the equations. The code produces as output the flow field map of the nondimensional stream function, axial and swirl velocity. It was found that the best location for seed injection to obtain a uniform distribution at the combustor exit is in the central location for seed injected at the entrance to the second stage combustor. P.T.H.

A82-12666 **Ionization waves in an argon discharge in a longitudinal gas flow.** Iu I Grigorian, A. E. Martirosian, M. Novak, V. O. Papanian (Akademiia Nauk Armianskoi SSR, Institut Fizicheskikh Issledovanii, Yerevan, Armenian SSR), and M Chvoika (Ceskoslovenska Akademie Ved, Fyzikalni Ustav, Prague, Czechoslovakia, Akademiia Nauk Armianskoi SSR, Institut Fizicheskikh Issledovanii, Yerevan, Armenian SSR). *(Fizika Plazmy,* vol. 6, Nov.-Dec. 1980, p 1357-1360.) *Soviet Journal of Plasma Physics,* vol 6, Nov.-Dec 1980, p. 744-746 18 refs. Translation.

An experimental study of the generation of ionization waves in a longitudinal gas flow with velocities of 0-30 m/s and pressures of 1-30 torr is reported, the study has reference to certain processes in gas lasers and MHD generators. It is shown that in a longitudinal stream of argon the phase velocity of ionization waves is not the simple sum of gas velocity and wave velocity in the gas at rest, but depends nonlinearly on the stream velocity. Standing ionization waves were found to appear when a zero phase velocity was obtained. Attention is given to the existence of a homogeneous positive column and regular and irregular self-excited ionization waves in relation to discharge current, pressure, and gas flow velocity. B.J.

A82-12897 **Increasing power and efficiency by dynamic suppression of ionization instability in a plasma.** A P Vinogradov and V. S. Filinov (Akademiia Nauk SSSR, Institut Vysokikh Temperatur, Moscow, USSR). *(Teplofizika Vysokikh Temperatur,* vol. 19, Mar.-Apr. 1981, p. 399-406.) *High Temperature,* vol 19, no. 2, Sept. 1981, p. 295-301. 10 refs. Translation.

The dynamic method for suppressing ionization instability is studied. The efficiency of MHD devices operating in the Faraday switching mode with developed ionization instability is compared with the efficiency of an MHD device operating under conditions of dynamic suppression of ionization instability. It is shown that when the external circuit parameters are suitably chosen, there is a gain in the electric and polytropic efficiency as well as in the power of an MHD device operating under conditions of dynamic suppression of ionization instability. The possible practical implementation of the dynamic method of ionization instability suppression with the aid of power semiconductor instruments is assessed C.R.

A82-12938 **Evaluation of organic acids as fuel cell electrolytes.** J Ahmad, T. H. Nguyen, and R. T. Foley (American University, Washington, DC) *Electrochemical Society, Journal,* vol. 128, Nov. 1981, p. 2257-2261. 9 refs. Grant No. DAAK70-77-C-0080.

The electrochemical behavior of methanesulfonic acid, ethanesulfonic acid, and sulfoacetic acid as fuel cell electrolytes was studied in a half-cell at various temperatures. The rate of the electro-oxidation of hydrogen at 115 C was very high in methanesulfonic acid. The rate of the electro-oxidation of propane in all three acids *was low even at 135 C. Further, there is evidence for adsorption of* these acids on the platinum electrode. It was concluded that anhydrous sulfonic acids are not good electrolytes, water solutions are required. Sulfonic acids containing unprotected carbon-hydrogen bonds are adsorbed on platinum and probably decompose during electrolysis. A completely substituted (fluorinated) sulfonic acid would be the preferred electrolyte. (Author)

A82-13847 † **Unconventional techniques of energy conversion (Netraditsionnye sposoby preobrazovaniia vidov energii).** Iu. S Bortnikov, N. S. Lidorenko, G F. Muchnik, S V Riabikov, and D. S. Strebkov. *Akademiia Nauk SSSR, Izvestiia, Energetika i Transport,* Sept.-Oct. 1981, p 3-12. In Russian.

The current status and future prospects of various unconventional energy technologies are examined. Consideration is given to geothermal, wind, ocean, thermoelectric, and hydrogen-based systems. Optimal design strategies and production plans for such systems are briefly discussed. B J.

A82-14007 # **Utility operating strategy and requirements for the wind power forecast.** W. Dub and H. Pape (Regensburg, Universitat, Regensburg, West Germany). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2539.* 10 p. 10 refs.

The commitment of a generation system including wind energy conversion systems will be based on wind speed and wind power forecasts. Forecasts for time spans of equal length with the startup/shutdown times of conventional units will be of great importance. The paper discusses forecast horizons up to 3 hours and 6 hours respectively In addition, the problem of getting good wind speed forecasts is investigated by fitting time series models to wind speed data. Finally, the impact of hypothetical perfect forecasts on the commitment of intermediate load units is demonstrated by means of the wind power variations within spans up to 3 hours. (Author)

A82-14011 # **Proposed 12.5 MWe shelf-mounted OTEC pilot plant for power, water and mariculture at St. Croix.** M S Jones, Jr. (Ebasco Services, Inc , Newport Beach, CA), P. E. Slattery (Ebasco Services, Inc., New York, NY), W. L. Green (J. Ray

McDermott and Co., Inc., New Orleans, LA), P. J. Bakstad (TRW, Inc., Redondo Beach, CA), and T. R. Blake (Virgin Islands Water and Power Authority, St. Thomas, VI). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec 1-3, 1981, Paper 81-2546* 11 p. 14 refs.

The U.S. Virgin Islands has developed a plan to use OTEC to generate electricity and fresh water, and to supply nutrient rich deep seawater for land based mariculture and aquaculture facilities Projects of this nature have the potential to ameliorate shortages of food, fresh water, and energy which limit the possibilities of improving life for inhabitants in many of the world's tropical islands. The project has been sized to produce 12.5 MW of electricity, up to 5 million gallons per day (MGD) of fresh water and 50 MGD of deep seawater. Its output would offset between 400,000 and 475,000 Bbl/yr of petroleum products derived from imported oil currently used to generate electricity and desalination. (Author)

A82-14012 # **Alternative ocean energy products and hybrid geothermal-OTEC /GEOTEC/ plants.** G. L Dugger, D. Richards, F. C. Paddison, L. L. Perini, W. H. Avery (Johns Hopkins University, Laurel, MD), and P. J. Ritzcovan (U.S Department of Energy, Div. of Ocean Energy Technology, Washington, DC). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2547.* 11 p 20 refs. Research supported by the U.S. Department of Energy

Products other than electricity from OTEC power plants are explored. Noting that the highest temperature gradients with the least seasonal variability are situated in tropical waters, it is suggested that portable products, such as NH3, liquid H2, methanol, and liquid hydrocarbon fuels, in addition to metals refining, are the most attractive applications of OTEC power Cost estimates are provided for each product based on an average annual temperature change of 23.9 C and a 325 MWe OTEC, the eighth plant costs are projected at $1,280/kW. Slowly cruising platforms for OTEC systems will have higher annual average temperature gradients than moored plants, and seasonal variations will relegate the monetary value of some OTEC electricity to fuel avoidance costs, due to lower winter gradient differences Geothermal OTEC plants' performance is examined and found to exceed the normal OTEC efficiency by 12%. D.H.K

A82-14016 # **Cost estimates for advanced/innovative wind energy conversion systems /AWECS/.** E W. Jacobs (Solar Energy Research Institute, Golden, CO). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2557* 5 p 7 refs

Three computer models for determining the economics of advanced wind energy conversion systems (AWECS) in production status are discussed The SAMICS program, designed for estimating costs of production-line operations, includes details of expenses for a plant in steady-state operation, and yields results in terms of prices, quantities, and a breakdown of cost components. The PRICE model gives cost estimates for electromechanical hardware systems, and comprises design, manufacturing, and subassembly costs. The FAST program derives costs of energy systems in terms of construction and installation All three models provide production costing, and it is noted that the FAST model can be used as an adjunct to the other two. Small WECS are viewed to become commercially viable at the 10,000 units/yr production level, using a one product job shop mode Examples for existing 40 kW and 10 kW preproduction model SWECS are provided and a price lowering curve is generated which is similar to a learning curve M.S.K.

A82-14017 # **A modular simulation model for a wind turbine system.** S. Bergman (Sydkraft AB, Malmo, Sweden), S. E. Mattsson, and A B. Ostberg (Lund Institute of Technology, Lund, Sweden) *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2558.* 9 p. 9 refs.

A mathematical simulation model for a large horizontal axis wind turbine system is presented. The model is intended for simulation of the synchronization of the wind turbine generator against the utility grid and the operation of the wind turbine system under different wind conditions and with different control algorithms. Particular attention has been given to the modularization. The model is divided into subsystems to make it easy to modify the model and adapt it to systems of similar type. The interactive simulation package SIMNON which allows good structuring and programming in a high level language has been used (Author)

A82-14018 # **Wind turbine assisted diesel generator systems.** L. A. Schienbein (DAF Indal, Ltd., Mississauga, Ontario, Canada). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2559.* 8 p

The need to reduce the cost of energy in remote communities served by diesel generators has led to the investigation of the use of wind energy to replace some or all of the fuel consumed. The development of wind-turbine-assisted diesel generators in Canada has progressed from the design and testing of a 12-kW unit to the design of a prototype 100-kW wind turbine diesel hybrid. This paper presents the results of the 12-kW tests and the implementation of the test results, and the results of further engineering and cost analyses in the design of a prototype 100-kW wind turbine diesel hybrid system. The value of wind energy in a wind turbine diesel hybrid is greatly improved if the diesel generator system itself is designed to operate more efficiently at part load, with or without wind power assistance. Excess wind energy and wind turbine power fluctuations (which result in voltage and frequency fluctuations) can be minimized by selecting the best rotor operating speed. (Author)

A82-14019 # **Methodology for the evaluation of aerodynamic performance and rotor optimization under constant RPM-operation.** F. Luft and D. Cromack (Massachusetts, University, Amherst, MA) *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2560* 6 p

Presented are a method for evaluating the aerodynamic performance of wind turbine rotors during constant RPM (varying tip-speed-ratio) operation and a summary of the results of a parametric study for optimization of the rotor using this method The proper choice of rotor RPM is discussed as well as the comprehensive method for evaluating the power coefficient versus tip-speed-ratio curves for various rotors. The power coefficient vs tip-speed-ratio curve for any rotor is combined with wind velocity probability data in a manner which yields a monthly productivity value. A summary of the results of the parametric performance study of linear-taper linear-twist blades is presented, including the shape of the blade yielding the maximum productivity along with a sensitivity analysis. (Author)

A82-14020 # **Proposed 10 MWe OTEC pilot plant for the Commonwealth of the Northern Mariana Islands.** L E Dunbar (ADVANTECH Corp., La Jolla, CA) and G. L. Chan. *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2561.* 9 p. 8 refs.

A preliminary conceptual design of a 10 MWe OTEC pilot plant has been proposed for the island of Saipan in the Commonwealth of the Northern Mariana Islands. This unique small OTEC plant is intended as a prototype for commercial plants in the small Pacific Island territories and nations. The system concept minimizes local construction to accommodate a lack of local skilled labor and facilities. The baseline design is a concrete barge-mounted plant built in Portland, Oregon, towed to Saipan, and permanently anchored in near-shore shallow water. Details of key subsystem design features are provided including a bottom-mounted cold water pipe, modular power subsystem, and wave shield for storm protection. The results of economic analyses are presented to illustrate the cost competitiveness of electricity from the OTEC plant compared to the current oil-fired diesel units in Saipan. (Author)

A82-14025 # **The transformation of wind energy by a high altitude power plant /HAPP/.** G. Riegler, W. Riedler, and E. Horvath (Graz, Technische Universitat, Graz, Austria). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2568.* 8 p. 9 refs.

Design considerations for a high altitude power plant (HAPP) are discussed. A HAPP has a generator platform supported by a balloon, a tethering and conduction cable, and a ground station for control and energy distribution. Each streamlined balloon would

carry six symmetrically arranged wind turbines and could be raised or lowered by a ground winch in response to 4 hr meteorological forecasts. A double bladed, variable pitch, horizontal axis rotor was chosen for HAPP application in the jet stream at 8,000-10,000 m height. Humidity and icing are calculated to be within tolerable limits, higher winter and lower summer heights are indicated. Optimization studies for 2, 5, and 7 MW turbines are presented, and rotor diameters are found to be limited to 40 m for weight considerations. Pilot plant, production, and operating costs are estimated to result in a cost of energy of $0.093/kWh, with the He leakage being the biggest expense. M.S.K.

A82-14026 # **The stability of a tethered gyromill.** D C. Rye, B. W. Roberts (Sydney, University, Sydney, Australia), and J. Blackler. *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2569* 10 p. 6 refs.

It has been proposed that electricity could be generated from upper atmospheric winds using a tethered rotary winged craft known as a gyromill. The paper investigates the static and dynamic stability of such a craft when hovering at limited altitudes. Two static stability criteria are presented, one pertaining to short cables, and another to longer cables. A mathematical model is developed to examine the dynamic behavior and several numerical solutions presented. Two modes are identified, a pitch mode and a pendular mode. It is found that the pendular mode may be divergent or non-divergent, depending on the cable attachment point (Author)

A82-14027 # **Rotor speed control by automatic yawing of two-bladed wind turbines with passive cyclic pitch variation.** K. H Hohenemser and A H. P Swift (Washington University, St. Louis, MO). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2570.* 8 p. 9 refs. Research sponsored by the Solar Energy Research Institute.

A yaw dynamics analysis was developed for a two-bladed horizontal axis wind turbine with passive cyclic pitch variation achieved by letting the blade pair freely oscillate about a common axis with which the blades formed a small prelag angle. This type of rotor was found capable of high yaw rates without imposing vibratory hub moments and without producing noticeable flapping amplitudes. Experiments were conducted with a tail vane stabilized 7 6 m diameter wind rotor driving a three phase alternator tuned and loaded to produce a rotor torque proportional to the square of the rotor speed. Two yaw control systems which replaced the usual blade feathering controls were investigated an active yaw control system using a hydraulic rotor speed governor, and a passive system responding to a combination of rotor thrust and torque. Both systems limited during strong gusts rotor speed quite accurately The passive system appeared to be more promising because of its greater reliability and because of the greater ease of adapting it to larger size wind turbines. (Author)

A82-14028 # **Lightning protection for wind turbine electronics.** D. L Begley, C. W. Dodd, and T M. McCalla, Jr. (Southern Illinois University, Carbondale, IL). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2571.* 6 p 5 refs.

Preventive measures for the protection of wind turbines from lightning strike damage are outlined. Lightning can dissipate up to a billion joules in less than a second while electronic components have tolerances in the microjoule range. Structural members may also suffer damage by mechanical stresses due to parallel conductance of lightning amperage, millions of volts are capable of causing flashovers or ionized arcing through air or poor insulation. Studies are cited to indicate that semiconductor device failures are dependent on pulse duration and amplitude. A solution is offered in the form of lightning ground rods, counterpoises, and interconnections which route lightning strike currents away from all electronics, additional shielding of the central electronics is also suggested. Various layers of protective measures are diagrammed, and the use of a transient suppressor to short excess current to ground is recommended. D.H.K.

A82-14029 # **An aeroelastic analysis of the Darrieus wind turbine.** E. E. Meyer (Boeing Commercial Airplane Co., Seattle, WA) and C. E. Smith (Oregon State University, Corvallis, OR). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec 1-3, 1981, Paper 81-2572.* 12 p. 18 refs.

The stability of a single Darrieus wind turbine blade spinning in still air is investigated using linearized equations of motion. The three most dangerous flutter modes are characterized for a one-parameter family of blades. In addition, the influence of blade density, mass and aerodynamic center offsets, and structural damping is presented. (Author)

A82-14030 # **Assessment of MHD power plants with coal gasification.** M R. DeLallo, Jr., R. E. Weinstein, J. C. Cutting, and W R. Owens (Gilbert/Commonwealth, Reading, PA). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2574.* 6 p. 5 refs Contract No. DE-AC01-77ET-11058.

An assessment of the operational characteristics and cost of magnetohydrodynamic (MHD) power plants integrated with coal gasification was performed. The coal gasifier produces a slag and sulfur free fuel for the MHD combustor. This clean fuel eliminates slag and sulfur interactions with the MHD topping cycle and simplifies the design of the combustor, the MHD channel, and the heat and seed recovery (HRSR) subsystem components. This may increase MHD and HRSR system reliability and provide the potential for earlier commercial demonstration of MHD. Integration techniques with three advanced medium BTU gasifiers were evaluated and an optimum system defined. A detailed comparison was then performed with a direct coal fired MHD power plant using oxygen enrichment. Results indicate that incorporating a coal gasification process with MHD simplifies system design at the expense of lower overall net plant efficiency and higher levelized cost of electricity (Author)

A82-14031 # **Up- and down-wind rotor half interference model for VAWT.** H McCoy and J. L Loth (West Virginia University, Morgantown, WV) *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2579* 9 p. 12 refs. Contract No. DE-FG02-80CS-89001.

This paper presents a theoretical aerodynamic performance optimization for two dimensional vertical axis wind turbines. A momentum type wake model is introduced with separate cosine type interference coefficients for the up and downwind half of the rotor. The cosine type loading permits the rotor blades to become unloaded near the junction of the upwind and downwind rotor halves. Both the optimum and the off design magnitude of the interference coefficients are obtained by equating the drag on each of the rotor halves to that on each of two cosine loaded actuator discs in series. The values for the optimum rotor efficiency, solidity and corresponding interference coefficients have been obtained in a closed form analytic solution by maximizing the power extracted from the downwind rotor half as well as from the entire rotor A numerical solution was required when viscous effects were incorporated in the rotor optimization (Author)

A82-14032 # **A design for an MHD power plant as a prime mover for a Naval Vessel.** M. A Paluszek (Charles Stark Draper Laboratory, Inc., Cambridge, MA). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2575* 11 p. 21 refs. NSF Grant No 22733

A Magnetohydrodynamic Power Plant, designed to be the prime mover for a Naval Vessel, is presented The system is an open cycle, fossil fueled, subsonic MHD Faraday generator with directly fired air preheaters. A superconducting electric transmission drives the propellers and a standard naval steam plant is used as a bottoming cycle. The increased overall efficiency achievable with this plant allows a lighter, smaller volume ship to accommodate the same payload and reduces the overall fuel cost of the vessel. (Author)

A82-14033 # **Wind ripple analysis.** R E. Akins (Sandia National Laboratory, Albuquerque, NM). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec 1-3, 1981, Paper 81-2580.* 8 p. 6 refs. Contract No. DE-AC04-76DP-00789.

Efficient and economical utilization of wind power will require

the ability to measure and ultimately predict the effects fluctuations in the incident wind will have on a wind turbine. In order to quantitatively assesss these effects, experimental techniques have been developed which allow analysis of full-scale performance of wind turbines with particular emphasis on the effects caused by turbulence in the incident wind. Examples of these techniques are presented using data from the DOE/Sandia Vertical Axis Wind Turbine (VAWT) program. (Author)

A82-14034 # **Aerodynamic loads and rotor performance for the Darrieus wind turbines.** I. Paraschivoiu (Hydro-Québec, Institut de Recherche, Varennes, Canada). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2582.* 10 p 13 refs

Aerodynamic blade loads and rotor performance are studied for the Darrieus windmill by using a double-multiple streamtube model. The Darrieus is represented as a pair of actuator disks in tandem at each level of the rotor, with upstream and downstream half-cycles. An equilibrium velocity exists in the center plane, and the upwind velocity is higher than the downwind velocity, lift and drag coefficients are calculated from the Reynolds number and the local angle of attack. Half-rotor torque and power are found by averaging the contributions from each streamtube at each position of the rotor in the upwind cycle An example is provided for a 17 m Darrieus employing NACA blades While the method is found to be suitable for predicting blade and rotor performance, the need to incorporate the effects of dynamic stall in the model is stressed as a means to improve accuracy D.H.K.

A82-14036 # **Problems and potential for MHD retrofit of existing coal-fired plants.** G Berry, C Dennis, T. Johnson, V. Minkov, V. Pearson, and M. Petrick (Argonne National Laboratory, Argonne, IL). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2586.* 10 p. 5 refs.

Retrofitting existing power plants with an open-cycle MHD system has been re-examined in light of recent developments in the heat and seed recovery technology area A new retrofit cycle configuration has been developed which provides for a direct gas-gas coupling, also, the MHD topping cycle can be decoupled from the existing plant for either separate or joint operation. The retrofit concept has been applied to Vermilion Station No. 1, a coal-fired power plant presently in operation. Substantial increases in efficiency have been demonstrated and the economic validity of the MHD retrofit approach has been established. (Author)

A82-14037 # **Industrial applications of MHD high temperature air heater technology.** D. P. Saari, J. E. Fenstermacher, L. R. White, and C. L. Marksberry (Fluidyne Engineering Corp., Minneapolis, MN). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2588.* 11 p. 39 refs. Contract No. DE-AC01-80ET-15602.

The MHD high temperature air heater (HTAH) requires technology beyond the current state-of-the-art of industrial regenerative heaters. Specific aspects of HTAH technology which may find other application include refractory materials and valves resistant to the high temperature, corrosive, slag-bearing gas, materials resistant to cyclic thermal stresses, high temperature support structures for the cored brick bed, regenerative heater operating techniques for preventing accumulation of slag in the heater, and analytical tools for computing regenerative heater size, cost, and performance. Areas where HTAH technology may find application include acetylene/ethylene production processes, flash pyrolysis of coal, high temperature gas reactors, coal gasification processes, various metallurgical processes, waste incineration, and improvements to existing regenerator technology such as blast furnace stoves and glass tank regenerators. (Author)

A82-14038 # **OTEC ocean system development.** D. Hove (Dynamics Technology, Inc., El Segundo, CA) and T McGuinness (NOAA, OTEC Program Management Office, Rockville, MD). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2590* 8 p. 17 refs.

Ocean systems embodied in OTEC floating power plant designs include features beyond present offshore practice. Design aspects of the platform, cold water pipe and mooring systems have been investigated in Government sponsored research programs to establish a technology base for commercial plant development. Recent laboratory tests have provided validation of concepts and design tools, and future programs will include large scale demonstration tests. (Author)

A82-14356 **A review of rain erosion problems for aerogenerators.** A R. Mortimer (Science Research Council, Rutherford and Appleton Laboratories, Chilton, Oxon, England). *Wind Engineering,* vol. 5, no. 3, 1981, p 136-146. 27 refs.

Erosive mechanisms and protective measures available for windpowered generators exposed to rain are examined. Rain erosion is modeled in two stages an incubation phase, when plastic deformation and crack formation occur with no loss of weight, and a phase of actual material loss. Raindrop impact causes a progressive tearing action, which is significant in the erosion of soft, compliant elastomers, light rain over a long time period is noted to cause fatigue Choosing a protective surface necessitates consideration of both surface impact and the effects on the substrate Metal, polymeric, and composite coatings are discussed, and it is found that softness reduces impact damage, and fine weaves in composites enhances stress concentration corrosion resistance. Continued studies specifically dealing with wind turbine blades are recommended, as current knowledge is derived from existing helicopter and propeller driven airplane data D.H.K.

A82-14357 **A first order mathematical model of the lift/drag characteristics of aerofoil sections.** G W -W. Pontin (Wesco Windmills, Ltd., England). *Wind Engineering,* vol 5, no. 3, 1981, p 147-153.

The mathematical model described is believed to represent the lift/drag characteristics of commonly used airfoil sections with an accuracy sufficient for the purpose of wind turbine design. In this model an airfoil profile is characterized by six constants and the effects of roughness and Reynolds number by a further three correction factors in a form suitable for compact digital computer storage and manipulation. (Author)

A82-14358 **Wind energy for the Federal Republic of Germany.** L Jarass, L Hoffmann, G. Obermair (Regensburg, Universitat, Regensburg, West Germany), and A Jarass (Forschungsgesellschaft fur alternative Technologien und Wirtschaftsanalysen mbH, Regensburg, West Germany). *Wind Engineering,* vol 5, no. 3, 1981, p. 154-161.

An evaluation of parameters affecting the operation of large windpowered turbines in conjunction with the electric grid of West Germany is presented North Sea coastal areas were found to have winds with a 6-7 5 m/sec average at 10-40 m, a lack of a predominant wind direction implies that generator spacing will be uniform in all directions. The 100 m GROWIAN wind turbine is considered as the prototype machine, and will produce an optimum of 3 MW, operating in a range of 5-24 m/sec, with nominal output at about 13 m/sec. Sensitivity studies are outlined for varying levels of coastal and national grid penetration, showing a saturation of the coastal grid would occur with fifteen 300 MW windfarms. Economic analyses indicate that large scale wind electric production is now competitive with conventional central generating plants, while wind energy storage is economical only if storage stays below 1 kW storage for every kW installed. D H.K.

A82-14359 **Energy transfer in wind-assist electric power systems.** E H. Gilmore (West Texas State University, Canyon, TX). *Wind Engineering,* vol. 5, no 3, 1981, p. 162-174. 12 refs. Research supported by the U.S Department of Agriculture.

A model is developed for describing mechanical wind-assist electric power systems operating under steady-state conditions. Representations for operating characteristics of system components are combined with the constraints assumed for the system to produce this model. Descriptions are in the form of torque, rpm pairs for the rotor. Analytic solution methods are discussed and a graphical solution procedure is illustrated. Applications in the areas of design and analysis of systems are considered, and the results of one series of tests on one wind-assist system are considered in terms of model parameters. (Author)

A82-14360 **An analytic model of high solidity vertical axis windmills.** R. G. Carothers and G M. Bragg (Waterloo, University, Waterloo, Ontario, Canada). *Wind Engineering,* vol 5, no. 3, 1981, p. 175-190 8 refs.

By introducing an induced cross flow to the conventional flow models used for vertical-axis windmills an analytic model for high solidity rotors is developed Results as predicted by the model are compared with those determined from wind tunnel tests. (Author)

A82-14489 **On the efficiency of thermal engines with power output - Harmonically driven engines.** V. Fairén (Stanford University, Stanford, CA, Madrid, Universidad Complutense, Madrid, Spain) and J Ross (Stanford University, Stanford, CA) *Journal of Chemical Physics,* vol 75, Dec. 1, 1981, p 5490-5496 11 refs. Research supported by the U S Department of Energy

In a previous article a model of a heat engine was defined and studied with the purpose of emphasizing the role of inertial effects, particularly their importance in relation to optimization problems. Here the performance of models of heat engines harmonically driven around a state of equilibrium is compared For the first model, with inertia, the model is defined, its nonlinear response with emphasis on the linear approximation is calculated, and the issues related to the coupling of the thermal and mechanical driving forces are discussed The influence of increasing values of the mechanical friction coefficient is studied, and it is shown that when this coefficient is small, the work output displays subharmonic resonances that disappear when the friction coefficient increases In the second model, without inertial effects, no such resonances appear as expected, since these are due only to the inertial terms (Author)

A82-14844 # **A numerical model for the flow within the tower of a tornado-type wind energy system.** S. S Ayad (Solar Energy Research Institute, Golden, CO). *ASME, Transactions, Journal of Solar Energy Engineering,* vol 103, Nov 1981, p. 299-305 11 refs Contract No EG-77-C-01-4042

The optimum performance of a model tornado-type wind energy system is predicted based on the pressure distribution in a tower with a simulated turbine flow. A two equation turbulence model is used to fix the mean pressure values and the three components of wind velocity, consideration is given to different tower geometries and turbine exit flow conditions. The flow is assumed to be incompressible and axisymmetric, and a numerical solution is obtained by employing a finite difference method with a leapfrog scheme on a staggered mesh, with an iterative technique to account for the pressure gradient. A maximum power of 35% of a closed bottom tower was found at a turbine/tower diameter ratio of 0.5. Wind tunnel tests with a scale model agreed well with the predictions. D.H K.

A82-14845 # **One viewpoint concerning unit size in the development of wind turbines.** W E. Howell and C. J. Todd (U.S. Bureau of Reclamation, Office of Atmospheric Resources Research, Denver, CO) *ASME, Transactions, Journal of Solar Energy Engineering,* vol 103, Nov. 1981, p 306-312. 18 refs.

The effects of the size of windpowered generators on the growth of windpower utilization are considered. Noting that previous models have shown that the cost of electricity is negatively correlated with machine size, it is asserted that actual production experience will introduce additional benefits. The study was based on analyses using NASA supplied wind speed frequency distributions, and considers a range of 12-1200 GW of installed capacity at 8 and 10.7 m/sec windspeeds. Experience rates of 95, 90, and 85% were selected and calculations made for the first 0.3, 0.6, 1 2, and 2.4 MW machines of production runs Highest experience rates favored a 0 6 MW size, and solutions to spacing requirements in windfarms to avoid the effects of wake turbulence are shown to be most economically achieved with machines in the 0.5 MW range It is concluded that emphasis on medium size wind turbines, 0.3-0.6 MW, presents the least risk and greatest flexibility for rapid development of economically feasible windpower. D.H.K.

A82-15069 **Carbonate fuel cell power plant systems.** R. M. Reinstrom (General Electric Co , Energy Systems Programs Dept., Schenectady, NY). *(Institute of Electrical and Electronics Engineers, Summer Meeting, Portland, OR, July 26-31, 1981.) IEEE Transaction on Power Apparatus and Systems,* vol. PAS-100, Dec. 1981, p. 4752-4759. 11 refs. Research sponsored by the U S. Department of Energy.

Carbonate fuel cells are an attractive means of developing highly efficient power plants capable of achieving low atmospheric emissions. Because carbonate fuel cells can be used with coal derived fuel gases and their operating temperatures allow the use of turbomachinery bottoming cycles, they are well suited for large installations like central utility stations. Presently, system development activity is directed toward evaluating the readiness of gasifier and fuel processor technology, defining candidate cycle configurations, and calculating projected plant efficiencies. (Author)

A82-15070 **The electric utility 4.5 MW fuel cell power plant - An urban demonstration.** R. A. Bell and R. B. Hayman (Consolidated Edison Company of New York Inc , New York, NY). *(Institute of Electrical and Electronics Engineers, Summer Meeting, Portland, OR, July 26-31, 1981.) IEEE Transactions on Power Apparatus and Systems,* vol. PAS-100, Dec. 1981, p. 4760-4764.

The fuel cell could offer an attractive power generation option for electric utilities. This paper reviews the electric utilities' efforts to develop this technology including the siting and construction of the 4.5 MW phosphoric-acid fuel cell demonstrator in New York City. The paper concludes that the fuel cell is moving from technology demonstration status toward commercial service in electric utility systems during this decade. (Author)

A82-15071 **Potential dynamic impacts of wind turbines on utility systems.** H. W Zaininger and D. J. Bell (Zaininger Engineering Co., San Jose, CA). *(Institute of Electrical and Electronics Engineers, Summer Meeting, Portland, OR, July 26-31, 1981.) IEEE Transaction on Power Apparatus and Systems,* vol PAS-100, DEC 1981, p. 4821-4829. 11 refs. Research sponsored by the Electric Power Research Institute.

This paper presents the results of an initial assessment of potential wind power generation dynamic impacts on utility systems from a global utility perspective performed for the Electric Power Research Institute. Dynamic study of minute-to-minute ramping, frequency excursions, and short-term transient stability was performed using the isolated Hawaiian Electric Company (HECO) system as an illustrative example. Potential minute-to-minute ramping requirements imposed on conventional generation units of two interconnected utilities, Kansas Gas and Electric (KG&E) and Public Service Company of Colorado (PSCo) were investigated, using interconnected utility operating criteria. (Author)

A82-15650 **Wind-energy recovery by a static Scherbius induction generator.** G. A Smith and K. A Nigim (Leicester, University, Leicester, England). *IEEE Proceedings, Part C - Generation, Transmission and Distribution,* vol. 128, pt. C, no. 6, Nov. 1981, p. 317-324 9 refs.

The paper describes a technique for controlling a doubly fed induction generator driven by a windmill, or other form of variable-speed prime mover, to provide power generation into the national grid system. The secondary circuit of the generator is supplied at a variable frequency from a current source inverter which for test purposes is rated to allow energy recovery, from a simulated windmill, from maximum speed to standstill. To overcome the stability problems normally associated with doubly fed machines a novel signal generator, which is locked in phase with the rotor EMF, controls the secondary power to provide operation over a wide range of subsynchronous and supersynchronous speeds. Consideration of power flow enables the VA rating of the secondary power source to be determined as a function of the gear ratio and online operating range of the system A simple current source model is used to predict performance which is compared with experimental results. The results indicate a viable system, and suggestions for further work are proposed. (Author)

A82-15667 **North American tidal power prospects.** W. W Wayne, Jr. *International Journal of Ambient Energy,* vol. 2, July 1981, p. 151-158.

Prospects for North American tidal power electrical generation are reviewed Studies by the US Army Corps of Engineers of 90 possible generation schemes in Cobscook Bay, ME, indicated that maximum power generation rather than dependable capacity was the most economic method. Construction cost estimates for 15 MW bulb

units in a single effect mode from basin to the sea are provided, five projects were considered ranging from 110-160 MW. Additional tidal power installations are examined for: Half-Moon Cove, ME (12 MW, 18 ft tide); Cook Inlet, AK, which is shown to pose severe environmental and engineering problems due to fish migration, earthquake hazards, and 300 ft deep silt deposits; and the Bay of Fundy, Canada. This last has a 17.8 MW plant under construction in a 29 ft maximum tide area. Other tidal projects of the Maritime Provinces are reviewed, and it is noted that previous economic evaluations based on an oil price of $16/barrel are in need of revision. M.S.K.

A82-16052 Investigations on a Se-CdO photovoltaic cell. C H. Champness, S. Fukuda, and S Jatar (McGill University, Montreal, Canada). *Solar Energy Materials,* vol 5, Oct. 1981, p. 391-401. 5 refs Research supported by the Natural Sciences and Engineering Research Council of Canada.

Based on earlier studies of Altmejd and Champness (1978), Se-CdO cells were investigated in order to determine the counter electrode deposition conditions. The cell structures were made by the Preston method using residual air In this method CdO is reactively sputtered on a crystallized selenium film using a cadmium target in the presence of argon plus residual air, pressure is critically controlled in order to obtain the appropriate excess of cadmium in the CdO, giving a low resistivity with sufficient transparency The spectral response is between 350 and 700 nm, and is controlled on the long wavelength side by the selenium and on the short wavelength side by the CdO. The effect of heat treatment of the selenium film in oxygen prior to CdO film deposition raised the open-circuit voltage and fill factor, resulting in a cell giving about 1 7% efficiency, without an optimized grid or antireflecting coating. Preliminary experiments were made to sputter CdO reactively on glass from gas pre-mixtures of oxygen and argon to obtain easier pressure control, these, however, did not give films of low enough resistivity coupled with high transparency J F.

A82-16600 Analytical solution of a simulation model for wind turbines. H M Power (University College, Dublin, Ireland) *Applied Energy,* vol. 9, Dec 1981, p 311-316

A recently developed model for wind turbine dynamics has the form J(d omega/dt) = g(V, omega) - T, where J represents the moment of inertia of the system referred to the axis of the turbine, T is the torque absorbed by the load, and g(V, omega) is the torque generated by the turbine when rotating at omega radians/sec in a windspeed of V meters/sec. The equation of motion can be used to simulate the behavior of a turbine connected to a load having a parabolic torque versus speed characteristic by approximating any given windspeed versus time profile by a piecewise-constant variation. It is shown that, subject to the stated load, the equation of motion can be solved explicitly for any time interval during which V is considered constant. J.F.

A82-16743 Computational analysis of diffuser-augmented wind turbines. C. A. J Fletcher (Sydney, University, Sydney, Australia) *Energy Conversion and Management,* vol 21, no 3, 1981, p. 175-183. 16 refs Research supported by the Energy Authority of New South Wales and National Energy, Research Development and Demonstration Council

Diffuser-augmented wind turbines are suitable candidates for the generation of electricity from jet-stream winds A blade element, computational analysis is developed that includes wake rotation effects and blade Reynolds number effects The influence of the diffuser is allowed for by introducing empirical values for the diffuser efficiency and exit-plane pressure coefficient Good agreement is obtained for power coefficient and turbine axial velocity with experimental results. The use of screens to simulate the turbine is found to overestimate the turbine output by neglecting blade profile drag but to underestimate turbine output by neglecting favorable rotational influences on diffuser efficiency Maximum power is delivered with a solidity ratio of 0.10 to 0 15 depending on the aerofoil section used. (Author)

A82-16827 * # Ceramics for the AGT101 automotive gas turbine. D. M. Kreiner and J M. Wimmer. *Government Institutes, Gas Research Institute, National Coal Association, EPRI, and AGA, Energy Technology Conference, 8th, Washington, DC, Mar 9-11, 1981, Paper.* 15 p Contract No. DEN3-167.

An advanced gas turbine powertrain for automotive application is being developed Objectives of the program include a fuel consumption of 42.8 mpg on No 2 diesel fuel in a 3000 pound car, same overall vehicle performance as obtained with a conventional spark ignition internal combustion engine, low emission, multiple fuel capacity, reliability, and competitive cost. The AGT101 powertrain consists of a power section, gearbox and transmission, and the design and analysis conducted thus far support the initial engine concept, as no significant design changes have been required The ceramic rotor design approach and component materials are discussed, and it is projected that the AGT powertrain will be competitive with any other alternative powertrain in meeting the design objectives D L.G.

A82-16844 Turbines in the ocean. F G W Smith and R. H. Charlier (Northeastern Illinois University, Chicago, IL) *Sea Frontiers,* vol 27, Sept.-Oct. 1981, p. 300-305.

It is noted that the relatively high-speed ocean currents flowing northward along the east coast of the U.S may be able to supply a significant proportion of the future electric power requirements of urban areas. The Gulf Stream core lies only about 20 miles east of Miami, here its near-surface water reaches velocities of 4.3 miles per hour Attention is called to the estimate that the energy available in the current of the Gulf Stream adjacent to Florida is approximately equivalent to that generated by 25 1,000-megawatt power plants. It is also contended that this power could be produced at competitive prices during the 1980s using large turbines moored below the ocean surface near the center of the Stream. Assuming an average ocean-current speed between 4 and 5 knots at the current core, the power density of a hydroturbine could reach 410 watts per square foot, about 100 times that of a wind-driven device of similar scale operating in an airflow of approximately 11 knots. C R

A82-17015 Nonlinear development of magnetic reconnection in the tearing-type and the Petschek-type field geometries. M Ugai (Ehime University, Matsuyama, Japan) *Plasma Physics,* vol. 23, Sept. 1981, p. 857-867 10 refs.

Distinct hydromagnetic characteristics associated with the tearing-type (Furth etal., 1963) and the Petschek-type (Petschek, 1964) field geometries are studied numerically Both the tearing-type and the Petschek-type reconnections are initiated by a local resistive disturbance, and develop from an initially antiparallel magnetic field In the tearing-type field geometry the current-sheet plasma, accelerated at X-type neutral points through reconnection, cannot be ejected away from the system, but is confined in the resulting magnetic islands It is found that the nonlinear saturation oscillates as a result of the interaction between the confined plasma and the surrounding magnetic field, the period of the oscillation is approximately given by the time required for an Alfven wave to cross one wavelength. On the other hand, in the Petschek-type field geometry the plasma can freely be ejected away from the system, so that the antiparallel field is allowed to collapse into the X-type neutral point (Author)

A82-17626 American Wind Energy Association, National Conference, Pittsburgh, PA, June 8-11, 1980, Proceedings. Edited by V. Nelson and M. Mooring (West Texas State University, Canyon, TX). Washington, DC, American Wind Energy Association, 1980. 170 p.

The state-of-the-art of large and small wind turbine applications is detailed. Large wind energy conversion systems (WECS) were examined in the light of federal programs, early operational experience with MW sized wind turbines, large Darrieus windpowered generators, legal, institutional, reliability, and cost factors, lightning protection, and implications of PURPA legislation. Evaluation procedures for vibration analysis, yaw dynamics, and hysteresis were discussed for small WECS, along with water heating applications, performance and reliability characteristics, and the aerodynamic performance of small vertical axis WECS. Topics significant to commercialization of WECS were explored, including achievable goals and wind energy assessment techniques, WECS use by rural electric systems, product liability insurance, and standards for WECS. M.S.K.

A82-17627 * # Energy potential and early operational experience for large wind turbines. W. H. Robbins and R. L. Thomas

(NASA, Washington, DC). In: American Wind Energy Association, National Conference, Pittsburgh, PA, June 8-11, 1980, Proceedings. Washington, DC, American Wind Energy Association, 1980, p. 7-12. 9 refs.

Projections for the total potential output of large wind turbines in the U.S. are reviewed. NASA has developed nine large wind-powered generators, of 100 kW, 200 kW, 2 MW, and 2.5 MW capacities, with rotors 100-300 ft in diameter, and all with horizontal axes. Approximately 214,000 sq miles of the U.S. have been determined as having substantial wind regimes and terrain suitable for large wind turbine siting. This translates into 340,000 Mod 2 (2.5 MW) wind turbines producing 4.9 quads of electricity annually, equivalent to saving 2.5 billion barrels of oil/yr. The cost of electricity is seen as the critical factor in utility acceptance of large wind turbines, and the Mod 2 machines are noted to achieve the 2-4 cents/kWh (1977 dollars) COE which is necessary. Problems such as pollution, including visual, auditory, EM, and land use difficulties are considered, and solutions are indicated. M.S.K.

A82-17628 # **Alcoa vertical axis wind turbines.** H. R. Kutcher (Alcoa Research Laboratories, Pittsburgh, PA). In: American Wind Energy Association, National Conference, Pittsburgh, PA, June 8-11, 1980, Proceedings. Washington, DC, American Wind Energy Association, 1980, p. 13-15.

An introductory line of vertical axis wind turbines which have been designated ALVAWTS is under development and testing. This paper describes those machines, discusses development and commercialization efforts, and provides data for three models which are believed to be cost effective for use today at sites with mean annual wind speeds in excess of 6.3 m/s (14 mph). (Author)

A82-17629 # **Application of large and small wind turbine generators - A utility perspective.** M. Klinger, E. J. Warchol, N. G. Butler, M. J. Berger, and R. E. Reinhart (Bonneville Power Administration, Portland, OR). In: American Wind Energy Association, National Conference, Pittsburgh, PA, June 8-11, 1980, Proceedings. Washington, DC, American Wind Energy Association, 1980, p. 16-19.

A82-17630 # **Wind energy conversion system design and analysis program.** J. S. Foley (United Technologies Research Center, East Hartford, CT). In: American Wind Energy Association, National Conference, Pittsburgh, PA, June 8-11, 1980, Proceedings. Washington, DC, American Wind Energy Association, 1980, p. 39-45. 5 refs.

This paper describes a computer program which was developed primarily to guide the design process of a wind energy conversion system, particularly in evaluating system concepts for the minimization of cost of energy (COE) and sizing of a wind system for maximum performance at a given wind site. It is, in effect, a complete preliminary design process which accepts, as independent variables, specifications for a WECS design (rotor diameter, rated power, etc.), and wind site characteristics (mean wind speed and shear profile), and calculates all weights, costs, and energy production quantities to arrive at a complete description of the WECS in either a single-unit or a wind-farm configuration. An important feature of the program is an internal optimization routine which can optimize one or more of four key variables (rotor RPM, rotor diameter, rated power, and tower height) for minimum COE for either a single unit or a wind farm installation. The use of the program in the design process is demonstrated for a Hamilton Standard Multi-Megawatt Wind Turbine and for UTRC's entry in the 15 kW SWECS competition. (Author)

A82-17631 # **Lightning protection for composite rotor blades.** H. W. Gewehr (Kaman Aerospace Corp., Bloomfield, CT). In: American Wind Energy Association, National Conference, Pittsburgh, PA, June 8-11, 1980, Proceedings. Washington, DC, American Wind Energy Association, 1980, p. 46-48.

The development of a lightning protection skin for all-composite windpowered turbine rotors is described. Preliminary tests revealed a necessity for lightning conductors in fiberglass blades, to eliminate high current entry into the interior of the rotor. A woven cloth of aluminized glass fibers was incrementally built up until a 200,000 Amp current could be survived. A full-chord aluminum tip cap and a coated trailing edge braid on the Mod 1 blades is considered effective protection of up to a 200,000 Amp lightning stroke. Further tests to determine adequate protection for a 40 kW wind turbine are indicated. It is noted that lightning will not penetrate a one inch thick fiberglass composite spar wall if there is no metal inside the spar, lightning will penetrate a .060 in. fiberglass afterbody skin to reach a wet paper core, and lightning conductors must be firmly attached to the structure. M.S.K.

A82-17633 # **Operations of small wind turbines on a distribution system.** D. Curtice (Systems Control, Inc., Palo Alto, CA). In: American Wind Energy Association, National Conference, Pittsburgh, PA, June 8-11, 1980, Proceedings. Washington, DC, American Wind Energy Association, 1980, p. 55-59.

The technical aspects of interconnecting a small wind energy conversion system (SWECS) with a utility grid are examined. Four commercially available wind turbines with outputs less than 100 kW were studied, covering the gamut of induction generator, self- and line-commutated inverters, and a synchronous generator. Penetrations of 5, 20, and 50% of the total utility power output were considered. Effects on utility protection equipment coordination were found to be safe with regard to overcurrent devices, noting that a SWECS would respond to a three-phase utility fault. Isolated operation was found to be possible with synchronous and self-commutated SWECS, and a disconnect switch is necessary to protect line workers during repair periods. The growth of SWECS penetration into the total power of a grid is expected to be gradual, and voltage flicker can be fixed by a simple device to prevent sudden large inputs by a SWECS. M.S.K.

A82-17634 # **Overview of the Wind Energy Application Network for Hawaii.** D. R. Neill (Hawaii Natural Energy Institute, Honolulu, HI). In: American Wind Energy Association, National Conference, Pittsburgh, PA, June 8-11, 1980, Proceedings. Washington, DC, American Wind Energy Association, 1980, p. 60-67.

A82-17635 # **Enertech High Reliability prototype vibration analysis.** J. H. Sexton (Rockwell International Corp., Rocky Flats Plant, Golden, CO). In: American Wind Energy Association, National Conference, Pittsburgh, PA, June 8-11, 1980, Proceedings. Washington, DC, American Wind Energy Association, 1980, p. 71-75.

Modal analysis techniques were experimentally applied to study the dynamic interaction between a wind turbine generator and its support tower. Details of the techniques applied and corresponding results are discussed. Results of vibration tests indicate the Enertech High-Reliability wind turbine generator (WTG/support structure) second mode bending was 13.2 Hz, while the blade's first mode bending frequencies were 12.4 Hz for blade two and 14.6 Hz for blade one. Significant WTG/tower response was observed and recorded during WTG operation which was traced to this system response characteristic. (Author)

A82-17636 # **Evaluation of wind turbine generator operational hysteresis using 'Method of Bins'.** C. A. Waldon (Rockwell International Corp., Rocky Flats Plant, Golden, CO). In: American Wind Energy Association, National Conference, Pittsburgh, PA, June 8-11, 1980, Proceedings. Washington, DC, American Wind Energy Association, 1980, p. 76-80.

A two-dimensional method-of-bins data processing system for a small wind energy conversion system (SWECS) is used to demonstrate the production of a composite power curve. The curve takes into account hysteresis occurring during different wind regimes, and is combined with a Weibull distribution for windspeed and duration for site specific output calculations. An example is provided for a 1 kW horizontal axis SWECS, including modifications to the program to account for blade-pitch and/or tail furling safety mechanisms which prevent SWECS overspeed. The action of hysteresis can be accounted for by including parameters for rotor pitch, tail position, and wind tracking, and requires multidimensional bins for accurate predictions of power output. M.S.K.

A82-17637 # **Yaw dynamics of a horizontal axis wind turbine.** R. Kirchhoff, D. Cromack, and R. Cohen (Massachusetts,

University, Amherst, MA). In: American Wind Energy Association, National Conference, Pittsburgh, PA, June 8-11, 1980, Proceedings. Washington, DC, American Wind Energy Association, 1980, p. 81-87. 5 refs.

The dynamics of horizontal axis wind turbine response in yaw are analyzed. A model is explored consisting of an ellipsoidal nacelle, a rigid pole, no wind shear, and zero coning in the rotor blades. The torque applied to the nacelle and the rotor blades, due to gyroscopic, Coriolis, and damping forces are considered linearly. A coordinate system for the moment of inertia and the angular acceleration is devised, and the pressures on each blade (3 blades in the study) are integrated. The possibility of a coupling between the wind speed and the lowest natural frequency is suggested, and experiments with a non-rigid tower are indicated to examine a configuration where Coriolis forces may dominate. M.S.K.

A82-17638 # **Experiences with a Grumman windstream 25.** L. H. Soderholm (Science and Education Administration, Ames, IA). In: American Wind Energy Association, National Conference, Pittsburgh, PA, June 8-11, 1980, Proceedings.
Washington, DC, American Wind Energy Association, 1980, p. 90-92.

Features of a new 3-bladed, 15 kW, downwind horizontal axis wind turbine are described. The windpowered generator has passive yaw, a 25 ft blade diameter, is rated at 26 mph, and uses a 20 kW brushless, self-excited alternator. Proper lubricating oil for ambient conditions was found to be necessary to maintain efficient operation in extreme weather conditions. A solid shaft has eliminated low-stress fatigue in the hub-propellor connection, and corrosion-proof materials have been incorporated in the blade pitch control limit switches. It is noted that including easy access on the ground to all electronic circuits and circuit breakers enhances the saftey and utility of a small wind energy conversion system (SWECS). It is summarized that the provision of easy installation, safety control redundancy, proper yaw orientation forces, accurate stress evaluation, and proper generator excitation are necessary for the acceptance of SWECS. M.S.K.

A82-17639 # **Wind driven fluid devices for water heating.** M. Rolland and D. Cromack (Massachusetts, University, Amherst, MA). In: American Wind Energy Association, National Conference, Pittsburgh, PA, June 8-11, 1980, Proceedings.
Washington, DC, American Wind Energy Association, 1980, p. 93-95. 7 refs.

Present techniques for analysis of water brake applications to wind energy conversion systems was shown to be inadequate for moderate to large scale wind turbines. Several vaned hydraulic energy converters are compared for size, speed, and capacity to identify devices suitable for wind turbine applications. A parametric relationship is developed to aid the designer in choice of an appropriate device. Examples of specific systems are presented with emphasis on domestic, agricultural, and industrial applications. (Author)

A82-17640 # **Development of high-performance, high-reliability windpower generators.** K. H. Bergey (Bergey Windpower Co., Inc., Norman, OK). In: American Wind Energy Association, National Conference, Pittsburgh, PA, June 8-11, 1980, Proceedings. Washington, DC, American Wind Energy Association, 1980, p. 101-105.

The BWC 650 and BWC 1000 windpower generators represent a new approach to high-performance and high-reliability for small windpower machines. Their variable pitch rotor system consists of torsionally flexible blades combined with out-of-plane balance weights. The resulting Powerflex blade system provides the performance advantages of variable pitch blades while maintaining fixed pitch simplicity. The permanent magnet alternators used in the two models are designed for low speed operation without the need for step-up gear boxes. The Autofurl tail automatically turns the rotor out of the wind above 32 mph. When the winds subside, it turns the rotor back into the wind. Development problems and testing techniques are discussed, including fatigue testing, dynamic blade angle measurements, and tower tests under actual storm conditions. (Author)

A82-17641 # **Analytical evaluation of the aerodynamic performance of a high-reliability vertical-axis wind turbine.** R. B. Noll (Aerospace Systems, Inc., Burlington, MA) and N. D. Ham (MIT, Cambridge, MA). In: American Wind Energy Association, National Conference, Pittsburgh, PA, June 8-11, 1980, Proceedings.
Washington, DC, American Wind Energy Association, 1980, p. 106-113. 13 refs. Research supported by the Rockwell International Corp.

The aerodynamic performance of a high-reliability vertical-axis wind turbine is discussed. The turbine has three, straight blades which are cyclically pitched. Due to its unique configuration, aerodynamic performance models used for classical horizontal-axis machines and for the vertical-axis Darrieus wind machines are not applicable. Therefore, an analytical model was formulated for the turbine aerodynamic performance and has been programmed for computer calculation. Both the mathematical model and computer program VAPE (Vertical-axis wind turbine Aerodynamic Performance Evaluation) are discussed. Connections for strut drag, turbulent wake state, and dynamic stall are included. (Author)

A82-17642 # **Controlled velocity testing of small wind energy conversion systems - An evaluation of a technique.** J. C. Balcerak (Rockwell International Corp., Golden, CO). In: American Wind Energy Association, National Conference, Pittsburgh, PA, June 8-11, 1980, Proceedings. Washington, DC, American Wind Energy Association, 1980, p. 114-119.

The results of tests of small wind energy conversion systems (SWECS) on board moving railroad flatcars are reported. Mounting the SWECS on the flatcars allowed testing at different fixed speeds and orientations. Initial tests determined the power curve of the machines, the wind velocity profile over a flatcar, and the acceleration/deceleration effects on the towers. Testing procedures on the 4000 ft long rail track are described, as are preliminary steps to define wake profiles behind the moving SWECS blades. Power curves for several manufacturers machines are provided, and it is observed that the output of two machines greatly exceeded the manufacturers predictions, due to a continued increase of rotor speed with increasing wind velocity. Continuation and expansion of the moving bed test facility for SWECS is recommeded on a reimbursible basis. M.S.K.

A82-17643 # **First results from the UMass wind tunnel test program.** L. W. Slager (Massachusetts, University, Amherst, MA). In: American Wind Energy Association, National Conference, Pittsburgh, PA, June 8-11, 1980, Proceedings. Washington, DC, American Wind Energy Association, 1980, p. 120-128. 17 refs.

Along with the recently reported theoretical-experimental study comparing lifting line theory (with Reynolds number corrections) predictions to results of wind tunnel model tests of three foot diameter rotors, an ongoing series of tests exploring such effects as pitch angle, coning angle, solidity, number of blades, surface roughness, and tower shadow have been and are being carried out. These tests are being performed on both optimum and nonoptimum (linear taper, linear twist and constant chord, zero twist) horizontal axis rotors. In addition, sailwing and Darrieus-type rotors in various configurations are also being tested. Some results for the above tests will be presented. These results establish the credibility of small model testing and the need for careful rotor design by considering other effects than just twist and chord distribution. They also confirm theory in some cases and are at variance in others. Qualitative explanations (using system dynamics or other variables) are offered and suggestions for future research are made. (Author)

A82-17644 # **SWECS technology - State-of-the-art and achievable goals.** R. P. Cingo (Rockwell International Corp., Pittsburgh, PA). In: American Wind Energy Association, National Conference, Pittsburgh, PA, June 8-11, 1980, Proceedings.
Washington, DC, American Wind Energy Association, 1980, p. 131-138.

The progress of the development of commercially-ready small wind energy conversion systems (SWECS) is summarized, along with suggestions for applications of improvements. Six commercially available machines and seven DOE prototype SWECS were examined for kWh/yr per lb of material, kWh/yr per sq m of swept area, dollars/lb in manufacture, and cost of energy in cents/kWh. Significant advancements in the economics of SWECS were found with the use of poltruded blades, induction molding techniques, and

aerodynamically controlled rotors. The development of a standard, dual output gearbox for multiple applications is recommended, as well as cataloguing tower dynamics characteristics, the design of components specifically for SWECS use, and the introduction of low-cost installation procedures. Finally, it is noted that reliability and system life for SWECS are two relatively unknown factors. M.S.K.

A82-17646 # **Performance testing and rating standards for Wind Energy Conversion Systems.** M. Bergey (Bergey Windpower Co., Inc., Norman, OK). In: American Wind Energy Association, National Conference, Pittsburgh, PA, June 8-11, 1980, Proceedings. Washington, DC, American Wind Energy Association, 1980, p. 163-167.

A82-17889 ° # **End region and current consolidation effects upon the performance of an MHD channel for the ETF conceptual design.** S. Y. Wang and J. M. Smith (NASA, Lewis Research Center, Cleveland, OH). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 20th, Orlando, FL, Jan. 11-14, 1982, Paper 82-0325.* 5 p. 6 refs.

It is noted that operating conditions which yielded a peak thermodynamic efficiency (41%) for an EFT-size MHD/steam power plant were previously (Wang et al., 1981; Staiger, 1981) identified by considering only the active region (the primary portion for power production) of an MHD channel. These previous efforts are extended here to include an investigation of the effects of the channel end regions on overall power generation. Considering these effects, the peak plant thermodynamic efficiency is found to be slightly lowered (40.7%); the channel operating point for peak efficiency is shifted to the supersonic mode (Mach number of approximately 1.1) rather than the previous subsonic operation (Mach number of approximately 0.9). Also discussed is the sensitivity of the channel performance to the B-field, diffuser recovery coefficient, channel load parameter, Mach number, and combustor pressure. C.R.

A82-17913 # **Optical diagnostic techniques for coal-fired MHD applications.** D. L. Murphree, R. L. Cook, L. E. Bauman, E. J. Beiting, R. E. Stickel, R. O. Daubach, and M. F. Ali (Mississippi State University, Mississippi State, MS). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 20th, Orlando, FL, Jan. 11-14, 1982, Paper 82-0377.* 19 p. 32 refs. Contract No. DE-AC02-80ET-15601.

Microprocessor-controlled, optical diagnostic instrumentation has been developed for the measurement of gas temperature, gas velocity and turbulence profiles, slag temperature and emissivity, optical transmission, and nitric oxide concentration in the particle/seed-laden, coal-fired magnetohydrodynamic (MHD) gas stream. Both a performance evaluation of these systems on DOE/MHD test facilities and the resulting diagnostic data on MHD/HRSR components are presented. Preliminary results of the Coherent anti-Stokes Raman Spectroscopy technique for spatially and temporally resolved temperature measurements in this harsh MHD environment are presented. (Author)

A82-17914 # **MHD coal combustor development.** J. Hardgrove, M. Bauer, H. Iwata, and R. Hamberg (TRW Energy Development Group, Redondo Beach, CA). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 20th, Orlando, FL, Jan. 11-14, 1982, Paper 82-0380.* 10 p. Contracts No. DE-AC22-79ET-11053; No. DE-AC22-81PC-40502.

The development status of 10 and 20 MW(thermal) MHD slagging coal combustors that have been selected by the DOE for scaling to the 50 MW size for integrated power train testing is surveyed. The results of a recently completed endurance demonstration of the 20 MW combustor are also discussed. A summary is given of the various types of coal combustors that have been experimentally evaluated during the past six years in the U.S. and Poland. The design of the combustors involves a cylindrical horizontal vortex flow combustion chamber with tangential oxidizer injection and axial gas outflow. The slag flows essentially under the influence of gas shear and is tapped near the combustor exit. No significant hardware problems have been encountered with the combustor components operating over 271 hours and being subjected to high thermal cycling (more than 400 cycles). C.R.

A82-17922 # **MHD generator scaling analysis for baseload commercial power plants.** D. W. Swallom and C. C. P. Pian (Avco Everett Research Laboratory, Inc., Everett, MA). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 20th, Orlando, FL, Jan. 11-14, 1982, Paper 82-0394.* 11 p. 5 refs. Contract No. DE-AC01-80ET-15614.

MHD generator channel scaling analyses have been performed to definitize the effect of generator size and oxygen enrichment on channel performance. These studies have shown that MHD generator channels can be designed to operate efficiently over the range of 250 to 2135 thermal megawatts. The optimum design conditions for each of the thermal inputs were established by investigating various combinations of electrical load parameters, pressure ratios, magnetic field profiles, and channel lengths. These results provide design flexibility for the baseload combined cycle MHD/steam power plant. (Author)

A82-17923 # **Loading schemes for a 50 MW/th/ diagonally connected MHD generator.** C. C. P. Pian and A. M. Demirjian (Avco Everett Research Laboratory, Inc., Everett, MA). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 20th, Orlando, FL, Jan. 11-14, 1982, Paper 82-0395.* 8 p. Contract No. DE-AC01-80ET-15614.

The characteristics of diagonally connected subsonic MHD generators operating with and without current control/power shuffle circuits are investigated. The results of the analysis are presented for the 50 MW(th) CDIF 1B2 generator. It is shown that an axial current flows in the uncontrolled diagonal generator, which decreases the generator's performance. Electrode current control circuits can be used as power shufflers to eliminate the axial current and to improve the efficiency. The improved performance efficiency can be maintained to part-load conditions when the inverter, channel and combustor controls are integrated. Control requirements for generators with mid-channel power taps are also discussed. (Author)

A82-17941 ° # **Impact of uniform electrode current distribution on ETF.** D. J. Bents (NASA, Lewis Research Center, Cleveland, OH). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 20th, Orlando, FL, Jan. 11-14, 1982, Paper 82-0423.* 8 p. 5 refs.

A basic reason for the complexity and sheer volume of electrode consolidation hardware in the MHD ETF Powertrain system is the channel electrode current distribution, which is non-uniform. If the channel design is altered to provide uniform electrode current distribution, the amount of hardware required decreases considerably, but at the possible expense of degraded channel performance. This paper explains the design impacts on the ETF electrode consolidation network associated with uniform channel electrode current distribution, and presents the alternate consolidation designs which occur. They are compared to the baseline (non-uniform current) design with respect to performance, and hardware requirements. A rational basis is presented for comparing the requirements for the different designs and the savings that result from uniform current distribution. Performance and cost impacts upon the combined cycle plant are discussed. (Author)

A82-18124 **International Symposium on Wave and Tidal Energy, 2nd, St. John's College, Cambridge, England, September 23-25, 1981, Proceedings.** Symposium sponsored by the British Hydromechanics Research Association. Edited by H. S. Stephens and C. A. Stapleton (British Hydromechanics Research Association, Cranfield, Beds., England). Cranfield, Beds., England, BHRA Fluid Engineering, 1981. 447 p.

Topics discussed include wave power device interactions, the mathematical modeling of tidal power, and wave power with air turbines. Particular attention is given to the hydrodynamic characteristics of the Bristol Cylinder, the Strangford Lough tidal energy project, and the Foilpropeller for wave power propulsion. Consideration is also given to a submerged oscillating water column device, models of wave energy transformation near a coast, and the environmental implications of tidal power. J.F.

A82-18201 **Possible application of electromagnetic guns to impact fusion.** R. N. Kostoff (U.S. Department of Energy, Washington, DC), A. T. Peaslee, Jr. (Los Alamos National Laboratory, Los

Alamos, NM), and F. L. Ribe (Washington, University, Seattle, WA). *(U.S. Army Armaments Research and Development Command and Defense Advanced Research Projects Agency, Conference on Electromagnetic Guns and Launchers, San Diego, CA, Nov. 4-6, 1980.) IEEE Transactions on Magnetics,* vol. MAG-18, Jan. 1982, p. 194-196. 21 refs. Research sponsored by the U.S. Department of Energy.

The possible application of electromagnetic guns to impact fusion for the generation of electric power is discussed, and advantages of impact fusion over the more conventional inertial confinement fusion concepts are examined. It is shown that impact fusion can achieve the necessary high yields, of the order of a few gigajoules, which are difficult to achieve with lasers except at unrealistically high target gains. The rail gun accelerator is well adapted to the delivery of some 10-100 megajoules of energy to the fusion target, and the electrical technology involved is relatively simple: inductive storage or rotating machinery and capacitors. It is concluded that the rail gun has the potential of developing into an impact fusion macroparticle accelerator. V.L.

A82-18220 # Experimental demonstration of the feasibility of the Mist Flow Ocean Thermal Energy Process. S. L. Ridgway, C. K. B. Lee, and R. P. Hammond (R & D Associates, Marina del Rey, CA). *American Institute of Aeronautics and Astronautics, Terrestrial Energy Systems Conference, 2nd, Colorado Springs, CO, Dec. 1-3, 1981, Paper 81-2596.* 8 p. 9 refs. Research sponsored by the U.S. Department of Energy.

The Mist Flow Ocean Thermal Energy Process is a practical method for exploiting the ocean temperature difference without using heat exchangers or large vapor turbines. Warm ocean surface water is sprayed upward into the bottom of an evacuated vertical duct. Vapor flashes from the sprayed water droplets and drags them upward as it proceeds to the top of the duct. There the vapor is condensed by cold water obtained from the depths. The validity of the concept has been demonstrated in a set of experiments conducted in a 4-meter tall transparent test column of 23 x 36 cm cross section. The coupling between the vapor and the droplets remained strong as energy equivalent to over 60 meters of lift was transferred from the vapor to the water droplets. Power plant designs based on these experimental data imply costs of about $1,200 per kilowatt for power plant sizes in the 10 MW range. Power plants operating with only 16 C temperature difference appear practical.
(Author)

A82-18328 # Performance of a small low speed Darrieus type rotor. G. Ahmadi (Shiraz University, Shiraz, Iran). *Revue Roumaine des Sciences Techniques, Série de Mécanique Appliquée,* vol. 26, May-June 1981, p. 489-494. 15 refs. Research supported by Shiraz University.

A model for the performance of a small, low speed, high chordal ratio Darrieus is presented. A tip speed ratio below 1.5 was chosen, and experiments on a test machine with NACA 0012 blades with a 12 cm chord are reported. The wood blades were 32.5 cm long, vertically mounted, and spaced 33.6 cm apart, yielding the chord to diameter ratio of 0.7. The Darrieus was tested at varying speeds and pitch angles, and power coefficients were calculated. A 7.5 deg pitch angle was determined to be optimum for the model, with efficiency increasing with windspeed. The high chordal ratio resulted in low power coefficients being obtained, near 5 percent at 20 m/sec.
M.S.K.

A82-18394 Design of a cell for electrode kinetic investigations of fuel cell reactions. H. Olender, J. McBreen, W. E. O'Grady, S. Srinivasan (Brookhaven National Laboratory, Upton, NY), and K. V. Kordesch (Graz, Technische Universität, Graz, Austria). *Electrochemical Society Journal,* vol. 129, Jan. 1982, p. 135-137. 10 refs. Contract No. DE-AC02-76CH-00016.

Two designs of a cell for investigation of electrode kinetics of fuel cell reactions in acid media are described. The cells are suitable for evaluation of carbon supported platinum electrodes under conditions simulating a phosphoric acid fuel cell environment at elevated temperature and pressure. The usefulness of this for obtaining fuel cell performance, overpotential-current density relation, and in situ platinum surface area measurements in 98.6% H3PO4 at 150 C is demonstrated. The cell design is also ideal for the electrochemical determination of cross migration of oxygen through the matrix at 180 C. (Author)

A82-18466 Electrical properties of infrared photovoltaic Cd/x/Hg/1-x/Te detectors. P. Becla and E. Placzek-Popko (Wroclaw, Politechnika, Wroclaw, Poland). *Infrared Physics,* vol. 21, Nov. 1981, p. 323-332. 16 refs.

N82-10005 West Virginia Univ., Morgantown
AN INDOOR BLADE TEST FACILITY FOR DETERMINING THE BASIC AERODYNAMIC PROPERTIES OF DARRIEUS WIND TURBINE AIRFOILS WITH TEST RESULTS FOR AN NACA 0015 AND A MODIFIED SECTION Ph.D. Thesis
Walter Paul Wolfe 1981 332 p
Avail Univ Microfilms Order No 8118421

An indoor facility was developed for use in the aerodynamic testing of Darrieus wind turbine blades A three component strain gage balance was used to reduce lift, drag, and moment coefficients of blades whose angle of attack, chord to radius ratio and Reynolds number could be systematically varied A computer data acquisition system was developed to automatically record, reduce, and save the test data. It was learned that the unusual flow field of this test environment necessitates unique induced velocity corrections to the test data Computer codes were developed to calculate the angles of attack induced at the blade by the trailing tip vortices The results were then used to correct the test data The effects of flow curvature on blade aerodynamics were experimentally verified Both blades demonstrated virtual camber and incidence as evidenced by non-zero moment coefficients and angles of zero lift and minimum drag
Dissert Abstr

N82-10406# General Electric Co., St Petersburg, Fla Gas Turbine Div
WATER-COOLED GAS TURBINE DEVELOPMENT PROGRAM Final Report
Jun 1981 249 p Sponsored in part by Electric Power Research Inst 2 Vol
(EPRI Proj 234-3)
(DE81-904245, EPRI-AP-1889-Vol-1) Avail NTIS HC A11/MF A01

Work on the EPRI water cooled gas turbine development program, RP234 is summarized The viability of water cooling to achieve higher firing temperatures and increased fuels flexibility in utility gas turbines was established It is found that water cooling is a viable concept and that it results in considerable improvements in gas turbine combined cycle efficiency at increased firing temperatures DOE

N82-10434# Sandia Labs., Albuquerque, N Mex
RESIDUAL STRESSES IN DARRIEUS VERTICAL AXIS WIND TURBINE BLADES
P Veers Apr 1981 63 p
(Contract DE-AC04-76DP-00789)
(DE81-1026144, SAND-81-0923) Avail NTIS HC A04/MF A01

A numerical package called RESID was essential to calculate the residual stresses in VAWT blades induced during cold forming Using a strength of materials - elementary beam theory approach, RESID models the material response with a bilinear stress-strain curve, and the cross sectional geometry with an array of area increments Through an iterative solution procedure residual stresses are predicted for a specified final radius of curvature or applied bending moment Results are compared to theoretical solutions for simple geometries and with MARC Finite element results for VAWT blade geometries Calculating residual stress levels, determining acceptable residual stress levels, and a method of reducing residual stresses are discussed A complete listing and sample run are inclined in the appendexes DOE

N82-10452# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany) Inst fuer Aeroelastic
CALCULATION OF NATURAL MODES OF VIBRATION FOR ROTOR BLADES BY THE FINITE ELEMENT METHOD
Fritz Kiessling and Dieter Ludwig Jan 1981 66 p refs In GERMAN, ENGLISH summary
(DFVLR-FB-81-07) Avail NTIS HC A04/MF A01, DFVLR, Cologne DM 14.20

The mass and stiffness matrices for a rotating blade are established by the finite element method The formulation is

based on the Lagrange function presented for combined flapwise bending, chordwise bending, and torsion of twisted nonuniform rotor blades The element matrices were created by the nonnumeric computer program REDUCE by which it is possible to evaluate the formulas by symbolic manipulation An ordering scheme was introduced to demonstrate which terms were simplified or neglected As examples, eigenanalyses are performed for a nonrotating homogeneous beam and for the rotor blade of a wind energy converter Author (ESA)

N82-10492 Texas A&M Univ, College Station
A COMPUTER MODEL OF A STIRLING ENGINE USING A TWO-PHASE TWO-COMPONENT WORKING FLUID Ph.D. Thesis
David Allen Renfroe 1981 193 p
Avail Univ Microfilms Order No 8118295

Stirling engines are potentially the most efficient converters of thermal energy to mechanical work that are manufacturable In addition to its high efficiency capability, it also operates relatively cleanly, quietly, and with multiple fuel capability Its one deficiency is the low specific power (power output/engine size) A method of increasing specific power is described This is by utilizing a two-phase two-component (TPTC) working fluid or one having a carrier gas and a component which changes phase during the cycle, such as a mixture of water and air In order to study the effect of adding water to the working fluid of a Stirling engine on its operation, a computer model of the system was developed The TPTC model is an extension of a Stirling engine with an ideal gas working fluid and includes provisions for accounting for differences in heat transfer and flow losses for a TPTC working fluid Dissert Abstr

N82-10493 Virginia Univ, Charlottesville
FUNDAMENTAL INVESTIGATIONS ON FUEL CELLS FOR TRANSPORTATION APPLICATIONS Ph.D. Thesis
Earl Jennings Taylor 1981 268 p
Avail Univ Microfilms Order No 8117914

Three areas concerning fuel cells for transportation applications were investigated The areas are (1) a comparison of oxygen reduction in phosphoric acid and in trifluoromethanesulfonic acid, (TFMSA), (2) testing of three types of fuel cells under simulated vehicular operating conditions, and (3) the design, fabrication, and testing of a 1/2-kilowatt alkaline fuel cell module Additions of TFMSA to phosphoric acid enhance the oxygen reduction in phosphoric acid It is shown that the single cell has no adverse effect on fuel cell performance in simulated automobile power requirements It is demonstrated that the single cells can be scaled-up without loss of performance Author

N82-10494 Princeton Univ, N J
THE PLASMADYNAMICS AND IONIZATION KINETICS OF THERMIONIC ENERGY CONVERSION Ph.D. Thesis
John Langie Lawless, Jr 1981 198 p
Avail Univ Microfilms Order No 8118339

Radiation by a Cesium recombination laser operating in a different thermionic converter as an energy efficient process is discussed To reduce the plasma arc drop, thermionic energy conversion was studied It is predicted that it is possible to generate the required laser light from a thermionic-type Cesium plasma A numerical method is developed to solve the thermionic plasma dynamics The effects of the complete system of electron atom inelastic collisions on the ionization recombination problem are reduced to a simple system one quantum approximation A Cesium recombination laser is predicted and the magnitudes for the population inversion and the laser efficiency are derived Thermionic converter performance using laser radiation is considered It is found that laser radiation impinging on a thermionic plasma enhances the ionization process thereby raising the plasma density and reducing the plasma arc drop Dissert Abstr

N82-10495*# Gilbert/Commonwealth, Reading, Pa
MAGNETOHYDRODYNAMICS MHD ENGINEERING TEST FACILITY ETF 200 MWE POWER PLANT. CONCEPTUAL DESIGN ENGINEERING REPORT CDER. VOLUME 3: COSTS AND SCHEDULES Final Report
Sep 1981 61 p 5 Vol
(Contracts DEN3-224, DE-AI01-77ET-10769)
(NASA-CR-165452-Vol-3, DOE/NASA/0224-1-Vol-3) Avail NTIS HC A04/MF A01 CSCL 10B

The estimated plant capital cost for a coal fired 200 MWE electric generating plant with open cycle magnetohydrodynamics is divided into principal accounts based on Federal Energy Regulatory Commision account structure Each principal account is defined and its estimated cost subdivided into identifiable and major equipment systems The cost data sources for compiling the estimates, cost parameters, allotments, assumptions, and contingencies, are discussed Uncertainties associated with developing the costs are quantified to show the confidence level acquired Guidelines established in preparing the estimated costs are included Based on an overall milestone schedule related to conventional power plant scheduling experience and starting procurement of MHD components during the preliminary design phase there is a 6 1/2-year construction period The duration of the project from start to commercial operation is 79 months The engineering phase of the project is 4 1/2 years, the construction duration following the start of the man power block is 37 months A R H

N82-10524# Little (Arthur D), Inc, Cambridge, Mass
LARGE WIND TURBINE GENERATOR PERFORMANCE ASSESSMENT, TECHNOLOGY STATUS REPORT NO. 3 Interim Report
W A Vachon Jul 1981 136 p refs Sponsored by Electric Power Research Inst
(EPRI Proj 1348-1)
(DE81-903763, EPRI-AP-1959) Avail NTIS HC A07/MF A01

Detailed summaries of test results are presented for the US Department of Energy's 200-kW MOD-OA horizontal-axis WTs that were interconnected with electric utilities at various locations around the United States A description of the progress and experiences with both the MOD-1 1 5-MW WT and the cluster of three MOD-2 2 5-MW WTs is also presented, along with a summary of plans for the DOE vertical-axis wind turbine program A brief summary of Danish large WT programs is also provided DOE

N82-10536# Tata Energy Research Inst, Bombay (India) Documentation Center
WATER-PUMPING-WINDMILL DESIGNS: A HANDBOOK
Tarangini Rastogi, comp and Narsing R Rao, comp Jun 1981 162 p refs
(DE81-904016, NP-1904016) Avail NTIS HC A08/MF A01

Windmills are becoming an attractive proposition for water pumping in the rural areas Information on designs of water pumping windmills which could be constructed with inexpensive and locally available materials and skills is presented This handbook covers about 23 indigeneous windmill designs and information such as name of the designer, institutional affiliation, type of windmill, specific applications and suitability, design features, and operating data wherever available Most of these designs tested and were successfully used in different parts of the world Commercially obtainable windmills listed along with complete address of the manufacturers and relevant technical specifications T M

N82-10553# Argonne National Lab., Ill
LIQUID-METAL MHD FOR SOLAR AND COAL
E S Pierson, D Cohen, and S J Grammel 1980 10 p refs Presented at the 7th Intern Conf on MHD Elect Power Generation, Cambridge, Mass, 16-20 Jun 1980
(Contract W-31-109-eng-38)
(DE81-023545, CONF-800617-8) Avail NTIS HC A02/MF A01

The two phase generator, liquid metal magnetohydrodynamic energy conversion system has an inherently thermodynamic efficiency for the same heat source and sink temperatures and is better suited for cogeneration than other conversion systems For solar applications, attractive efficiencies in comparison with alternative systems are calculated, and cogeneration advantages are indicated For coal applications, recent coal combustion gas copper reaction results show that the copper can be used to control SO2 emissions DOE

N82-10559# Midwest Research Inst, Golden, Colo Solar Energy Research Inst
FABRICATION, TESTING, AND MODELING PLANS FOR A 125-KW COUNTER-ROTATING-TURBINE WAVE ENERGY CONVERTER
J Miles and T Penney Jun 1981 12 p refs Presented at the 8th Ocean Energy Conf, Washington, D C, 7-11 Jun 1981
(Contract EG-77-C-01-4042)
(DE81-023946, SERI/TP-634/1215, CONF-810622-4) Avail

NTIS HC A02/MF A01

An air turbine accepting bi-directional flow and featuring counter-rotating turbine wheels is described The turbine is for use with an oscillating water column and an air chamber to form a wave energy converter Plans are presented for testing the turbine in a steady-state manner so as to obtain output torque and mass flow as functions of operational parameters Concurrent modeling studies are described which will lead to the design of an optimized airchamber DOE

N82-10882# Massachusetts Inst of Tech , Cambridge Energy Lab

KEY CONTRIBUTIONS IN MHD POWER GENERATION Quarterly Technical Progress Report, 1 Mar. - 31 May 1980

J F Louis May 1981 162 p refs

(Contract DE-AC01-79ET-15518)

(DE81-028121 DOE/ET-15518/5) Avail NTIS HC A08/MF A01

Progress is reported in (1) investigating electrical behavior in the vicinity of electrode and insulating walls, (2) studying critical performance issues in the development of combustion disk generators (3) developing and testing electrode modules (including studies of insulator properties) (4) determining coal combustion kinetics and ash behavior relevant to two-stage MHD combustors, and (5) investigating the mixing and flow aerodynamics of a high swirl geometry second stage DOE

N82-10888# TRW Defense and Space Systems Group, Redondo Beach, Calif Combustion and Power Technology Dept

HIGH PRESSURE MHD COAL COMBUSTORS INVESTIGATION, PHASE 2 Final Technical Report

H Iwata and R Hamberg May 1981 129 p

(Contract DE-AC22-78ET-11053)

(DE81-027238, DOE/ET-11053/T1, FE-2706-43) Avail NTIS HC A07/MF A01

A high pressure MHD coal combustor was investigated The purpose was to acquire basic design and support engineering data through systematic combustion experiments at the 10 and 20 thermal megawatt size and to design a 50 MW/sub t/ combustor This combustor is to produce an electrically conductive plasma generated by the direct combustion of pulverized coal with hot oxygen enriched vitiated air that is seeded with potassium carbonate Vitiated air and oxygen are used as the oxidizer, however, preheated air will ultimately be used as the oxidizer in coal fired MHD combustors DOE

N82-10936 City Univ of New York, N Y

THERMOELECTRIC CONVERSIONS BASED ON NOISE RECTIFICATION Ph.D. Thesis

Andrei Cernasov 1981 178 p

Avail Univ Microfilms Order No 8119649

A complete analysis of the feasibility, operation, and performance of heat engines based on the rectification of thermal noise is presented Both the close to thermodynamic equilibrium and 'far from thermodynamic equilibrium' cases are considered All standard thermodynamic results, including the Second Law, are found to hold for all cases While high efficiencies and output power densities are possible, if normal exponential type diodes are used the small physical sizes of efficient fluctuation heat engines are beyond the capabilities of present technology However, no thermodynamics reasons for the weakly nonlinear character of practical diodes, like PN junctions, are found Since high nonlinearity ca compensate for large system sizes, when highly nonlinear diodes are discovered, efficient fluctuation heat engines could become feasible Dissert Abstr

N82-10961# Los Alamos Scientific Lab , N Mex

DESIGN CONSIDERATIONS FOR VEHICULAR FUEL CELL POWER PLANTS

D K Lynn, J B McCormick, R E Bobbett, S Srinivasan, and J R Huff 31 Mar 1981 14 p refs Presented at 16th Intersoc Energy Conversion Engr Conf , Atlanta, 9-14 Aug 1981

(Contract W-7405-eng-36)

(DE81-769737, LA-UR-81-1054, CONF-810812-7) Avail NTIS HC A02/MF A01

Designs in fuel cells as an efficient, nonpolluting vehicular power source that can operate on nonpetroleum fuel were investigated Phosphoric acid fuel cell power plant designs were studied to determine the performance level they would provide, both for a compact passenger vehicle and a 40 ft city bus The fuel is steam reformed methanol It is indicated that 1978 fuel cell technology provides a 22 to 50% improvement in fuel economy over the 1980 EPA estimate for the conventionally powered General Motors X car A reasonable advanced in fuel cell technology improves performance and fuel consumption of both vehicles substantially DOE

N82-11044# Sandia Labs , Albuquerque N Mex Advanced Energy Projects Div

WIND RIPPLE ANALYSIS

R E Akins 1981 8 p refs

(Contract DE-AC04-76DP-00789)

(DE81-030129 DOE/DP-00789/T15) Avail NTIS HC A02/MF A01

Experimental techniques were developed which allow analysis of full scale performance of wind turbines with particular emphasis on the effects caused by turbulence in the incident wind These techniques are presented, using data from the DOE/Sandia Vertical Axis Wind Turbine program Three techniques were developed for use in evaluating the fluctuating output of a wind turbine Techniques were sought which allowed accurate assessment of the wind ripple of the contributions to the fluctuation in turbine output caused by atmospheric turbulence The advantages and disadvantages of these techniques are addressed DOE

N82-11045# Washington Univ Technology Associates, Inc St Louis, Mo

YAWING OF WIND TURBINES WITH BLADE CYCLIC PITCH VARIATION

K H Hohenemser A H P Swift, and D A Peters Aug 1981 15 p

(Contract DE-AC02-77CH-00178, EG-77-C-01-4042)

(DE81-030091 SERI/TR-8085-3-T1) Avail NTIS HC A02/MF A01

A two-bladed wind rotor with passive cyclic pitch variation, yawed for the purpose of rotor speed and torque control was studied to determine the potential cost effectiveness of wind energy conversion A simple mechanism adopted from rotorcraft technology for obtaining passive cyclic pitch variation makes rapid yaw rates possible without causing vibratory hub moments and without producing appreciable out-of-plane blade excursions A 7 6 m diameter vane stabilized fully instrumented wind rotor having low blade solidity was operated 1980, during 41 days for 96 hours The operational envelope extended to 16m/sec wind velocity to 45 degree yaw angle power on and 80 degree yaw angle power off The rotor was automatically yawed when 228 rpm at 10 kW rotor power was exceeded Reverse yawing was performed manually Within the tested performance envelope, loads and vibrations were low The rotor ran smoothly even at high yaw angles and at high yaw rates DOE

N82-11173# National Bureau of Standards, Washington, D C Chemical Stability and Corrosion Div

MASS SPECTROMETRIC STUDIES OF MHD SLAG THERMOCHEMISTRY Interim Report

J W Hastie and E R Plante Jun 1981 36 p refs

(PB81-221434, NBSIR-81-2293) Avail NTIS HC A03/MF A01 CSCL 07D

The following potassium-containing systems were studied binary mixtures of K2O with SiO2 Al2O3, Fe2O3, and ZrO2, a series of more complex synthetic slags containing K2O, SiO2, CaO, MgO, Al2O3, and Fe2O3 and MHD channel slag (Illinois No 6 coal) and several slag-NaCl mixtures Data were obtained over a sufficiently wide range of component-type, composition and temperature to reveal systematic trends in slag activities from which empirical predictions are possible However, anomalous behavior was also noted, mainly in the form of nonequilibrium effects Application of the vaporization and activity data to plasma-slag interaction and to the recovery of potassium seed from slag is also considered GRA

N82-11380# Cherrywood Farms, Williamsburg, Mich

PROJECT DEMONSTRATION OF WIND-TURBINE ELECTRICITY: INTERCONNECTING A NORTHERN MICHIGAN FRUIT FARM WITH A MAJOR UTILITY Interim Report, 2 Sep. 1980 - 27 Apr. 1981

David M Amon 1981 86 p

(Contract DE-FG02-80R5-10226)

(DE81-030950, DOE/R5-10226/1) Avail NTIS HC A05/MF A01

Progress is reviewed in a project to test the economic feasibility of wind turbine technology for generating electricity The use of wind genrated electricity on a commercial fruit farm

interconnecting a commercial fruit farm with a major utility to sell power are the find project goals DOE

N82-11399*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
HIGH THERMAL POWER DENSITY HEAT TRANSFER Patent Application
James F Morris, inventor (to NASA) Filed 30 Oct 1980 10 p
(NASA-Case-LEW-12950-1, US-Patent-Appl-SN-202228) Avail NTIS HC A02/MF A01 CSCL 20D

Heat from a high temperature heat pipe is transferred through a vacuum or a gap filled with electrically nonconducting gas to a cooler heat pipe The heat pipe is used to cool the nuclear reactor while the heat pipe is connected thermally and electrically to a thermionic converter If the receiver requires greater thermal power density, geometries are used with larger heat pipe areas for transmitting and receiving energy than the area for conducting the heat to the thermionic converter In this way the heat pipe capability for increasing thermal power densities compensates for the comparatively low thermal power densities through the electrically non-conducting gap between the two heat pipes NASA

N82-11421# Little (Arthur D), Inc, Cambridge, Mass
ASSESSMENT OF I.C. ENGINES AS DRIVERS FOR HEAT ACTUATED HEAT PUMPS
J C Burke, W P Teagan, and P G Goff 1981 6 p Presented at the DOE Heat Pump Contractors' Program Integration Meeting, McLean, Va, 2-4 Jun 1981 Prepared for ORNL
(Contract W-7405-eng-26)
(DE81-024086, CONF-810672-11) Avail NTIS HC A02/MF A01

The present suitability and future potential of gas-fired and oil-fired internal combustion (IC) engines for use in heat-actuated heat pumps for space conditioning applications are assessed Drives for residential and light commercial machines up to 100 KW output or approximately 50 HP engine input are considered A conceptual design identifying major generic elements was prepared to serve as a basis for estimating performance maintenance costs A review of prior experiences with IC engines with heat pumps used in similar situations was conducted Capital costs and maintenance costs were estimated and diesel and spark ignition engine efficiencies were determined Institutional and operational considerations were identified DOE

N82-11478# AiResearch Mfg Co, Torrance, Calif
BRAYTON/RANKINE 10-TON GAS-FIRED SPACE CONDITIONING SYSTEM, PHASE 2 Annual Report
16 Mar 1981 103 p refs
(Contracts GRI-5014-341-0114, W-7405-eng-26)
(PB81-223372, GRI-80/0053, ATR-1) Avail NTIS HC A06/MF A01 CSCL 13I

The heat-actuated space conditioning system provides moe efficient use of natural gas and is intended as an all-gas alternative to the electric heat pump The system employs a subatmospheric natural-gas-fired heat pump A centrifugal R-12 refrigerant compressor is driven directly from the Brayton engine rotating group through a hermetically sealed coupling Unique features that offer high life-cycle performance include a permanent magnet coupling, foil bearings, and atmospheric in-line combustor, and a high-temperature recuperator Predicted overall engine efficiency is 27 percent and predicted overall coefficient of performane (COP) at the energy source is 1 0 in cooling and 1 2 to 1 4 in heating GRA

N82-11585# Brown Univ, Providence, R I
ANALYSIS OF THERMAL/MECHANICAL ENERGY-CONVERSION CONCEPTS Final Report
R DiPippo, J Kestin, and P F Maeder Jun 1981 15 p refs
(Contract DE-AS02-76ET-28320)
(DE81-027854, DOE/ET-28320/48) Avail NTIS HC A02/MF A01

A list of project activities, meetings, and publications is presented DOE

N82-11907# Oak Ridge National Lab, Tenn
ENGINEERING CHALLENGES OF FUSION-REACTOR DEVELOPMENT
Jan B Talbot 1981 10 p refs Presented at the Soc of Women Eng 1981 Natl Conv, Anaheim, Calif, 24-28 Jun 1981
(Contract W-7405-eng-26)
(DE81-024129, CONF-810699-1) Avail NTIS HC A02/MF A01

A brief review of the fusion research program and some problems to be faced in the near future and described DOE

N82-11934# Mississippi State Univ, Mississippi State Energy Center
MAGNETOHYDRODYNAMIC RESEARCH PROGRAM OF THE MHD ENERGY CENTER AT MISSISSIPPI STATE UNIVERSITY AND STRUCTURAL FEATURES OF MHD RADIANT BOILERS
W S Shepard 1981 53 p Lectures presented to MHD/HRSR Sci and Engr of the Peoples Republic of China, 10-31 Jul 1981
(Contract DE-AC02-80ET-15601)
(DE81-029901, DOE/ET-15601/T3, TR-3) Avail NTIS HC A04/MF A01

Magnetohydrodynamic is conducted largely through use of test stand which simulates conditions in the MHD gas stream Continual modification of the test stand to reflect experimental results produced a test stand capable of test runs of 100 hours, runs of more than 500 hours are planned The test stand is described, and experimental results are discussed The design and construction of MHD radiant boiler are described The radiant furnance serves several functions in a heat recovery and seed recovery system, it cools flue gases to a temperature suitable for entrance to the secondary superheater, it generates steam, it provides for the removal of molten ash at high temperatures, and it provides access for intrusive and nonintrusive instrumentation to the gas-side environment DOE

N82-11935# Massachusetts Inst of Tech, Cambridge Plasmas Fusion Center
RF-DRIVEN TOKAMAK REACTOR WITH SUB-IGNITED, THERMALLY STABLE OPERATION
L P Harten, A Bers, V Fuchs, (IREQ, Varennes, Canada), and M M Shoucri, (IREQ, Varennes, Canada) Feb 1981 9 p refs Presented at the 4th Topical Conf on RF Heating of Plasma, Austin, Tex, Feb 1981
(Contract DE-AC02-76ET-51013)
(DE81-029437, DOE/ET-51013/8, PFC/RR-81-6) Avail NTIS HC A02/MF A01

A Radio-Frequency Driven Tokamak Reactor (RFDTR) can use RF-Power, programmed by a delayed temperature measurement, to thermally stabilize a power equilibrium below ignition, and to drive a steady state current We propose the parameters for such a device generating approx = 1600 MW thermal power and operating with Q approx = 40 (= power out/power in) A one temperature zero-dimensional model allows simple analytical formulation of the problem The relevance of injected impurities for locating the equilibrium is discussed We present the results of a one-dimensional (radial) code which includes the deposition of the supplementary power, and compare with out zero-dimensional model DOE

N82-11944# Los Alamos Scientific Lab, N Mex
UNCERTAINTIES ASSOCIATED WITH INERTIAL-FUSION IGNITION
Gene H McCall 1981 10 p refs Presented at the Conf on Optics, Santa Fe, N Mex, Apr 1981
(Contract W-7405-eng-36)
(DE81-025408, LA-UR-81-1750, CONF-81-429-34) Avail NTIS HC A02/MF A01

An estimate is made of a worst case driving energy which is derived from analytic and computer calculations The uncertainty can be reduced by a factor of 10 to 100 if certain physical effects are understood That is not to say that the energy requirement can necessarily be reduced below that of the worst case, but it is possible to reduce the uncertainty associated with ignition energy With laser costs in the $0 5 to 1 billion per MJ range, it can be seen that such an exercise is worthwhile DOE

N82-11947# Westinghouse Electric Corp, Pittsburgh, Pa Research and Development Center
DEVELOPMENT, TESTING, AND EVALUATION OF MHD MATERIALS AND COMPONENT DESIGNS. VOLUME 1. EXECUTIVE SUMMARY Final Report, 15 Oct. 1973 - 31 Dec. 1975
W E Young Nov 1980 44 p refs
(Contract DE-AC01-76ET-10805)

(DE81-026203, DOE/ET-10805/T1-Vol-1, FE-1540-29-Vol-1) Avail NTIS HC A03/MF A01

Results of studies on gas electrical properties, coal combustion, and MHD materials intended to support the Waltz Mill channel experiments are presented Materials testing indicated that stabilized zirconia should be an acceptable electrode material Cyclone coal combustors were studied and designs developed for a Waltz Mill size unit and a 25,000 lb/h prototype The Waltz Mill facility performed in a highly satisfactory manner Six non generating and 16 load tests were made on three channels Following a failure of the air heater tests were run essentially on materials and structure The system was dismantled and reconstruction started to enable testing at the proposed Component Development Integrated Facility A very successful 127-hour run was made on a pair of US designed and constructed MHD electrode modules in the Soviet Union's U-02 facility DOE

N82-11993*# Rasor Associates, Inc., Sunnyvale, Calif
JET IMPINGEMENT HEAT TRANSFER ENHANCEMENT FOR THE GPU-3 STIRLING ENGINE
Douglas C Johnson, Craig W Congdon, Lester L Begg, Edward J Britt, and Lanny G Thieme Oct 1981 28 p refs
(NASA-TM-82727, DOE/NASA/51040/33) Avail NTIS HC A03/MF A01 CSCL 13F

A computer model of the combustion-gas-side heat transfer was developed to predict the effects of a jet impingement system and the possible range of improvements available Using low temperature (315 C (600 F)) pretest data in an updated model, a high temperature silicon carbide jet impingement heat transfer system was designed and fabricated The system model predicted that at the theoretical maximum limit, jet impingement enhanced heat transfer can (1) reduce the flame temperature by 275 C (500 F), (2) reduce the exhaust temperature by 110 C (200 F), and (3) increase the overall heat into the working fluid by 10%, all for an increase in required pumping power of less than 0 5% of the engine power output Initial tests on the GPU-3 Stirling engine at NASA-Lewis demonstrated that the jet impingement system increased the engine output power and efficiency by 5% - 8% with no measurable increase in pumping power The overall heat transfer coefficient was increased by 65% for the maximum power point of the tests A R H

N82-12444*# Chrysler Corp., Detroit, Mich
AGT-102 AUTOMOTIVE GAS TURBINE Summary Report
Jun 1981 434 p refs Sponsored by NASA Lewis Research Center Prepared jointly with Williams Research Corp., Walled Lake, Mich
(Contract DE-AC02-76CS-52749)
(NASA-CR-165353, DOE/NASA/2749-81/1) Avail NTIS HC A19/MF A01 CSCL 13I

Development of a gas turbine powertrain with a 30% fuel economy improvement over a comparable S1 reciprocating engine, operation within 0 41 HC, 3 4 CO, and 0 40 NOx grams per mile emissions levels, and ability to use a variety of alternate fuels is summarized The powertrain concept consists of a single-shaft engine with a ceramic inner shell for containment of hot gasses and support of twin regenerators It uses a fixed-geometry, lean, premixed, prevaporized combustor, and a ceramic radial turbine rotor supported by an air-lubricated journal bearing The engine is coupled to the vehicle through a widerange continuously variable transmission, which utilizes gearing and a variable-ratio metal compression belt A response assist flywheel is used to achieve acceptable levels of engine response The package offers a 100 lb weight advantage in a Chrysler K Car front-wheel-drive installation Initial layout studies, preliminary transient thermal analysis, ceramic inner housing structural analysis, and detailed performance analysis were carried out for the basic engine S L

N82-12446*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
MAGNETOHYDRODYNAMICS (MHD) ENGINEERING TEST FACILITY (ETF) 200 MWe POWER PLANT. DESIGN REQUIREMENTS DOCUMENT (DRD) Final Report
H S Rigo, R W Bercaw, J A Burkhart, T S Mroz, D J Bents, and A M Hatch (MIT) Sep 1981 88 p refs Revised
(Contract DE-AI01-77ET-10769)
(NASA-TM-82705, DOE/NASA/10769-20-Rev-3) Avail NTIS HC A05/MF A01 CSCL 10B

A description and the design requirements for the 200 MWe (nominal) net output MHD Engineering Test Facility (ETF) Conceptual Design, are presented. Performance requirements for the plant are identified and process conditions are indicated at interface stations between the major systems comprising the plant Also included are the description, functions, interfaces and requirements for each of these major systems The lastest information (1980-1981) from the MHD technology program are integrated with elements of a conventional steam electric power generating plant M D K

N82-12537# Aeronautical Research Inst of Sweden, Stockholm
A TWO-DIMENSIONAL STUDY OF THE MAXIMUM POWER THAT CAN BE OBTAINED FROM A WIND TURBINE IN A WIND SHEAR LAYER
Bo C A Johansson Apr 1981 60 p refs
(FFA-134) Avail NTIS HC A04/MF A01

A two dimensional study, where the undisturbed velocity field is given and allowed to vary arbitrarily vertically, and the location of the wind turbine is given, is presented The maximum power is calculated by the method of calculus of variations The maximum power of common wind velocity profiles is only slightly larger than the power, which is obtained by a constant relative wind speed retardation, while for a linear velocity profile there is a considerable difference S L

N82-12570*# Gilbert/Commonwealth, Reading, Pa
MAGNETOHYDRODYNAMICS (MHD) ENGINEERING TEST FACILITY (ETF) 200 MWe POWER PLANT. CONCEPTUAL DESIGN ENGINEERING REPORT (CDER). VOLUME 1: EXECUTIVE SUMMARY Final Report
Sep 1981 48 p
(Contracts DEN3-224, DE-AI01-77ET-10769)
(NASA-CR-165452-Vol-1, DOE/NASA-0224/1-Vol-1) Avail NTIS HC A03/MF A01 CSCL 10B

Main elements of the design are identified and explained, and the rationale behind them was reviewed Major systems and plant facilities are listed and discussed Construction cost and schedule estimates are presented, and the engineering issues that should be reexamined are identified The latest (1980-1981) information from the MHD technology program is integrated with the elements of a conventional steam power electric generating plant T M

N82-12572*# United Technologies Corp., South Windsor, Conn Power Systems Div
LOW NO SUB X HEAVY FUEL COMBUSTOR CONCEPT PROGRAM Final Report, 23 Oct. 1979 - Jul. 1981
Paul Russell, George Beal, and Bruce Hinton 15 Oct 1981 99 p refs Prepared in cooperation with Pratt and Whitney Aircraft, East Hartford, Conn
(Contracts DEN3-149, DE-AI01-77ET-13111)
(NASA-CR-165512, DOE/NASA/0149-1, QTR-3236) Avail NTIS HC A05/MF A01 CSCL 10B

A gas turbine technology program to improve and optimize the staged rich lean low NOx combustor concept is described Subscale combustor tests to develop the design information for optimization of the fuel preparation, rich burn, quick air quench, and lean burn steps of the combustion process were run The program provides information for the design of high pressure full scale gas turbine combustors capable of providing environmentally clean combustion of minimally of minimally porcessed and synthetic fuels It is concluded that liquid fuel atomization and mixing, rich zone stoichiometry, rich zone liner cooling, rich zone residence time, and quench zone stoichiometry are important considerations in the design and scale up of the rich lean combustor E A K

N82-12590# Purdue Univ., Lafayette, Ind School of Electrical Engineering
SECURITY ASSESSMENT OF POWER SYSTEMS INCLUDING ENERGY STORAGE AND WITH THE INTEGRATION OF WIND ENERGY Progress Report, 1 Apr. - 30 Jun. 1981
D P Carroll and P C Krause Jul 1981 17 p
(Contracts DE-AS02-77ET-29100, EC-77-S-02-4206)
(DE81-030166, DOE/ET-29100/T1) Avail. NTIS HC A02/MF A01

Methods of Resynchronizing wind turbine generators, and performance of wind turbines in a turbulent atmosphere, were discussed The work on reduced order modeling by SEPI is reported Aggregation techniques which have been formulated are validated DOE

N82-12591# Sandia Labs, Albuquerque, N Mex Advanced Energy Project Div

VERTICAL-AXIS WIND-TURBINE CONTROL STRATEGY

Gerald M McNerney Aug 1981 21 p refs
(Contract DE-AC04-76DP-00789)
(DE81-031932, SAND-81-1156) Avail. NTIS HC A02/MF A01

Early expense in automatic operation of the Sandia 17-m vertical axis research wind turbine (VAWT) demonstrated the need for a systematic study of control algorithms To this end, a computer model was developed that uses actual wind time series and turbine performance data to calculate the power produced by the Sandia 17-m VAWT operating in automatic control The model was used to investigate the influence of starting algorithms on annual energy production The results indicate that, depending on turbine and local wind characteristics, a bad choice of a control algorithm can significantly reduce overall energy production The model can be used to select control algorithms and threshold parameters that maximize long-term energy production DOE

N82-12592# COECORP, Mountain View, Calif

INVESTIGATION AND RESEARCH OF SPECIFIC COMBUSTION-TURBINE AND COMBINED-CYCLE FIELD PROBLEMS Annual Report

Aug 1981 62 p Prepared in cooperation with Aptech Engineering Services, Inc Sponsored by Electric Power Research Inst
(EPRI Proj 1802)
(DE81-904231, EPRI-AP-1981) Avail NTIS HC A04/MF A01

Specific combustion turbine and combined cycle field problems are discussed These are (1) fuel filter plugging, (2) apparent compressor surge, (3) oily waste water, (4) compressor wheel failure, and (5) combustor problems Results of research efforts are outlined DOE

N82-12634# Edgerton, Germeshausen and Grier, Inc, Idaho Falls, Idaho

INNOVATIVE EQUIPMENT FOR SMALL-SCALE HYDRO DEVELOPMENTS

J D Lawrence and Leslie Pereira 1981 17 p refs Presented at the Waterpower Conf, Washington, D C, 22 Jun 1981 Prepared in cooperation with Acres American, Inc, Buffalo, N Y
(Contract DE-AC07-76ID-01570)
(DE81-027820, EGG-M-03381, CONF-8106137-4) Avail NTIS HC A02/MF A01

The feasibility of using off the shelf pumps as turbines, with induction motors as generators, and combinations of available equipment such as speed increasers, inlet valves, and gates for typical small scale hydro installations are discussed A computer simulation model was developed in the study which provides a basis to estimate the performance of pumps in the turbine mode of operation It is indicated that a major part of the small hydro plant potential can be economically covered by the use of pumps as turbines and induction motors as generators especially for the smaller ratings DOE

N82-12648# Joint Publications Research Service, Arlington, Va

GERMAN-ARGENTINE EXPERIMENT: VERTICAL-ROTOR WIND ENGINE

Peter Raabe *In its* W Europe Rept Sci and Technol, No 72 (JPRS-78876) 1 Sep 1981 p 18-19 Transl into ENGLISH from Tagesspiegel (Berlin), 4 Jul 1981 p 12

Avail NTIS HC A03/MF A01

Designed by aerodynamists, a wind motor built in Patagonia, is independent of the direction of the wind due to its vertical rotating axis The narrow rotor blades have optimum aerodynamic efficiency Drum-like wind collectors at the top and bottom of the rotating axis serve as starters The plant incorporates simple instead of sophisticated mechanical parts, and its maintenance requirements are extremely low Only the two rotating bearings located at the top and bottom of the axis require lubrication, with the oil being changed only twice a year A R H

N82-12943*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio

END REGION AND CURRENT CONSOLIDATION EFFECTS UPON THE PERFORMANCE OF AN MHD CHANNEL FOR THE ETF CONCEPTUAL DESIGN

S Y Wang and J Marlin Smith [1981] 9 p refs To be presented at the 20th Aerospace Sci Conf, Orlando, Fla, 11-14 Jan 1982, sponsored by AIAA
(Contract DE-AI01-77ET-10769)
(NASA-TM-82744, DOE/NASA/10769-22, E-1057) Avail NTIS HC A02/MF A01 CSCL 20I

The effects of MHD channel end regions on the overall power generation were considered The peak plant thermodynamic efficiency was found to be slightly lower than for the active region (41%) The channel operating point for the peak efficiency was shifted to the supersonic mode (Mach No, M sub c approx 1 1) rather than the previous subsonic operation (M sub c approx 0 9) The sensitivity of the channel performance to the B-field, diffuser recovery coefficient, channel load parameter, Mach number, and combustor pressure is also discussed In addition, methods for operating the channel in a constant-current mode are investigated This mode is highly desirable from the standpoint of simplifying the current and voltage consolidation for the inverter system This simplification could result in significant savings in the cost of the equipment The initial results indicate that this simplification is possible, even under a strict Hall field constraint, with resonable plant thermodynamic efficiency (40 5%) N W

N82-13013*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

TEST RESULTS AND FACILITY DESCRIPTION FOR A 40-KILOWATT STIRLING ENGINE Final Report

Gary G Kelm, James E Cairelli, and Robert J Walter Jun 1981 47 p refs
(Contract DE-AI01-77CS-51040)
(NASA-TM-82620, DOE/NASA/51040-27, E-871) Avail. NTIS HC A03/MF A01 CSCL 10B

A 40 kilowatt Stirling engine, its test support facilities, and the experimental procedures used for these tests are described Operating experience with the engine is discussed, and some initial test results are presented S L

N82-13114*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

THE EFFECT OF ROTOR BLADE THICKNESS AND SURFACE FINISH ON THE PERFORMANCE OF A SMALL AXIAL FLOW TURBINE

Richard J Roelke and Jeffrey E Haas 1982 13 p refs Proposed for presentation at the Gas Turbine Ann Meeting, London, 18-22 Apr 1982, sponsored by ASME Prepared in cooperation with Army Aviation Research and Development Command, Cleveland
(Contract DE-AI01-77CS-51040)
(NASA-TM-82726, DOE/NASA/51040-34, TR-81-C-29) Avail NTIS HC A02/MF A01 CSCL 21E

An experimental investigation was conducted to determine the effect of blade profile inaccuracies and surface finish on the aerodynamic performance of a 11 13 cm tip diameter turbine The as-received cast rotor blades had a significantly thicker profile than the design intent and a fairly rough surface finish Stage test results showed an increase of one point in efficieny by smoothing the surface finish and another three points by thinning the blade profiles to near the design profile Most of the performance gain between the as-cast thick and the thinned rotor blades both with the same surface finish, was attributed to reduced trailing edge losses of the recontoured blades Author

N82-13367# Tennessee Univ Space Inst, Tullahoma Energy Conversion Div

TWO-DIMENSIONAL EFFECTS IN POWER TAKE-OFF REGION

M Isnikawa and Y C L Wu May 1981 29 p refs
(Contract DE-AC02-79ET-10815)
(DE82-000091, DOE/ET-10815/55) Avail NTIS HC A03/MF A01

A two-dimensional analytical model of the power take-off (PTO) region of a diagonal conducting wall MHD generator is presented and compared with experimental results Reasonable agreement was found in both voltage and current distributions from the two-dimensional analysis, while similar comparison of experimental data with one-dimensional calculations with experiments was not satisfactory Power take-off from mid-channel was also investigated It was found that larger current was carried by these electrodes In addition, large circulating current was found in the sidewalls resulting from diagonalization Therefore ballast resistors are required to equalize the current A general PTO resistor design was proposed Trade-off considerations

between power output and protection of over-current were made DOE

N82-13386*# *Jet Propulsion Lab., California Inst of Tech.*, Pasadena
EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF A FLUIDIC POWER GENERATOR
V Sarohia, L Bernal, and R B Beauchamp 15 Nov 1981 81 p refs
(Contract NAS7-100)
(JPL-Pub-81-100) Avail NTIS HC A05/MF A01 CSCL 20D

A combined experimental and analytical investigation was performed to understand the various fluid processes associated with the conversion of flow energy into electric power in a fluidic generator Experiments were performed under flight-simulated laboratory conditions and results were compared with those obtained in the free-flight conditions It is concluded that the mean mass flow critically controlled the output of the fluidic generator Cross-correlation of the outputs of transducer data indicate the presence of a standing wave in the tube, the mechanism of oscillation is an acoustic resonance tube phenomenon A linearized model was constructed coupling the flow behavior of the jet, the jet-layer, the tube, the cavity, and the holes of the fluidic generator The analytical results also show that the mode of the fluidic power generator is an acoustical resonance phenomenon with the frequency of operation given by f approx = a/4L, where f is the frequency of jet swallowing, a is the average speed of sound in the tube, and L is the length of the tube Analytical results further indicated that oscillations in the fluidic generator are always damped and consequently there is a forcing of the system in operation M D K

N82-13451# California Univ Los Angeles School of Engineering and Applied Science
ASYMMETRIC STRESS AND FAILURE ANALYSIS
J Yu and R Westmann [1981] 6 p refs
(Contract DE-AT03-76SF-74016)
(DE81-026842, DOE/SF-74016/T3) Avail NTIS HC A02/MF A01

The cladding failure due to asymmetric structural response of the fuel cell is studied The fracture and cracking patterns prior to the development of fuel-cladding contact and the forces in the cladding after fuel-cladding contact has been made are investigated DOE

N82-13490*# Engelhard Industries, Inc., Edison, N J
DEVELOP AND TEST FUEL CELL POWERED ON-SITE INTEGRATED TOTAL ENERGY SYSTEM. PHASE 3: FULL-SCALE POWER PLANT DEVELOPMENT Quarterly Report, Feb. - Apr. 1981
A Kaufman 24 Jun 1981 50 p
(Contract DEN3-241)
(NASA-CR-165328, DOE/NASA/0241-1, QR-1) Avail NTIS HC A03/MF A01 CSCL 10B

An integrated 5 kW power system based upon methanol fuel and a phosphoric acid fuel cell operating at about 473 K is described Description includes test results of advanced fuel cell catalysts, a semiautomatic acid replenishment system and a completed 5 kW methanol/system reformer The results of a preliminary system test on a reformer/stack/inverter combination are reported An initial design for a 25 kW stack is presented Experimental plans are outlined for data acquisition necessary for design of a 50 kW methanol/steam reformer Activities related to complete mathematical modelling of the integrated power system, including wasteheat utilization, are described E A K

N82-13507*# Case Western Reserve Univ., Cleveland, Ohio.
TRANSIENT CATALYTIC COMBUSTOR MODEL Final Report
James S Tien May 1981 87 p refs
(Grant NsG-3230, Contract DE-AI01-77CS-51040)
(NASA-CR-165324, DOE/NASA/3230-1) Avail. NTIS HC A05/MF A01 CSCL 10B

A quasi-steady gas phase and thermally thin substrate model is used to analyze the transient behavior of catalytic monolith combustors in fuel lean operation The combustor response delay is due to the substrate thermal inertia Fast response is favored by thin substrate, short catalytic bed length, high combustor inlet and final temperatures, and small gas channel diameters The calculated gas and substrate temperature time history at different axial positions provides an understanding of how the catalytic combustor responds to an upstream condition change. The computed results also suggest that the gas residence times in the catalytic bed in the after bed space are correlatable with the nondimensional combustor response time The model also performs steady state combustion calculations; and the computed steady state emission characteristics show agreement with available experimental data in the range of parameters covered. A catalytic combustor design for automotive gas turbine engine which has reasonably fast response (< 1 second) and can satisfy the emission goals in an acceptable total combustor length is possible S L.

N82-13510*# Acurex Corp., Mountain View, Calif Energy and Environmental Div.
DEVELOPMENT OF A HIGH-TEMPERATURE DURABLE CATALYST FOR USE IN CATALYTIC COMBUSTORS FOR ADVANCED AUTOMOTIVE GAS TURBINE ENGINES Final Report
H Tong, G C Snow, E. K Chu, R L. S Chang, M J Angwin, and S L. Pessagno Sep 1981 169 p refs
(Contracts DEN3-83, DE-AI01-77CS-51040)
(NASA-CR-165396, DOE/NASA/0083-1) Avail. NTIS HC A08/MF A01 CSCL 10B

Durable catalytic reactors for advanced gas turbine engines were developed Objectives were, to evaluate furnace aging as a cost effective catalytic reactor screening test, measure reactor degradation as a function of furnace aging, demonstrate 1,000 hours of combustion durability, and define a catalytic reactor system with a high probability of successful integration into an automotive gas turbine engine Fourteen different catalytic reactor concepts were evaluated, leading to the selection of one for a durability combustion test with diesel fuel for combustion conditions Eight additional catalytic reactors were evaluated and one of these was successfully combustion tested on propane fuel This durability reactor used graded cell honeycombs and a combination of noble metal and metal oxide catalysts The reactor was catalytically active and structurally sound at the end of the durability test E A K

N82-13515# Electric Power Research Inst., Palo Alto, Calif Steam Generator Project Office
WORKSHOP PROCEEDINGS: U-BEND TUBE CRACKING IN STEAM GENERATORS
Carl E Shoemaker, ed Jun. 1981 343 p refs Workshop held at Denver, 20-21 Aug. 1980
(DE81-903765; EPRI-WS-80-136; CONF-8008122) Avail. NTIS HC A15/MF A01

A design to reduce the rate of tube failure in high pressure feedwater heaters, a number of failed drawn and stress relieved Monel 400 U-bend tubes removed from three high pressure feedwater heaters was examined. Steam extracted from the turbine is used to preheat the boiler feedwater in fossil fuel fired steam plants to improve thermal efficiency. This is accomplished in a series of heaters between the condenser hot well and the boiler The heaters closest to the boiler handle water at high pressure and temperature Because of the severe service conditions, high pressure feedwater heaters are frequently tubed with drawn and stress relieved Monel 400 DOE

N82-13519# Oregon State Univ., Corvallis Dept of Atmospheric Science
WIND POWER: RESEARCH ON NETWORK WIND POWER OVER THE PACIFIC NORTHWEST. EXECUTIVE SUMMARY Progress Report, Oct. 1979 - Sep. 1980
R W Baker and E W Hewson Oct 1980 23 p refs
(DE81-029360, DOE/BP-58) Avail. NTIS HC A02/MF A01

The research in FY-80 is composed of six primary tasks. These tasks include data collection and analysis, wind flow studies around an operational wind turbine generator (WTG), kite anemometer calibration, wind flow analysis and prediction, the Klickitat County small wind energy conversion system (SWECS) program, and network wind power analysis The data collection and analysis task consists of four sections, three of which deal with wind flow site surveys and the fourth with collecting and analyzing wind data from existing data stations DOE

N82-13526# South Carolina Energy Research Inst., Columbia
RESIDUAL-ENERGY-APPLICATION PROGRAM: EAST FACILITY REQUIREMENTS DOCUMENT, VOLUME 1
P W Yngve, F H Zander, and F J McCrosson 31 Jul 1981 85 p refs

(Contract DE-AC09-77ET-12866)
(DE81-027536, DOE/ET-12866/8-Vol-1) Avail NTIS HC A05/MF A01

The objectives of the EAST Facility are to perform research and development on heat energy recovery and conversion equipment, establish high confidence in system performance, system availability, and system operating, maintenance, and material costs, and provide a national competence in technologies required for the installation and operation of heat recovery systems An initial testing capability recommended for EAST is presented and design specifications are provided for the physical plant and major test support systems Five options are included for tailoring the full-up testing capability to reduce costs of the core facility T M

N82-13550 Stanford Univ , Calif
ELECTRICAL EFFECTS OF SLAG IN A DIFFUSE MODE MAGNETOHYDRODYNAMIC GENERATOR Ph.D. Thesis
Ron Michael Nelson 1981 181 p
Avail: Univ. Microfilms Order No 8124118

A high temperature (1900 K) platinum-rhodium capped magnesia electrode was developed and successfully tested in a slagging MHD generator Diffuse mode (non-arcing) operation of high temperature anodes was achieved at current densities up to 3 amps sq cm2 The problem of cathode shorting caused by the ionic nature of slag electrical conductivity (with iron as the major mobile species) was not substantially alleviated by high temperature operation A computer code was developed which solves the governing electrical equations along with slag energy and thickness equations for a two dimensional, periodic electrode pair in a slagging MHD generator The numerical results compare favorably with the experimental results including cases with shorted cathode walls The computer model was used to assess the effects of slag and other operating parameters on generator performance Dissert Abstr

N82-13926# Mississippi State Univ , Mississippi State MHD Energy Center
TESTING AND EVALUATION OF MHD MATERIALS AND SUBSTRUCTURES Final Technical Report, Apr. 1976 - Jun. 1981
Jun 1981 204 p refs
(Contract DE-AC01-76ET-10785)
(DE81-024331, DOE/ET-10785/T1) Avail NTIS HC A10/MF A01

Stand that can simulate the environment in any of the various substructures of a coal fired baseline MHD power plant After construction was completed, shakedown tests were performed, and the Test Stand was used in a series of tests to simulate the gas stream composition and temperature conditions in the baseline plant's radiant boiler The tests were conducted in order to study the effect of stoichiometry and staged combustion on the generation of nitrogen oxide A computer based monitoring and control system was developed that provides safe Test Stand operation, controls the critical parameters, and accurately measures, displays, and logs the necessary physical data Several computer programs were developed to determine the thermal performance of the Test Stand, and several models were developed to predict the thermal performance of the Test Stand with bare walls and with slag coated walls, and to determine the gas stream properties as a function of temperature and pressure. DOE

N82-13983# Galaxy, Inc , Washington, D C
UPDATE ON SPECIFIED EUROPEAN R AND D EFFORTS. PART 1: APPENDICES
Oct. 1980 117 p Partly in ENGLISH, partly in GERMAN
(Contract DE-AC03-79SF-10538)
(DE81-026404, DOE/SF-10538/T10) Avail NTIS HC A06/MF A01

Progress and update on specified European R and D are reported. The following topics are discussed blueburner test with different swirl spray nozzles, aerodynamics of a flat nonswirl blue flame, and large industrial blue flame burners, manufacturer's design and performance literature for the 2500 to 3500 KW KG5 gas turbine, the Kongsberg 1500 to 2000 kVA generating set, the 500 to 700 kVA generating set, the KG 831 gas turbine generating set, the KG 2 gas turbine, and selection criteria for gas turbines for emergency power supplies, and high temperature corrosion and carburization and silicon coatings as high temperature corrosion protection for gas turbine blades DOE

N82-14520# Massachusetts Inst of Tech , Cambridge National Magnet Lab
CONCEPTUAL DESIGN OF SUPERCONDUCTING MAGNET SYSTEM FOR MAGNETOHYDRODYNAMIC (MHD) ENGINEERING TEST FACILITY (ETF) 200 MWe POWER PLANT Final Report
Nov 1981 259 p refs
(Grant NAG3-100)
(NASA-CR-165053, FBNML-NAS-E-2) Avail NTIS HC A12/MF A01 CSCL 14B

A super conducting magnet system conceptual design to meet the requirements of a magnetohydrodynamic test facility power train is presented A detailed description of the magnet is accompanied by numerous engineering drawings Functional requirements, system interfaces, and design criteria are reviewed System limits, safety precautions, operational procedures, and maintenance procedures are discussed R J F

N82-14633*# National Aeronautics and Space Administration Lewis Research Center, Cleveland Ohio
ALUMINUM BLADE DEVELOPMENT FOR THE MOD-0A 200-KILOWATT WIND TURBINE Final Report
Bradford S Linscott, Richard K Shaltens, and A G Eggers (Westinghouse Electric Corp , Pittsburg) Dec 1981 43 p refs
(Contract DE-AB29-76ET-20370)
(NASA-TM-82594, DOE/NASA-20370/20) Avail NTIS HC A03/MF A01 CSCL 10A

The rotor blade configuration, fabrication methods, analyses, operating experience, design modifications, and cost are described Each 60-ft -(18 3-m-) long aluminum blade used current aircraft fixed wing and rotary wing design and fabrication technologies Structural damage, repairs, and modifications that occurred during 6500 hours of operation are summarized T M

N82-14642# United Technologies Corp , South Windsor, Conn Power Systems Div
INVESTIGATION OF THE IN-SITU OXIDATION OF METHANOL IN FUEL CELLS Final Report, Jun. 1980 - May 1981
D A Landsman and F J Luczak Sep 1981 32 p refs
(Contract DAAK70-80-C-0049, DA Proj 1L1-61102-AH-51)
(AD-A105947, FCR-3463) Avail NTIS HC A03/MF A01 CSCL 10/2

Direct anodic oxidation and internal reforming were examined as ways of using methanol as fuel in a phosphoric acid fuel cell The literature was reviewed to identify the most effective catalysts for the direct electrochemical oxidation of methanol It is shown that, even with the best of these catalysts, anode polarization at practical current densities is 300 mV higher on methanol than on hydrogen It was also found that unreacted methanol which diffuses across the cell can cause severe polarization of the cathode Theoretical and experimental studies of internal reforming showed that a fuel cell will generate sufficient waste heat to sustain the methanol steam reforming reaction Thus, thermally integrated, internal reforming is a feasible alternative to external reforming The reforming catalyst is preferably located in separate chambers built into the stack, since this prevents phosphoric acid from attacking the reforming catalyst and methanol from migrating to the cathode Author (GRA)

N82-14666# Bonn Univ (West Germany) Inst fuer Physikalische Chemie
ELECTRODES AND DIAPHRAGMS FOR FUEL CELLS Final Report, Dec. 1979
Wolf Vielstich and Ernst Knauf Bundesministerium fuer Forschung und Technologie Feb 1981 45 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-047, ISSN-0340-7608) Avail NTIS HC A03/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 9.50

Nickel whisker electrodes with variations in network structure, pore size, and metal coatings were produced for use in water electrolytic cells and fuel cells The resistance due to gas bubbles was decreased considerably by slits milled into the electrode Platinization was optimized for use in glycol/air cells and glycol anodes with constantly good anode potentials were obtained with whisker structures by standardization of the platinization process It is concluded that the activity of the glycol anodes depends strongly on the procedure of deposition of the noble metals and less on the whisker structure as such Author (ESA)

N82-15454# Los Alamos Scientific Lab., N Mex
FAILURE MODE ANALYSIS USING STATE VARIABLES DERIVED FROM FAULT TREES WITH APPLICATION
Robert J Bartholomew 1981 11 p refs Presented at the ANS/ENS Topical Meeting on Probabilistic Risk Assessment, Port Chester, N.Y., 20-24 Sep 1981
(Contract W-7405-eng-36)
(DE81-030239, LA-UR-81-2595, CONF-810905-3) Avail NTIS HC A02/MF A01

Fault Tree Analysis (FTA) is used extensively to assess both the qualitative and quantitative reliability of engineered nuclear power systems employing many subsystems and components FTA is very useful, but the method is limited by its inability to account for failure mode rate of change interdependencies (coupling) of statistically independent failure modes The state variable approach (using FTA derived failure modes as states) overcomes these difficulties and is applied to the determination of the lifetime distribution function for a heat pipe thermoelectric nuclear power subsystem Analyses are made using both Monte Carlo and deterministic methods and compared with a Markov model of the same subsystem. DOE

N82-15527*# Burns and Roe, Inc., Woodbury, N Y
MHD OXIDANT INTERMEDIATE TEMPERATURE CERAMIC HEATER STUDY Final Report
A W. Carlson, I L Chait, D. P Saari, and C. L Marksberry Sep 1981 199 p refs Prepared in cooperation with Fluidyne Engineering Corp
(Contract DEN3-107, DE-AI01-77ET-10769)
(NASA-CR-165453, DOE/NASA-0107/3) Avail. NTIS HC A09/MF A01 CSCL 10A

The use of three types of directly fired ceramic heaters for preheating oxygen enriched air to an intermediate temperature of 1144K was investigated The three types of ceramic heaters are (1) a fixed bed, periodic flow ceramic brick regenerative heater, (2) a ceramic pebble regenerative heater The heater design, performance and operating characteristics under conditions in which the particulate matter is not solidified are evaluated. A comparison and overall evaluation of the three types of ceramic heaters and temperature range determination at which the particulate matter in the MHD exhaust gas is estimated to be a dry powder are presented E A K.

N82-15561# Sandia Labs., Albuquerque, N Mex.
PROJECT DEEP STEAM: FOURTH MEETING OF THE TECHNICAL ADVISORY PANEL
R L. Fox, A B Donaldson, S W Eisenhawer, C M Hart, D. R Johnson, A J Mulac, J R Wayland, and L. J Weirick Jul. 1981 104 p Proceedings of Meeting held at Albuquerque, N Mex., 4-5 Nov 1980
(Contract DE-AC04-76DP-00789)
(DE81-029457, SAND-81-0043) Avail: NTIS HC A06/MF A01

The status of project DEEP STEAM was reviewed. Proceedings, are divided into five main sections (1) the injection string modification program, (2) the downhole steam generator program, (3) supporting activities, (4) field testing; and (5) recommendations and discussion DOE

N82-15580# Midwest Research Inst., Golden, Colo Solar Energy Research Inst
OVERVIEW AND FY 1981 PROGRESS ON OPEN-CYCLE OTEC POWER SYSTEMS
T R Penney and B Shelpuk Aug 1981 7 p refs Presented at the Oceans Conf., Boston, 19-21 Sep 1981
(Contract EG-77-C-01-4042)
(DE81-029277, SERI/TP-634-1282, CONF-810911-3) Avail: NTIS HC A02/MF A01

Progress in an advanced research and development program studying viable alternatives to closed cycle OTEC is reported Work on a 100 MWe steam turbine, heat exchangers, and deaeration for Claude or open cycle OTEC systems are reported Capsule descriptions of ocean energy conversion techniques are given, including wave energy conversion, ocean current energy conversion, and salinity gradient energy conversion as well as varieties of ocean thermal energy conversion DOE

N82-15893# Department of Energy, Washington, D. C Office of Energy Research.
TECHNOLOGY OF CONTROLLED NUCLEAR FUSION
F. H Tenney, ed. and C C Hopkins, ed Jul. 1981 644 p refs Proceedings of the 4th ANS Topical Meeting held at King of Prussia, Pa., 14-17 Oct 1980 Sponsored in part by DOE, Washington, D.C and EPRI
(DE81-027361, CONF-801011-Vol-3) Avail. NTIS HC A99/MF A01

An assessment of magnetically confined fusion power reactors, their technological use and applications, is made The key engineering areas studied relate to: thermomechanics, thermohydraulics, electromagnetics, nucleonics, systems engineering, assembly, maintenance, repair, instrumentation and control of reactors and reactor materials The subjects of safety factors, laser applications, and wall design are also addressed. M.D K.

06
ENERGY TRANSPORT, TRANSMISSION, AND DISTRIBUTION

Includes transport of fuels by pipelines, tubes, etc., microwave power transmission, and superconducting power transmission.

A82-10806 **Heat Transfer - Milwaukee 1981; Proceedings of the Twentieth National Heat Transfer Conference, Milwaukee, WI, August 2-5, 1981.** Conference sponsored by the American Institute of Chemical Engineers and American Society of Mechanical Engineers Edited by R P Stein (Argonne National Laboratory, Argonne, IL) *AIChE Symposium Series*, vol 77, no 208, 1981 435 p

Aspects of direct contact heat transfer are considered along with transport phenomena in fusion reactors, enhanced nucleate boiling, flow boiling, heat transfer in non-Newtonian systems, two-phase systems, heat transfer in fossil fuel conversion systems, process heat transfer, thermal and hydraulic behavior in rod and tube bundles, and two-phase systems in rod and tube bundles Attention is also given to solar energy heat transfer, heat transfer in fluidized beds, and fire and combustion fundamentals, taking into account thermal stress oscillations induced by dynamic instabilities in radiation-heated boiler tubes, convection losses from a cavity receiver, numerical solutions of turbulent models for flow over a flat plate with angle of attack, and the heat transfer from smooth horizontal tubes immersed in gas fluidized beds A description is provided of aspects of turbulent combustion modelling, the exhaust gas emission from a swirl stabilized combustor, the analytical solution for diffusion in the core of a droplet with internal circulation, and the radiant ignition of a thin combustible solid G R

A82-11743 * # **Solar power satellite microwave power transmission and reception system.** W Finnell (NASA, Marshall Space Flight Center, Huntsville, AL). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 266-271. 10 refs.

The microwave power transmission and reception system of the Satellite Power System (SPS) has been intensively reviewed and assessed in a three-year concept development and evaluation program. This paper will review some concepts of SPS with particular emphasis on the design of the microwave power transmission and reception system. Technology requirements and proposals for meeting them will be discussed for various parts of the microwave system and to some degree for critical components such as power amplifiers. Specific subjects to be discussed are SPS concepts, antenna design, phase control, rectenna, and technology. (Author)

A82-11744 * # **Antenna optimization and cost consideration for the Solar Power Satellite microwave system.** E M Kerwin, J. H. Suddath, and G. D. Arndt (NASA, Johnson Space Center, Houston, TX). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 272-277 10 refs.

The sizing, criteria, cost analysis, and optimized taper of the Solar Power Satellite (SPS) transmitting antenna are discussed. The sizing parameters considered were a thermal limit of 23 kW/sq m in the antenna, a peak power density of 23 mW/sq cm in the ionosphere, and cost effectiveness. Cost schedules and equations are presented for the SPS, and four antenna tapers are analyzed and compared, including the reference 10 dB Gaussian taper. An even powered quadratic series is formulated to minimize electricity cost and stay within thermal and ionospheric power level limits. The optimized Johnson Space Center taper is found to display the lowest energy costs, 4% below the 10 dB Gaussian, and can deliver 5.69 GW at 45.4 mills/kWh to the grid Further studies are indicated for the optimal antenna and rectenna sizes. M.S.K.

A82-11746 # **Applications of power beaming from space-based nuclear power stations.** J. R. Powell, T E Botts (Brookhaven National Laboratory, Upton, NY), and A. Hertzberg (Washington, University, Seattle, WA). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1 New York, American Society of Mechanical Engineers, 1981, p 288-295 10 refs. Research supported by the U.S. Department of Energy.

Power beaming from space-based nuclear reactors to earth, aircraft, or spacecraft is offered as an alternative to the SPSS A rotating bed reactor (RBR) is described, in which the nuclear fuel is an annular bed of small particulates held in a rotating basket through which a coolant passes. Advantages over a previous nuclear rocket program, NERVA, are given as minimized size, external moderation and reflection, and several GW available from a reactor about one cu m in size Testing of a model fluidized bed is described, noting favorable results from U-233 fuel, a projected 50 cm diam bed, and total mass of 3 metric tons Two Brayton cycle generator systems are examined, and it is found that a turbine inlet temperature of 2,000 K and a simple Brayton cycle without regeneration yields a best efficiency of 30% The RBR components are discussed, and microwave and laser power beaming systems are compared, economic projections indicate laser beaming to cruising aircraft is competitive with current jet fuel use M S K

A82-12503 # **Microwave power transmission by satellites.** W. Keydel (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Hochfrequenztechnik, Oberpfaffenhofen, West Germany). In International Scientific Conference on Space, 21st, Rome, Italy, March 25, 26, 1981, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1981, p. 29-38. 16 refs.

The MPTS (microwave power transmission system) is examined with regard to the problems involved, the proposed solutions, the future outlook, and the necessity for further work. The MPTS is analyzed with regard to system considerations, design considerations (power transmission, frequency selection, power generation, the spacetenna, microwave-propagation problems, the rectenna, and efficiency), environmental impacts (electromagnetic compatibility and RF interference, and health and ecological effects). It is concluded that the MPTS is feasible, but that further studies are needed to optimize the system with respect to such factors as efficiency and environmental impact. B.J.

A82-12504 # **Mechanical and nonlinear effects in microwave power transmission.** G Franceschetti and I Pinto (Napoli, Università, Naples, Italy). In International Scientific Conference on Space, 21st, Rome, Italy, March 25, 26, 1981, Proceedings Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1981, p. 39-41. 11 refs.

The radiation recoil force arising in the spacetenna-rectenna link of a microwave power transmission system is discussed Consideration is also given to power-wasting nonlinear phenomena (harmonic generation) that could be excited by the microwave beam passing through the ionosphere Nonlinear effects that may occur in the spacetenna and rectenna are also examined. B J

A82-16991 **Space chamber experiments of ohmic heating by high power microwave from the Solar Power Satellite.** N. Kaya (Kobe University, Kobe, Japan) and H. Matsumoto (Kyoto University, Uji, Japan) *Geophysical Research Letters*, vol. 8, Dec 1981, p. 1289-1292 9 refs.

The prediction is made that a high power microwave from the Solar Power Satellite (SPS) interacts nonlinearly with the ionospheric plasma. The possible nonlinear interactions comprise ohmic heating and self-focusing and parametric instabilities A laboratory experiment in a space plasma simulation chamber is carried out in order to examine ohmic heating in detail A significant microwave heating plasma up to 150% temperature increase is observed with little electron density decrease. It is shown that the temperature increase is not due to the RF breakdown but to the ohmic heating in the simulated ionospheric plasma C.R

A82-17127 The significance of hydrogen as future secondary energy carrier (*Die Bedeutung von Wasserstoff als zukunftiger* Sekundärenergieträger). J. Nitsch (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut fur technische Physik, Stuttgart, West Germany). *DFVLR-Nachrichten,* Nov. 1981, p 2-6. In German.

An analysis is conducted concerning the possibilities for satisfying future energy requirements. Different types of energy requirements are considered together with the various classes of fuels which are currently employed to satisfy these requirements, taking into account developments that are changing present relationships. An investigation is conducted of alternate possibilities for supplying needed secondary gaseous energy carriers. According to one of the considered possibilities, hydrogen is to be provided by processes based on a large-scale utilization of solar energy. The structure of a hydrogen economy is discussed and questions regarding the economics of a use of hydrogen are explored. It is concluded that an employment of hydrogen as energy carrier depends also with respect to economic considerations primarily on the cost of electric energy. A description of the advantages of a hydrogen economy is also provided. G.R.

A82-17976 **International Microwave Symposium, Los Angeles, CA, June 15-19, 1981, Proceedings.** Symposium sponsored by the Institute of Electrical and Electronics Engineers and International Union of Radio Science. Edited by R. L. Eisenhart (Hughes Aircraft Co., Culver City, CA). *IEEE Transactions on Microwave Theory and Techniques,* vol. MTT-29, Dec. 1981. 144 p.

Papers presented in this volume cover diverse areas related to microwaves, including semiconductor devices, medical applications, circuit design, propagation, field theory, power, surface acoustic waves, ferrites, and measurements. Papers are included on the hybrid mode analysis of microstrip lines on anisotropic substrates, horn image-guide leaky-wave antenna, status of the microwave power transmission components for the solar power satellites, and analysis of microstrip circuits coupled to dielectric resonators. V.L.

A82-17982 * **Status of the microwave power transmission components for the solar power satellite.** W. C. Brown (Raytheon Co., Microwave and Power Tube Div., Waltham, MA). *(Institute of Electrical and Electronics Engineers and International Union of Radio Science, International Microwave Symposium, Los Angeles, CA, June 15-19, 1981.) IEEE Transactions on Microwave Theory and Techniques,* vol. MTT-29, Dec. 1981, p. 1319-1327. 14 refs. Research supported by the U.S. Department of Energy and NASA.

During the 1970-1980 time period a substantial advance has been made in developing all portions of a microwave power transmission system for the solar power satellite (SPS). The most recent advances pertain to the transmitting portion of the system in the satellite and are based upon experimental observations of the use of the magnetron combined with a passive directional device to convert it into a highly efficient directional amplifier with excellent low-noise properties and potentially very long life. The ability of its microwave output to track a phase reference makes it possible to combine it with many other radiating units to provide a highly coherent microwave beam. The ability of its output to track an amplitude reference while operating from a dc power source with varying voltage makes it possible to eliminate most of the power conditioning equipment that would otherwise be necessary. (Author)

N82-11255# Pittsburg Energy Technology Center, Pa Combustion Technology Div
TRANSPORT CHARACTERISTICS OF ALTERNATE SLURRY FUELS Quarterly Technical Progress Report, Apr. - Jun. 1981
1981 5 p Sponsored by DOE
(DE81-028580, DOE/TIC-1028580) Avail NTIS HC A02/MF A01

Progress is reported in an effort to develop flow data for various alternate fuels, such as coal/water mixtures, in a pump loop which accurately simulates fuel feed systems found in boiler and furnace applications Instruments and procedures were selected for the measurement and correlation of pressure loss as a function of slurry characteristics and system design. An existing loop was redesigned by lengthening both the vertical and horizontal straight sections and by simplifying the tank discharge/pump suction inlet section to eliminate unnecessary bends or elbows Locations were selected for the pressure measurements, temperature measurements, flow measurements, and grab sample ports A data acquisition system was defined DOE

N82-12520# Skelly and Loy, Harrisburg, Pa
EVALUATION OF NOVEL UNDERGROUND TRANSPORT SYSTEMS Final Report
Jun 1981 134 p refs
(Contract DE-AC01-79ET-11268)
(DE81-030279, DOE/ET-11268/T3) Avail NTIS HC A07/MF A01

The feasibility of new or novel underground haulage equipment for transporting personnel and supplies is assessed to determine their relative impact on productivity and the cost per ton that is attributable to this segment of the mining operation Novel equipment in its current design can potentially alleviate many of the personnel and supply problems encountered in United States coal mines A review of rail haulage systems and European underground mining provided the basis for the introduction of three novel haulage systems monorail, floor-mounted trapped rail haulage, and chairlifts It was determined that monorail and floor-mounted trapped rail haulage systems exhibit the highest potential for domestic utilization Monorail haulage equipment along with conventional battery powered rubber-tired equipment and two rail haulage systems were theoretically applied to five different mine sizes Each system was then reviewed on an economic, operational, maintenance, and safety basis From each standpoint, the monorail compared favorably with the other haulage systems DOE

N82-12525# Battelle Columbus Labs, Ohio
EXTENSIBLE BRIDGE-CONVEYOR CONCEPTS FOR COAL-MINE FACE HAULAGE Final Technical Report
James C Swain, David L Thomas, and Edward C Mullen 1981 87 p
(Contracts DE-AC01-79ET-14210, DI-DM-JO-177051)
(DE81-031974, DOE/ET-14210/T1) Avail NTIS HC A05/MF A01

The objective was to develop design concepts for extensible bridge conveyors which can be used in multiples to form a continuous haulage system Consultation services were provided by Jeffrey Mining Machinery Division on mining technology and B F Goodrich Engineered Systems Division on conveyor belt technology Additional information was gathered in a mine visit, during visits to conveyor manufacturers, and contacts with several component suppliers Three extensible conveyor approaches were selected and machinery arrangement and internal detail drawings were prepared for each Two of the concepts are for a face haulage system in which separate nonconnected extensible conveyors are individually trammed into position to form a continuous haulage system The third concept is for a connected extensible system similar to existing continuous face haulage systems but employing extensible rather than fixed-length bridges Cost estimates were prepared for the three concepts The concepts developed employ belt-type conveyors, however, chain-type conveyors were considered to be a viable alternative DOE

N82-12538*# National Aeronautics and Space Administration Lyndon B Johnson Space Center, Houston, Tex
WORKSHOP ON MICROWAVE POWER TRANSMISSION AND RECEPTION. WORKSHOP PAPER SUMMARIES
1980 1366 p refs Workshop held in Houston, Tex., 15-18 Jan 1980 Document contains eight bound supplements
(NASA-TM-84064) Avail NTIS HC A99/MF A01 CSCL 10A

Microwave systems performance and phase control are discussed Component design and reliability are highlighted The power amplifiers, radiating elements, rectennas, and solid state configurations are described The proper sizing of microwave transmission systems is also discussed

N82-12539*# National Aeronautics and Space Administration Lyndon B Johnson Space Center, Houston, Tex
SYSTEM PERFORMANCE CONCLUSIONS
G D Arndt *In its* Workshop on Microwave Power Transmission and Reception 1980 p 1-12

Avail NTIS HC A99/MF A01 CSCL 10A

System sizing is discussed in terms of reduced power levels and antenna diameters smaller than 1 km The microwave transmission efficiency for smaller SPS systems was investigated Startup and shutdown operations were examined with emphasis on solar eclipse effects on the solar arrays The antennas and subarray mechanical alignments are also discussed T M

N82-12541*# Axiomatix, Los Angeles, Calif
AN ACTIVE ALIGNMENT SCHEME FOR THE MPTS ARRAY
Richard Iwasaki *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 26-31
Avail NTIS HC A99/MF A01 CSCL 10A

In order to maximize the efficiency of the microwave power transmission system (MPTS), the surface of the array antenna must be extremely flat, which is difficult to achieve using passive techniques over the 1 km dimensions of the array In order to achieve and maintain this required flatness, a rotating laser beam used for leveling applications on Earth was utilized as a reference system A photoconductive sensor with a reflective collecting surface was used to determine the displacement and polarity of any misalignment and automatically engage a stepping motor to drive a variable-length mechanism to make the necessary corrections Once aligned, little power is dissipated since a nulling bridge circuit that centers on the beam is used, an important alignment feature since even laser beams broaden considerably at 1 km distances T M

N82-12542*# Los Alamos Scientific Lab , N Mex
IONOSPHERIC POWER BEAM STUDIES
Lewis M Duncan and William E Gordon (Rice Univ) *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 32-43

Avail NTIS HC A99/MF A01 CSCL 10A

A power density level of 23 mW/sq cm is presented as a design specification based on theoretical calculations of a threshold *for microwave ionosphere nonlinear interaction (thermal runaway)* For comparable power densities, enhanced electron heating is observed to change the electron temperature by a factor of two or three, but not by an order of magnitude T M

N82-12543*# Emmanuel Coll , Boston, Mass
PROPOSED EXPERIMENTAL STUDIES FOR ASSESSING IONOSPHERIC PERTURBATIONS ON SPS UPLINK PILOT BEAM SIGNAL
Santimay Basu and Sunanda Basu *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 44-54 refs

(Contract F19628-78-C-0005, Grant NSF ATM-78-25264)
Avail NTIS HC A99/MF A01 CSCL 10A

The microwave beam of the proposed Solar Power Satellite (SPS) at geosynchronous altitude is to be formed and directed by phase information derived from a pilot signal at 2 45 GHz transmitted from ground and received in a number of module locations on the SPS antenna The frequency of the pilot signal was chosen to be sufficiently low as to avoid the effects of strong scattering by turbulence in the neutral atmosphere and yet high enough to avoid any possible reofractive effects caused by the ionized upper atmosphere The propagation of the uplink pilot signal through the ionosphere which contains natural and possibly some artificial irregularities, was studied T M

N82-12546*# LinCom Corp , Pasadena, Calif
COHERENT MULTIPLE TONE TECHNIQUE FOR GROUND BASED SPS PHASE CONTROL
C M Chie *In* NASA *Johnson Space Center Workshop on* Microwave Power Transmission and Reception 1980 p 85-94 refs
(Contract NAS9-15782)
Avail NTIS HC A99/MF A01 CSCL 10A

The ground based phase control concept was studied as an alternative approach to the reference SPS phase control system The details of the ground based phase control system study are documented The coherent multiple tone technique used for the ground based phase measurement waveform design and phase control system is summarized T M

N82-12547*# Novar Electronics Corp , Barberton, Ohio
AN INTERFEROMETER-BASED PHASE CONTROL SYSTEM
James H Ott and James S Rice *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 95-98 refs

Avail NTIS HC A99/MF A01 CSCL 10A

A system for focusing and pointing the SPS power beam is discussed The system is ground based and closed loop One receiving antenna is required on Earth A conventional uplink data channel transmits an 8-bit phase error correlation back to the SPS for sequential calibration of each power module Beam pointing resolution is better than 140 meters at the Rectenna T M

N82-12548*# Novar Electronics Corp , Barberton, Ohio
A SONIC SATELLITE POWER SYSTEM MICROWAVE POWER TRANSMISSION SIMULATOR
James H Ott and James S Rice *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 97-99 ref

Avail NTIS HC A99/MF A01 CSCL 10C

A simulator which generates and transmits a beam of audible sound energy mathematically similar to the SPS power beam is described The simulator provides a laboratory means for analysis of ground based closed loop SPS phase control and of ionospheric effects on the SPS microwave power beam T M.

N82-12549*# Boeing Aerospace Co , Seattle, Wash
SPS PHASE CONTROL STUDIES
W W Lund, B R Sperber, and G R Woodcock *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 100-109
Avail NTIS HC A99/MF A01 CSCL 10A

To properly point and form the SPS microwave power beam, the outputs of the power amplifiers in the transmitting array must be phased in a specific and coherent fashion The purpose of the SPB phase control system is to bring this about reliably A number of different phase control schemes were studied The one selected for the SPS baseline system is a retrodirective CW phase that is distributed via fiber optics The basis of this selection is relative technical simplicity and requisite assurance of success T M

N82-12550*# Boeing Aerospace Co , Seattle, Wash
SPS FIBER OPTIC LINK ASSESSMENT
T O Lindsay and Ervin J Nalos *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 110-114

Avail NTIS HC A99/MF A01 CSCL 10A

Fiber optic technology was selected in the SPS baseline design to transmit a stable phase reference throughout the microwave array Over a hundred thousand microwave modules are electronically steered by the phase reference signal to form the power beam at the ground receiving station The initially selected IF distribution frequency of the phase reference signal was set at 980 MHz or a submultiple of it Fiber optics offers some significant advantages in view of the SPS application Optical transmission is highly immune to EMI/RFI, which is expected to be severe when considering the low distribution power In addition, there will be savings in both mass, physical size, and potentially in cost T M

N82-12551*# Rockwell International Corp , Pittsburgh, Pa
IONOSPHERIC EFFECTS IN ACTIVE RETRODIRECTIVE ARRAY AND MITIGATING SYSTEM DESIGN
A K Nandi and C Y Tomita *In* NASA Johnson Space Center *Workshop on Microwave Power Transmission and Reception* 1980 p 115-125 refs
Avail NTIS HC A99/MF A01 CSCL 10A

The operation of an active retrodirective array (ARA) in an ionospheric environment (that is either stationary or slowly-varying) was examined The restrictions imposed on the pilot-signal structure as a result of such operation are analyzed A 3-tone pilot beam system is defined which first estimates the total electron content along paths of interest and then utilizes this information to aid the phase conjugator so that correct beam pointing can be achieved T M

N82-12552*# Boeing Aerospace Co., Seattle, Wash
HIGH EFFICIENCY SPS KLYSTRON DESIGN
Ervin J Nalos *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 127-136

Avail NTIS HC A99/MF A01 CSCL 10A

The most likely compact configuration to realize both high efficiency and high gain is a 5-6 cavity design focused by an electromagnet An outline of a potential klystron configuration is given The selected power output of 70 kW CW resulted from a maximum assumed operating voltage of 40 kV The basic klystron efficiency cannot be expected to exceed 70-75% without collector depression Although impressive gains were achieved in raising the basic efficiency from 50% to 70% or so with a multi-stage collector, the estimated efficiency improvement due to 5-stage collector at the 75% level is only about 8% resulting in an overall efficiency of about 83% T M

N82-12553*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
ANALYTIC INVESTIGATION OF EFFICIENCY AND PERFORMANCE LIMITS IN KLYSTRON AMPLIFIERS USING MULTIDIMENSIONAL COMPUTER PROGRAMS; MULTI-STAGE DEPRESSED COLLECTORS; AND THERMIONIC CATHODE LIFE STUDIES
H G Kosmahl *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 139-146 refs
Avail NTIS HC A99/MF A01 CSCL 10A

Due to complexity of the program which used a hydrodynamic, axially and radially deformable disk-ring model and the resulting long computing time only the output gap was investigated Results from independent studies were used to initiate the starting conditions for the electrons and the RF voltage using our program Although this method of computation is less exact than processing the entire klystron interaction in 3-Dimensions it is shown that, for a confined flow focused throughout the penultimate cavity, radial velocities remain very small and the beam is highly laminar It is concluded that possible errors resulting from treating only the output cavity in 3-D would remain small T M

N82-12554*# Raytheon Co., Waltham, Mass New Products Center
THE ADAPTING OF THE CROSSED-FIELD DIRECTIONAL AMPLIFIER TO THE REQUIREMENTS OF THE SPS Progress Report
William C Brown *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 147-155 refs
Avail NTIS HC A99/MF A01 CSCL 10A

Progress in adapting the crossed-field directional amplifier to the SPS is reviewed Special emphasis is given to (1) recent developments in controlling the phase and amplitude of the microwave power output, (2) a received architecture for its placement in the subarray, and (3) recent developments in the critical pivotal areas of noise, potential cathode life, and efficiency Author

N82-12555*# Boeing Aerospace Co., Seattle, Wash
SPS ANTENNA ELEMENT EVALUATION
C D Lunden, W W Lund, and Ervin J Nalos *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 158-165

Avail NTIS HC A99/MF A01 CSCL 10A

The SPS transmitting array requires an architecture which will provide a low weight, high efficiency and high structural rigidity Waveguide slot arrays constitute the most desirable option Consequently, such an array was chosen for the SPS Waveguide slot arrays offer high efficiency, uniform illumination, and are fairly lightweight Bandwidths of such arrays are narrow, typically 1/2-2% Although this does not directly impact the SPS, which transmits power at a single frequency of 2 45 GHz, the narrow bandwidth does constrain the thermal and mechanical tolerances of the antenna The purpose of this program is to better define the electronic aspects of an SPS specific waveguide slot array The specific aims of the program are as follows (1) To build a full-scale half-module, 10 stick, array, the design parameters for which are to be determined analytical considerations tempered by experimental data on a single slotted radiating stick, (2) To experimentally evaluate the completed array with respect to antenna pattern, impedance and return loss, and (3) To measure swept transmission amplitude and phase to provide a data base for design of a receiving antenna L F M

N82-12556*# Rockwell International Corp., Pittsburgh, Pa
THE RESONANT CAVITY RADIATOR (RCR)
K G Schroeder, R L Carlise, and C Y Tomita *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 167-177

Avail NTIS HC A99/MF A01 CSCL 10A

The fundamental theory of MW antenna operation and basic array technology development status was used in the design of the 1-km diameter 5-Gw SPS microwave antenna However, the aperture size and the high efficiency requirements make the MW antenna extremely complex Studies show that the slotted waveguide array is one of the most efficient radiators for the antenna Subsequent analyses show that the temperature interface between waveguides and dc-RF conversion tubes can cause severe thermal design problems on the array An alternate design, the Resonant Cavity Radiator, is described here L F M

N82-12557*# Boeing Aerospace Co., Seattle, Wash
EVALUATION OF THICK WALL WAVE GUIDE ELEMENT
Ervin J Nalos *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 180-187
Avail NTIS HC A99/MF A01 CSCL 10A

The SPS transmitting array requires an archetecture which will provide a low weight, high efficiency and high structural rigidity As noted above, waveguide slot arrays constitute the most desirable option Consequently, such an array has been chosen for the SPS Waveguide slot arrays offer high efficiency, uniform illumination, are are fairly lighweight Bandwidths of such arrays are narrow, typically 1/2-2% Although this does not directly impact the SPS, which transmits power at a single frequency of 2 45 GHz, the narrow bandwidth does constrain the thermal and mechanical tolerances of the antenna The purpose of this program is to better define the electronic aspects of an SPS specific waveguide slot array The specific aims of the program are as follows (1) To build a full-scale half-module, 10 stick, array, the design parameters for which are to be determined by analytical considerations tempered by experimental data on a single slotted radiating stick, (2) To experimentally evaluate the completed array with respect to antenna pattern, impedance and return loss, and (3) To measure swept transmission amplitude and phase to provide a data base for design of a receiving antenna L F M

N82-12558*# Raytheon Co., Waltham, Mass New Products Center
METHOD FOR PRECISION FORMING OF LOW-COST, THIN-WALLED SLOTTED WAVEGUIDE ARRAYS FOR THE SPS
William C Brown *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 188-190
Avail NTIS HC A99/MF A01 CSCL 10A

A method for the precision-forming of thin-walled, slotted-waveguide arrays was devised Models were constructed with temporary tools and evaluated The application of the method to the SPS requirements is discussed Author

N82-12559*# Georgia Inst of Tech., Atlanta Engineering Experiment Station
CONSIDERATIONS FOR HIGH ACCURACY RADIATION EFFICIENCY MEASUREMENTS FOR THE SOLAR POWER SATELLITE (SPS) SUBARRAYS
D J Kozakoff, J M Schuchardt, and C E Ryan *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 191-200 refs

(Contract NAS8-33605)
Avail. NTIS HC A99/MF A01 CSCL 10A

The relatively large apertures to be used in SPS, small half-power beamwidths, and the desire to accurately quantify antenna performance dictate the requirement for specialized measurements techniques Objectives include the following (1) For 10-meter square subarray panels, quantify considerations for measuring power in the transmit beam and radiation efficiency to + or - 1 percent (+ or - 0 04 dB) accuracy (2) Evaluate measurement performance potential of far-field elevated and ground reflection ranges and near-field techniques

(3) Identify the state-of-the-art of critical components and/or unique facilities required (4) Perform relative cost, complexity and performance tradeoffs for techniques capable of achieving accuracy objectives the precision required by the techniques discussed below are not obtained by current methods which are capable of + or - 10 percent (+ or - dB) performance In virtually every area associated with these planned measurements, advances in state-of-the-art are required L F M

N82-12560*# Raytheon Co, Waltham, Mass New Products Center
THE HISTORY OF THE DEVELOPMENT OF THE RECTENNA
William C Brown *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 203-212 refs
Avail NTIS HC A99/MF A01 CSCL 10A

The history of the development of the rectenna is first reviewed through its early conceptual and developmental phases in which the Air Force and Raytheon Company were primarily involved The intermediate period of development which involved NASA, Jet Propulsion Laboratory, and Raytheon is then reviewed Some selective aspects of the current SPS rectenna development are examined Author

N82-12561*# Boeing Aerospace Co, Seattle, Wash
RECTENNA SYSTEM DESIGN
G R Woodcock and R W Andryczyk (GE) *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 213-222

Avail NTIS HC A99/MF A01 CSCL 10A

Various rectenna system options are discussed Among these are the half-wave dipole, modified half-wave dipole, yagi, half-wave dipole stripline, air dielectric transmission line feed, full wavelength dipole stripline, parabolic horn, and parabolic trough L F M

N82-12562*# Rensselaer Polytechnic Inst, Troy, N Y
RECTENNA SESSION: MICRO ASPECTS
Ronald J Gutmann *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 223-231 refs
Avail NTIS HC A99/MF A01 CSCL 10A

Two micro aspects of rectenna design are discussed evaluation of the degradation in net rectenna RF to DC conversion efficiency due to power density variations across the rectenna (power combining analysis) and design of Yagi-Uda receiving elements to reduce rectenna cost by decreasing the number of conversion circuits (directional receiving elements) The first of these involves resolvinga fundamental question of efficiency potential with a rectenna, while the second involves a design modification with a large potential cost saving L F M

N82-12563*# Novar Electronics Corp, Barberton, Ohio
A THEORETICAL STUDY OF MICROWAVE BEAM ABSORPTION BY A RECTENNA
James H Ott, James S Rice, and Donald C Thorn *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1981 p 234-240 refs

Avail NTIS HC A99/MF A01 CSCL 10A

The results of a theoretical study of microwave beam absorption by a Rectenna are given Total absorption of the power beam is shown to be theoretically possible Several improvements in the Rectenna design are indicated as a result of analytic modeling The nature of Rectenna scattering and atmospheric effects are discussed Author

N82-12564*# Jet Propulsion Lab, California Inst of Tech, Pasadena
RECTENNA ARRAY MEASUREMENT RESULTS
Richard M Dickinson *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 244-250 refs
Avail NTIS HC A99/MF A01 CSCL 10A

The measured performance characteristics of a rectenna array are reviewed and compared to the perfformance of a single element It is shown that the performance may be extrapolated from the individual element to that of the collection of elements Techniques for current and voltage combining were demonstrated. The array performance as a function of various operating parameters is characterized and techniques for overvoltage protection and automatic fault clearing in the array demonstrated A method for detecting failed elements also exists Instrumentation for deriving performance effectiveness is described Measured harmonic radiation patterns and fundamental frequency scattered patterns for a low level illumination rectenna array are presented Author

N82-12565*# National Aeronautics and Space Administration Lyndon B Johnson Space Center, Houston, Tex
SESSION ON SOLID STATE: INTRODUCTION
In its Workshop on Microwave Power Transmission and Reception 1980 p 253-257
Avail NTIS HC A99/MF A01 CSCL 10A

The possibilities of using solid state devices as part of the Satellite Solar Power System are discussed Solid state advantages and disadvantages are presented along with two potential concepts for use of solid state in the system design L F M

N82-12566*# Boeing Aerospace Co, Seattle, Wash
MODIFIED REFERENCE SPS WITH SOLID STATE TRANSMITTING ANTENNA
G R Woodcock and B R Sperber *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 258-267

Avail NTIS HC A99/MF A01 CSCL 10A

The motivations for considering solid state microwave power amplifiers for the solar power satellite transmitting antenna are the possibilities of greatly increased system reliability due to elimination of electron tube cathodes, a lower mass per unit power and transmitting array area due to the high power densities obtainable in semiconductors, and, probably, cost savings due to development of small hardware items that can be handled by individuals instead of organizations In order to provide a fair assessment where we stand today with regard to solid state SPS technology, the design described here is close to that of the NASA/DOE reference and is implemented using today's solid state technology with only a small 'push' The small push is raising the efficiency of DC-RF conversion from the 68 obtained by RCA in 1975 to somewhat over 8 of the solid state SPS This is generally considered feasible by semiconductor industry representatives Other solid state SPS configurations can yield somewhat better performance However, these generally do not provide as fair a vehicle for comparison with the reference and usually also incorporate somewhat more advanced technologies L F M

N82-12567*# Boeing Aerospace Co, Seattle, Wash
SPS SOLID STATE ANTENNA POWER COMBINER
G W Fitzsimmons *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 268-277
Avail NTIS HC A99/MF A01 CSCL 10A

Solid state dc-rf converters offer potential improvements in reliability, mass and low voltage operation, provided that anticipated efficiencies in excess of 80 percent can be realized Field effect transistors offer the greatest potential in the SPS frequency band at 2 45 GHz To implement this approach it is essential that means be found to sum the power of many relatively low power solid state sources in a low-loss manner, and that means be provided to properly control the phase of the outputs of the large number of solid state sources required To avoid the power combining losses associated with circuit hybrids it was proposed that the power from multiple solid state amplifiers be combined by direct coupling of each amplifier's output to the radiating antenna structure The selected power-combining antenna consists of a unique printed (metalized) microstrip circuit on a ceramic type dielectric substrate which is backed by a shallow lightweight aluminum cavity which sums the power of four microwave sources The antenna behaves like two one-half wavelength slot-line antennas coupled together via their common cavity structure L F M

N82-12568*# Rockwell International Corp, Pittsburgh, Pa
SOLID-STATE RETRODIRECTIVE PHASED ARRAY CONCEPTS FOR MICROWAVE POWER TRANSMISSION FROM SOLAR POWER SATELLITE
K G Schroeder and I K Petroff *In* NASA Johnson Space Center Workshop on Microwave Power Transmission and Reception 1980 p 279-298 ref
Avail NTIS HC A99/MF A01 CSCL 10A

Two prototype solid-state phased array systems concepts for potential use in the Solar Power Satellite are described In both concepts, the beam is centered on the rectenna by means of phase conjugation of a pilot signal emanating from the ground Also discussed is on-going solid-state amplifier development L F M

N82-13157# National Telecommunications and Information Administration Boulder Colo Inst for Telecommunication Sciences
EFFECTS OF THE SATELLITE POWER SYSTEM ON LOW EARTH ORBIT AND GEOSYNCHRONOUS SATELLITES
W B Grant, E L Morrison, and J R Juroshek Jun 1981 86 p refs
(Contracts DE-AI06-79RL-10077 DE-AI01-80ER-10160)
(PB81-232019 NTIA/Rept-81/75) Avail NTIS HC A05/MF A01 CSCL 22A

The large amount of power contained in the main beam and principal sidelobes of the proposed Solar Power System (SPS), now under study by DOE and NASA, potentially presents an EMC problem for other satellite systems This report examines selected geosynchronous orbit (GEO) satellites in adjacent slots to an SPS, GEO satellites on a chord passing an Earth horizon, and low-earth-orbit (LEO) satellites which may pass throught the SPS power beam Potential functional and operational impacts to on-board systems are analyzed Mitigation techniques for SPS effects are examined and recommendations summarized to allow satellites to operate satisfactorily in an SPS environment GRA

N82-13517# Brookhaven National Lab., Upton, N. Y
CRYOGENIC TESTING OF 100-M SUPERCONDUCTING POWER TRANSMISSION TEST FACILITY
R. J. Gibbs, J E Jensen, and R A Thomas 1981 8 p refs Presented at 1981 Cryogenic Engr Conf, San Diego, 10. Aug 1981
(Contract DE-AC02-76CH-00016)
(DE81-028331; BNL-29900; CONF-810835-2) Avail: NTIS HC A02/MF A01

The system was designed to cool the test facility for transmission cables The system was modified to incorporate a fourth turbine placed remotely from the refrigerator at the far end of the load In this configuration the load, consisting of the superconducting cables and their containment vessel, becomes a long counterflow heat exchanger with internal heat generation The results of these tests are presented with discussion of the operation, equipment performance, and possible areas for improvement. T.M

N82-14202*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
COMPARATIVE ANALYSES OF SPACE-TO-SPACE CENTRAL POWER STATIONS
Paul F Holloway and L Bernard Garrett Dec 1981 49 p refs
(NASA-TP-1955, L-14766) Avail NTIS HC A03/MF A01 CSCL 22B

The technological and economical impact of a large central power station in Earth orbit on the performance and cost of future spacecraft and their orbital transfer systems are examined It is shown that beaming power to remote users cannot be cost effective if the central power station uses the same power generation system that is readily available for provision of onboard power and microwave transmission and reception of power through space for use in space is not cost competitive with onboard power or propulsion systems Laser and receivers are required to make central power stations feasible Remote power transmission for propulsion of orbital transfer vehicles promises major cost benefits Direct nuclear pumped or solar pumped laser power station concepts are attractive with laser thermal and laser electric propulsion systems These power stations are also competitive, on a mass and cost basis, with a photovoltaic power station E A K

N82-14484# Los Alamos Scientific Lab, N Mex
COOL-DOWN FLOW-RATE LIMITS IMPOSED BY THERMAL STRESSES IN LNG PIPELINES
J K Novak, F J Edeskuty, and J R Bartlit 1981 8 p refs Presented at the Cryogenic Eng Conf, San Diego, Calif, 10-14 Aug 1981
(Contract W-7405-eng-36)
(DE81-028731, LA-UR-81-2365, CONF-810835-4) Avail NTIS HC A02/MF A01

Warm cryogenic pipelines are usually cooled to operating temperature by a small, steady flow of the liquid cryogen If this flow rate is too high or too low, undesirable stresses will be produced Low flow-rate limits based on avoidance of stratified two-phase flow were calculated for pipelines cooled with liquid hydrogen or nitrogen High flow-rate limits for stainless steel and aluminum pipelines cooled by liquid hydrogen or nitrogen were determined by calculating thermal stress in thick components vs flow rate and then selecting some reasonable stress limits The present work extends these calculations to pipelines made of AISI 304 stainless steel, 6061 aluminum, or ASTM A420 9% nickel steel cooled by liquid methane or a typical natural gas Results indicate that aluminum and 9% nickel steel components can tolerate very high cool-down flow rates, based on not exceeding the material yield strength DOE

N82-14638# Texas Technological Univ, Lubbock Plasma and Switching Lab
PULSED POWER RESEARCH COLLOQUIUM Annual Report
M Kristiansen, A H Guenther (Kirtland AFB, Albuquerque, N M), John Ungvarsky (AFWL, Kirtland AFB, Albuquerque, N M), F C Brockhurst (Air Force Inst of Technology, Wright-Patterson, AFB, Ohio), R D Franklin (AFWAL), A K Hyder (AFOSR), and R L Gullickson (Defense Nuclear Agency) 9 Jul 1981 10 p refs (Grant AF-AFOSR-3675-78, AF Proj 2301)
(AD-A105770, AFOSR-81-0686TR) Avail NTIS HC A02/MF A01 CSCL 10/2

A Pulsed Power Lecture Series is being conducted by Texas Tech University for the U S Air Force Modular instructional material for use in this lecture series is being developed Each module is a self consistent discussion of some aspect of pulsed power technology The contents range from the very basic (e g basic EM field theory) to advanced, modern topics, such as magnetic switching The lectures are delivered every two weeks at the Air Force Institute of Technology and the Air Force Weapons Laboratory The speakers then provide a written text of their lecture, which is edited and published in modular form by Texas Tech University It is planned to reissue these modules in report or book form at a later date A total of about 50 modules are planned Some 30 lecturers have been presented, to date, and about 12 modules have been issued Author (GRA)

N82-15134# Technische Hochschule, Aachen (West Germany) Inst. fuer Kunststoffverabeitung in Industrie und Handwerk.
SELECTION AND TESTING OF SUITABLE COATING SYSTEMS FOR STEEL PIPES USED FOR LONG DISTANCE HEAT TRANSFER Final Report, May 1980
Ernst Braches Bonn Bundesministerium fuer Forschung und Technologie Aug 1981 85 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-138; ISSN-0340-7608) Avail NTIS HC A05/MF A01

Anticorrosion properties of buried, plastics-coated steel pipes for long-distance heat supply lines, with regard to the possible application limits are considered Quantitative measuring methods were used to determine the influence of various media, temperatures, and temperature changes on the protective effect of the composites systems Electrochemical measuring methods (impedance and potential measurement), bond strength measurements and optical tests were employed It was possible to achieve a very good differentiation between the level of protection offered by the individual coating systems and show how they were affected by the various kinds of stress applied The electrochemical measuring methods, in particular, were outstandingly suitable for a quasi-nondestructive evaluation of a composite system subjected to various stresses It was also possible to show that the PU coating system did not lose any of its protective properties in any of the tests J M S

N82-15338# Brookhaven National Lab, Upton, N. Y.
IMPROVED TECHNIQUE TO MEASURE ELECTRONICALLY AC LOSSES IN SUPERCONDUCTING CABLES
F. Schauer and M Meth 1981 8 p refs Presented at the Cryogenic Eng Conf, San Diego, Calif, 10-14 Aug 1981
(Contract DE-AC02-76CH-00016)
(DE81-029323, BNL-29932, CONF-810835-15) Avail. NTIS HC A02/MF A01

An improved electronic method for measuring ac losses in superconducting cables of lengths from 1 m to 10m was developed This method compensates for phase shifts in the measuring circuit elements and for imbalance of the difference amplifier due to changes in the common mode voltage This measuring method is being further improved and adapted to the loss measurements of a 138V, 4 kA, 100 m long superconducting cable under construction DOE

07
ENERGY STORAGE

Includes flywheels, heat storage, underground air storage, compressed air, storage batteries, and electric hybrid vehicles

A82-10018 **Thermal storage in salt-hydrates.** M. Telkes (AEC Research Institute, Killeen, TX). In Solar materials science. New York, Academic Press, 1980, p. 377-404. 68 refs.

Water itself has a rather high entropy of fusion per unit weight, and when combined with anhydrous salt of high entropy of fusion, a salt hydrate of conveniently lower melting point may result, usually with the combined high entropies of fusion of the components. Aspects of melting and recrystallization are discussed. Several methods have been developed to prevent the settling of residual solids in partly incongruently melting salt-hydrates, with the result that the conditions can become completely reversible. The properties of salt-hydrates are listed in a table. Attention is given to supercooling, nucleation or crystal seeding, the rate of crystal growth, the rate of heat removal, the calculation of the heat of fusion from heats of solution, the calculation of the heat of fusion from entropies of fusion, calorimetric measurements and data, and the properties of selected salt-hydrates. G.R.

A82-10019 **Thermodynamic basis for selecting heat storage materials.** M. Telkes (AEC Research Institute, Killeen, TX). In Solar materials science. New York, Academic Press, 1980, p. 405-437. 25 refs.

The search for materials with high heat of fusion values can be based on theoretical considerations regarding the heat of fusion and its correlation with other known physical properties. Attention is given to investigations conducted by Kubaschewski (1949, 1959, 1967), Blanc (1958, 1959), and Ubbelohde (1950, 1957, 1965). It is found that Kubaschewski's rule can be applied to calculate the heat of fusion of inorganic compounds, by using definite values for the entropy of fusion per gram atom. It is pointed out that most of the theoretical work of the past has been hampered by lack of data on the heats of fusion of elements. Using recently published results a nearly complete table has been prepared, listing melting points, transition points, heats of fusion and transition, and entropies of fusion and transition. G.R.

A82-11707 * # **Development status of a regenerative fuel cell system for orbital operation.** A. C. Erickson (General Electric Co., Wilmington, MA) and H. McBryar (NASA, Johnson Space Center, Houston, TX). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 67-73. 6 refs Contract No. NAS9-15831.

Mission studies conducted by NASA for future long-term orbital operations have indicated the need for substantial increases in the power level of low-earth orbital energy storage facilities by the mid-to-late 1980's. A description is presented of the results of a comprehensive study for a state-of-the-art assessment of solid polymer electrolyte electrochemical cell technology Questions related to the weight optimization of the dedicated system are investigated, and attention is given to the analysis of a system having reversible modules capable of operating in either the electrolysis or fuel cell mode. It was found that performance improvements and weight reduction can be realized by advancing the state of the art of solid polymer electrolyte cell technology. G.R.

A82-11714 # **Effect of depth of discharge on cycle life of near-term batteries.** H. N. Seiger. In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 102-110. 35 refs. Research sponsored by the U.S. Department of Energy.

An investigation is conducted regarding the functional relationship between cycle life and depth of discharge (DOD) for lead-acid, nickel-iron, and nickel-zinc batteries. Also considered are the main factors affecting the degree to which cycle life is affected by DOD. The failure modes which affect the cycle life of the three systems are listed in a table. A semilogarithmic relationship between cycle life and DOD will be maintained for several years. Maximum energy is found to be related to battery voltage, DOD, and cycle life. G.R.

A82-11722 # **Techniques and applications of pulsed power technology.** M. F. Rose (U.S. Navy, Naval Surface Weapons Center, Dahlgren, VA). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 146-154. 18 refs. Navy-supported research.

For the purpose of pulse power, energy is usually stored, at a slow rate, in some suitable media and subsequently released on demand at whatever rate is suitable. The time scales for delivery range from milliseconds to nanoseconds. The most demanding technical applications for this technology are in inertial confinement fusion and in military oriented programs. A description of the basic storage mechanisms is provided, taking into account the electrostatic storage of energy, magnetic/inductive storage, inertial energy storage, and chemical storage. A comparison of large storage systems is conducted, and aspects of load characterization are discussed. Attention is given to advanced applications and advanced requirements G.R.

A82-11735 # **The nickel-hydrogen battery system - An historical overview.** L. Miller (Eagle-Picher Industries, Joplin, MO). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 220-223.

Around 1971, difficulties experienced in connection with the development of a regenerative or rechargeable hydrogen oxygen fuel cell for replacement of the nickel-cadmium system on Intelsat communication satellites resulted in the consideration of two related, alternative systems, including the oxygen-cadmium couple and the hydrogen-nickel couple. The oxygen-cadmium couple was soon eliminated for technical reasons. On the other hand, immediate achievement of success with the hydrogen-nickel couple resulted in its subsequent rapid development. A chronological review is provided of the major events leading up to the current system status of the nickel-hydrogen battery. G.R.

A82-11737 # **Ampere-hour integrator battery charge controller.** G. M. Lehto and R. M. Martinelli (Hughes Aircraft Co., Space and Communications Group, El Segundo, CA). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1 New York, American Society of Mechanical Engineers, 1981, p. 232-234

In a spacecraft environment proper battery management is essential to ensure long battery life A primary cause of reduced battery life is the improper rate and duration of battery charge The Ampere-hour Integrator Battery Charge Controller presents a method of autonomous charge management which offers significant advances in the control of charge return to the battery (Author)

A82-11774 * # **NASA preprototype redox storage system for a photovoltaic stand-alone application.** N. H. Hagedorn (NASA, Lewis Research Center, Cleveland, OH). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1 New York, American Society of Mechanical Engineers, 1981, p. 805-811

A 1-kW preprototype redox storage system that has undergone characterization tests and been operated as the storage device for a 5-kW (peak) photovoltaic array is described and performance data are presented. Loss mechanisms are discussed, and simple design changes leading to appreciable increases in efficiency are suggested The effects on system performance of nonequilibrium between the predominant species of complexed chromic ion in the negative electrode reactant solution are summarized. It is noted that with the aid of the prototype system, control concepts have been shown to be

valid and trouble free and some insight has been gained into interactions at the mutual interfaces of the redox system, the photovoltaic array, the load, and the control devices C R

A82-11779 # **Method of determining the creep characteristics of composite materials.** S. J. Calabrese and P Smith (Rensselaer Polytechnic Institute, Troy, NY). In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 1 New York, American Society of Mechanical Engineers, 1981, p 871-874 5 refs Research supported by the U S. Department of Energy

This paper presents the test method used to establish the creep characteristics of composite materials which were selected for use in a flywheel energy storage system under contract to the Department of Energy. The test specimen, rig and environmental chamber were designed to obtain data under air and vacuum conditions. A capacitance measuring system was used to monitor displacement over a long period of time Results of preliminary testing and a discussion of future work will be presented (Author)

A82-11782 # **Design considerations for a 1500 M head 300-600 MW double stage reversible pump/turbine with regulation.** S A Chacour, J R Degnan, and R. K Fisher, Jr In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 1. New York, American Society of Mechanical Engineers, 1981, p 1014-1020. 6 refs

It is noted that much attention has recently been given to the development of high-head pumped storage schemes The special design considerations required to develop the turbine machinery for this new category of service are presented Also included is a discussion of the advanced computer-aided design and analytical tools now available to optimize the prototype equipment Special manufacturing considerations and model testing philosophy are introduced It is noted that an optimized final machine design results from computer-aided mechanical design, detailed structural analysis, and a prediction of fatigue life. C R

A82-11846 # **Aquifer thermal energy storage - A feasibility study for large scale demonstration.** W V Skinner and D J Supkow (Dames and Moore, Cranford, NJ) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 3 . New York, American Society of Mechanical Engineers, 1981, p 2161-2166

Engineering procedures necessary for aquifer thermal energy storage (ATES), based on studies of the Magothy Aquifer on Long Island, NY, are presented, with chilled winter water pumped into the aquifer and reclaimed in summer months for air conditioning The choice of aquifer involves necessary volume, flow rate, efficiency of thermal recovery, and avoidance of conflict with other users, utilization depends on choice of appropriate piping, heat exchangers, and well construction to prevent degradation of the aquifer The methods employed to probe the Magothy for suitability are described, including drilling an asymmetric well cluster for observation, and 48 hr pumping and 8 hr recovery. Transmissivity was found to vary from 8,000 to 29,000 sq ft/day. A doublet well was then drilled and water withdrawn, chilled, and returned Later withdrawal indicated a 46% thermal recovery, with computer models projecting 80% with additional cycling The study verified the feasibility of ATES, which can be expanded with additional demand M.S K.

A82-11847 # **Planning an underground pumped hydro project for the Commonwealth Edison Company.** H H Chen (Harza Engineering Co , Chicago, IL) and I A Berman (Commonwealth Edison Co., Chicago, IL) In Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings Volume 3. New York, American Society of Mechanical Engineers, 1981, p 2167-2171.

The conceptual project design for a one-drop 3 GW underground pumped hydro energy storage in Illinois is presented A one-drop two stage design was chosen over a one-drop one stage and one and two stage two-drop designs for reasons of cost and flexibility Water is to be pumped into a bisected upper reservoir set in preCambrian granite, which is sufficiently impermeable to water, the 10 4 million cu m reservoir can then be used as a load leveler as it drains through a pump/turbine into a 9 5 million cu m lower reservoir Initial studies indicate that pumped hydro storage exceeds the efficiencies of both oil and peaking plant generation Due to a decrease in the projected rate of increase of electrical demand, the project has been deferred, allowing time for work on ultrahigh-head pump turbines M S K

A82-13082 * **Control of new energy sources in an electric utility system.** H. Kirkham (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). In Joint Automatic Control Conference, Charlottesville, VA, June 17-19, 1981, Proceedings. Volume 1 New York, American Institute of Chemical Engineers, 1981. 4 p. (WA-3B) Research sponsored by the U.S. Department of Energy and NASA

The addition of generators based on renewable resources to the electric power system brings new problems of control and communication if the generators are to be controlled as an integrated part of the power system. Since many of these generators are small, it will require a large number of them, connected to the distribution system, to represent an appreciable fraction of the total generation. This situation contrasts with present day generation control which typically involves only the control of a small number of large generators. This paper examines the system requirements for integrated control, and proposes a control arrangement in which the incremental cost of power is an important parameter (Author)

A82-13325 **The new batteries.** J. Hopkinson. *EPRI Journal,* vol. 6, Oct. 1981, p 7-13.

The state of advanced battery concept development is reviewed, noting advantages of battery use such as modular design, short lead time from order to installation, and widely varying load operation Compact design, quietness, pollution free operation, and low maintenance are also favorable, utility uses are foreseen as load leveling for base load capacity, the opportunity for a spinning reserve, and VAR control. Research programs for ZnCl, ZnBr, and the beta battery are reviewed, and the use of Pb-acid batteries is noted to be reaching an end because of lead supply problems, pollution, and price fluctuations. A 50 kWh ZnCl battery has been built that has lasted through 2 cycles, and a 80kW ZnBr battery has recently tested successfully to prove the feasibility of scale-up. Functioning chemicals in the beta battery require over 300 C temperatures to work, beta aluminum, a ceramic, is used as an electrolyte and separator. Seals to contain the reactive chemicals within the battery and compartmentalize the electrolytes are a focus of continuing research. M.S.K

A82-14513 † **Optimum reinforcement shapes and paths for rotating composite shells (Optimal'nye formy i traektorii armirovaniia vrashchaiushchikhsia obolochek iz kompozitov).** Iu. V Bokov, V. V. Vasil'ev, and G G. Portnov (Moskovskii Aviatsionnyi Tekhnologicheskii Institut, Moscow, USSR, Akademiia Nauk Latviiskoi SSR, Institut Mekhaniki Polimerov, Riga, Latvian SSR). *Mekhanika Kompozitnykh Materialov,* Sept.-Oct. 1981, p 846-854. 11 refs In Russian.

The paper deals with the problem of an optimum design for a composite flywheel in the form of a zero-moment shell of revolution fabricated by filament winding or by layup of orthotropic bands. The reinforcement paths and the shape of the generating line are derived for a uniformly stressed centrifugally loaded shell. A closed-form solution is obtained for the case of a composite lacking rigidity in the direction normal to the direction of reinforcement On the basis of the proposed solution, several classes of optimum shells are derived. The energy storage capacity of such shells is estimated and compared with that of rim-type flywheels. V L

A82-15726 **Rechargeable lithium/vanadium oxide cells utilizing 2Me-THF/LiAsF6.** K M. Abraham, J L Goldman, and M. D Dempsey (EIC Laboratories, Inc., Newton, MA) *Electrochemical Society, Journal,* vol. 128, Dec. 1981, p 2493-2501 21 refs. Grant No. DAAK20-79-C-0267

Various vanadium oxide compositions were synthesized and evaluated as rechargeable lithium/vanadium oxide cell cathodes using 2Me-THF/LiAsF6 The most useful compositions were found to be (1) VO(2.17), (2) VO(2 19), and (3) the Fe- or Cr-substituted oxide of apparent composition M(0 13)V(0.87)O(2.17). The superior rechargeability of VO(2.17) in practical high-capacity cells within

cycling limits of 3.0 and 1.9 V was demonstrated by the extended cycling of a cell with an average cathode utilization of about 0.52 electrons/vanadium in over 200 cycles Both VO(2 17) and VO(2 19) oxides require carbon in the cathode for acceptable performance, resulting in merely moderate volumetric energy densities. The incorporation of such metals as Cr or Fe into the vanadium oxide lattice is found to be useful in the synthesis of new cathode materials. O.C

A82-15727 **Insoluble sulfide positive electrodes for organic electrolyte lithium secondary batteries.** F. W. Dampier (EIC Corp., Newton, MA) *Electrochemical Society, Journal*, vol 128, Dec. 1981, p. 2501-2506 29 refs Contract No EY-76-C-02-2520.

A82-17763 # **A photovoltaic system with energy storage Natural Bridges National Monument 100-kW system.** F. J. Solman, H. J. Bullwinkel, J. D. Doucet, and B. L. Brench (MIT, Lexington, MA). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 20th, Orlando, FL, Jan. 11-14, 1982, Paper 82-0066.* 9 p. 13 refs. Research sponsored by the U.S. Department of Energy.

A large, stand-alone photovoltaic power system with energy storage has been in operation for over 18 months at Natural Bridges National Monument in southeastern Utah. Operating results for the system are in substantial agreement with simulations done before construction. Measured data are now available for the battery performance over this period. The design considerations and how they were realized are reviewed as are the departures from predicted performance. The performance of a digital state-of-charge meter used for battery management is also discussed. (Author)

A82-17770 # **Performance of a cylindrical phase change thermal energy storage unit.** R. Ponnappan and D. L. Jacobson (Arizona State University, Tempe, AZ). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 20th, Orlando, FL, Jan. 11-14, 1982, Paper 82-0076.* 9 p. 13 refs. Contract No. F33615-77-C-2059.

The high-temperature performance of a eutectic salt Phase Change Material (PCM) in a cylindrical Thermal Energy Storage Container (TESC) sample is evaluated by means of an experimental apparatus with a water-circulated calorimeter. The phase change characteristics of the salt during melting and solidification were observed by monitoring the external axial temperature profile of the container, and the analysis of the phase change heat transfer in the cylindrical geometry was based on the modified heat balance integral method of Tien (1980), which provides the solidification rate and time. Melting point (983 K), freezing point (944 K), latent heat of fusion (782.26 J/gm) and thermal diffusivity (0.00799 sq cm/sec) results are in agreement with those found in the literature. The experimental and analytical results of the nondimensionalized heat transfer resistance as a function of the solidified or melted weight fraction are compared. O.C.

A82-18498 **Life-testing of 1.7 kW h zinc-chloride battery system - Cycles 1 - 1000.** C. M. Blevins (Energy Development Associates, Madison Heights, MI). *Journal of Power Sources*, vol. 7, Jan. 1982, p. 121-132. 5 refs. Research supported by the Electric Power Research Institute and Gulf and Western Industries.

A 1.7 kW h zinc-chloride battery system was built in 1976 for electric vehicle and load-leveling applications. As of June 1979, the two-volt, multiple-cell battery stack, which embodies porous graphite-chlorine electrodes, accumulated 1000 charge-discharge cycles. The operation of the 1.7 kW h system depends upon a network of peripheral components that comprise four subsystems: (1) the electrolyte loop; (2) the chlorine gas loop; (3) the hydrogen recombination loop; and (4) the hydrate storage and decomposition loop. The system has attained 40% of the cycle life target for a commercial load-leveling battery. Over one-half year of operation or 138 cycles without electrolyte maintenance have been achieved to date. Internal inspection of the cell and examination of electrode voltage data indicate that the chlorine electrodes have remained stable and that the goal of 2500 cycles will be reached. J.F.

N82-10503*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
EFFECT OF POSITIVE PULSE CHARGE WAVEFORMS ON THE ENERGY EFFICIENCY OF LEAD-ACID TRACTION CELLS Final Report
John J Smithrick Sep. 1981 11 p refs
(Contract DE-AI01-77CS-51044)
(NASA-TM-82709, E-991, DOE/NASA/51044-22) Avail NTIS HC A02/MF A01 CSCL 10A

The effects of four different charge methods on the energy conversion efficiency of 300 ampere hour lead acid traction cells were investigated Three of the methods were positive pulse charge waveforms, the fourth, a constant current method, was used as a baseline of comparison The positive pulse charge waveforms were 120 Hz full wave rectified sinusoidal, 120 Hz silicon controlled rectified, and 1 kHz square wave The constant current charger was set at the time average pulse current of each pulse waveform, which was 150 amps The energy efficiency does not include charger losses The lead acid traction cells were charged to 70 percent of rated ampere hour capacity in each case The results of charging the cells using the three different pulse charge waveforms indicate there was no significant difference in energy conversion efficiency when compared to constant current charging at the time average pulse current value. Author

N82-10508# California Univ , Livermore Lawrence Livermore Lab
MECHANICAL ENERGY STORAGE TECHNOLOGY PROJECT Annual Report, 1980
T M Barlow, W T Crothers, T T Chiao, D N Frank, D M King, and S V Kulkarni 1 May 1981 203 p refs
(Contract W-7405-eng-48)
(DE81-029753; UCRL-50056-80) Avail NTIS HC A10/MF A01

Progress during 1980 in the development and evaluation of the energy-saving potential of flywheel energy storage systems for vehicles and for fixed-base power systems is reported Activities related to transportation applications, fixed-base applications, fiber-composite materials technology, flywheel rotor and containment technology, advanced component technology, and project management are described DOE

N82-10525# Hibbing Public Utilities Commission, Minn
FEASIBILITY OF A SMALL SCALE PUMPED STORAGE DEMONSTRATION PROJECT, HIBBING, MINNESOTA
1981 229 p refs Prepared in cooperation with Hansen (James) and Associates, Springfield, Vt
(Contract DE-AC07-76ID-01570)
(DE81-028678, DOE/TIC-1028678, IDO-10097) Avail NTIS HC A11/MF A01

The economic and technical feasibility of developing a 5 to 15 MW pumped storage power plant was examined The substitution of power from a pumped storage facility for the purchased peak power is advantageous because (1) the coal fired cogeneration plant operates with an improved heat rate, (2) numerous open pits from abandoned iron ore mines are available as reservoirs for pumped storage; and (3) the peaking power generated does not depend on petroleum fuel It is suggested that eight mine sites are suitable for pumped storage, oil fired peak power units should be avoided to improve the efficiency of the existing cogeneration, this is a nonpolluting form of power generation, and the development of small scale reversible pump/turbine units for commercial operation is desirable DOE

N82-10527# Acres American, Inc , Buffalo, N Y.
PRELIMINARY DESIGN STUDY OF UNDERGROUND PUMPED HYDRO AND COMPRESSED-AIR ENERGY STORAGE IN HARD ROCK. VOLUME 1: EXECUTIVE SUMMARY Final Report
May 1981 111 p Sponsored in part by Electric Power Research Inst Prepared for Potomac Electric Power Company, Washington, D C
(Contract DE-AC02-77ET-28013, EPRI Proj 1081-1)
(DE81-029440, EPRI-EM-1589-Vol-1, DOE/ET-5047/1) Avail NTIS HC A06/MF A01

A preliminary design study of water compensated Compressed Air Energy Storage (CAES) and Underground Pumped Hydroelectric (UPH) plants for siting in geological conditions suitable for hard rock excavations was performed The study was divided

into five primary tasks as follows establishment of design criteria and analysis of impact on power system, selection of site and establishment of site characteristics, formulation of design approaches, assessment of environmental and safety aspects; and preparation of preliminary design of plant The salient aspects considered and the conclusions reached during the consideration of the five primary tasks for both CAES and UPH are presented DOE

N82-10528# Acres American, Inc , Buffalo, N Y
PRELIMINARY DESIGN STUDY OF UNDERGROUND PUMPED HYDRO AND COMPRESSED-AIR ENERGY STORAGE IN HARD ROCK. VOLUME 2: PROJECT DESIGN CRITERIA: UPH Final Report
May 1981 185 p refs Sponsored in part by Electric Power Research Inst Prepared for Potomac Electric Power Co , Washington, D C
(Contract DE-AC02-77ET-28013, EPRI Proj 1081-1)
(DE81-028107, EPRI-EM-1589-Vol-2, DOE/ET-5047/2) Avail NTIS HC A09/MF A01

The design criteria for an underground pumped hydroelectric (JPH) storage facility having a maximum generating capacity of 2000 MW and a storage capacity of 20,000 MWh at a nominal head of 5000 ft are documented The UPH facility is a two step configuration with single stage reversible pump turbines, each step consisting of a 1000 MW plant at a nominal head of 2500 ft Overall design criteria including operating requirements, civil/structural criteria, geotechnical criteria, mechanical criteria and electrical criteria are detailed Specific requirements are given for the upper reservoir, intake/outlet structure, penstock and draft tubes, powerhouses, transformer galleries, intermediate reservoir, lower reservoir, shafts and hoists, switchyard and surface buildings The requirements for the power plant electrical and mechanical equipment, including pump turbine and motor generator units, are referred to Electrical design criteria are given to meet the requirements of two power houses located underground at different depths, but these criteria may not necessarily reflect PEPCO's current engineering practice The criteria refer to a specific site and take into account the site investigation results The design criteria given were used as the basis for the plant design DOE

N82-10529# Acres American, Inc , Buffalo, N Y
PRELIMINARY DESIGN STUDY OF UNDERGROUND PUMPED HYDRO AND COMPRESSED-AIR ENERGY STORAGE IN HARD ROCK. VOLUME 5: SITE SELECTION Final Report
Apr 1981 148 p refs Sponsored in part by Electric Power Research Inst Prepared for Potomac Electric Power Co , Washington, D C
(Contract DE-AC02-77ET-28013, EPRI Proj 1081-1)
(DE81-028199, EPRI-EM-1589-Vol-5, DOE/ET-5047/5) Avail NTIS HC A07/MF A01

A six-step site selection process undertaken to identify and subsequently rank potential sites suitable for either an underground pumped hydroelectric (UPH) facility, or a water-compensated hard-rock cavern compressed air energy storage (CAES) facility is described The region of study was confined to the service area of the Potomac Electric Power Company (PEPCO) and contiguous areas Overriding considerations related to geology, environmental impact and transmission-line routing were studies within the context of minimizing plant costs The selection process led to the identification of several sites suitable for the development of either a CAES or an UPH facility Design development and site exploration at the selected site are described DOE

N82-10530# Acres American, Inc., Columbia, Md
PRELIMINARY DESIGN STUDY OF UNDERGROUND PUMPED HYDRO AND COMPRESSED-AIR ENERGY STORAGE IN HARD ROCK. VOLUME 9: DESIGN APPROACHES, CAES. APPENDIX D: MECHANICAL SYSTEMS Final Report
Apr 1981 104 p Sponsored in part by Electric Power Research Inst Prepared for Potomac Electric Power Company, Washington, D C
(Contract DE-AC02-77ET-28013, EPRI Proj. 1081-1)
(DE81-028200, EPRI-EM-1589-Vol-9-App-D, DOE/ET-5047/9D) Avail: NTIS HC A06/MF A01

The development of the design approach taken for the mechanical systems included in a compressed air energy storage (CAES) facility were documented Design approaches developed the fuel oil system, water supply system, waste treatment system, fire protection and safety system, and miscellaneous plant services are based on similar designs for conventional utility plants because the operating characteristics, design parameters, and equipment capabilities for CAES plant mechanical systems are similar to standard utility systems The design approach for each of these systems develops several alternatives for achieving the CAES plant requirements in each area. The preferred alternative is then expanded into a preliminary system description DOE

N82-10532# GeoTrans, Inc , Herndon, Va
REVIEW OF SIMULATION TECHNIQUES FOR AQUIFER THERMAL ENERGY STORAGE (ATES)
James W Mercer, Charles R. Faust, William J Miller, and F J Pearson, Jr. Mar. 1981 225 p refs Prepared in cooperation with INTERA, Environmental Consultants, Inc , Houston, Texas Prepared for Pacific Northwest Lab., Richland, Washington
(Contract DE-AC06-76RL-01830)
(DE81-029943, PNL-3769) Avail NTIS HC A10/MF A01

The analysis of aquifer thermal energy storage (ATES) systems rely on the results from mathematical and geochemical models Therefore, the state-of-the-art models relevant to ATES were reviewed and evaluated These models describe important processes active in ATES including ground-water flow, heat transport (heat flow), solute transport (movement of contaminants), and geochemical reactions In general, available models of the saturated ground-water environment are adequate to address most concerns associated with ATES, that is, design, operation, and environmental assessment In those cases where models are not adequate, development should be preceded by efforts to identify significant physical phenomena and relate model parameters to measurable quantities DOE

N82-10535# Brobeck (William M) and Associates, Berkeley, Calif
DYNAMIC STABILITY OF STACKED DISK TYPE FLYWHEELS
F C Younger Apr. 1981 47 p refs Prepared for California Univ., Lawrence Livermore Lab
(Contract W-7405-eng-48)
(DE81-030008; UCRL-15372) Avail NTIS HC A03/MF A01

A flywheel assembly formed from adhesively bonded stacked fiber composite disks was analyzed The stiffness and rigidity of the assembly required to prevent unconrolled growth in the deformations due to centrifugal force was determined It is shown that stacked disk type flywheels become unstable when the speed exceeds a critical value This critical value of speed depends upon the stiffness of the bonded attachments between the disks It is found that elastomeric bonds do not provide adequate stiffness to insure dynamic stability for high speed stacked disk type flywheels. DOE

N82-10540# Mitre Corp , McLean, Va Metrek Div
STATUS OF THE DOE BATTERY AND ELECTROCHEMICAL TECHNOLOGY PROGRAM 2
R Roberts Dec 1980 279 p refs Presented at Dept. of Energy Battery and Electrochem Contractor's Conf , 10-12 Dec 1979
(Contract DE-AC01-79ET-25407)
(DE81-029879, DOE/ET-25407/1) Avail: NTIS HC A13/MF A01

The status of electrochemical storage systems is reviewed. Secondary batteries were recommended, however, selected mechanically rechargeable batteries and aspects of energy conservation in industrial electrochemistry were included. Batteries included are: lead acid, nickel/iron, nickel/zinc; advanced: lithium/metal sulfide, sodium/sulfur, zinc/chlorine; and research and development· metal/air, hydrogen/chlorine, zinc/bromine, redox, organic electrolytes, solid state. Electrode reactions, cell performance modeling, new battery materials are examined Energy conservation and alternative processes in electrochemical industry are reviewed The potential contributions of the battery program to the various missions supported such as electric vehicles, photovoltaic systems, distributed electrical energy systems, and energy conservation in industry are discussed DOE

N82-10546# Potomac Electric Power Co , Washington, D C
PRELIMINARY DESIGN STUDY OF UNDERGROUND PUMPED HYDRO AND COMPRESSED-AIR ENERGY STORAGE IN HARD ROCK. VOLUME 3: PROJECT DESIGN

CRITERIA: CAES Final Report
Apr 1981 218 p Prepared in cooperation with Acres American, Inc., Columbia, Md
(Contract DE-AC02-77ET-28013, EPRI Proj 1081-1)
(DE81-028197, EPRI-EM-1589-Vol-3) Avail: NTIS HC A10/MF A01

The design criteria presented provided the basis for development of the design approaches and preliminary plant design. These design criteria are based, where possible, upon related facilities and experiences and are representative of normal utility practices. They cover the major plant equipment, systems, and facilities and the plant characteristics which depend upon or have an impact on plant surroundings. Project team studies and outside development contracts concentrated on those areas where current technology or practice does not provide adequate information to support plant design activities or economic analyses. DOE

N82-10548# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
RAPID CHARGING OF LEAD-ACID BATTERIES FOR ELECTRIC-VEHICLE PROPULSION AND SOLAR-ELECTRIC STORAGE
P. Longrigg. Jun. 1981 44 p. refs
(Contracts EG-77-C-01-4042; DE-AC02-77CH-00178)
(DE81-028084, SERI/RR-742-1068) Avail. NTIS HC A03/MF A01

A survey of the various charging techniques that are available and that have been used extensively for lead acid batteries is presented. Descriptions of newer techniques involving gas evolution controlled charging are also included. An evaluation of fast charge approaches, with an analysis of battery state equations, is presented. DOE

N82-10549# Oak Ridge Y-12 Plant, Tenn. Fabrications Systems Dept.
COMPOSITE FLYWHEEL BALANCE EXPERIENCE
R. S. Steele. 6 Apr. 1981 9 p. refs. Presented at the IECEC Conf., Atlanta, 9-14 Aug. 1981
(Contract W-7405-eng-26)
(DE81-769341, Y/DX-290, CONF-810812-2) Avail. NTIS HC A02/MF A01

The high performance composite flywheels which have properties useful in reducing the total energy requirements for automobiles were examined. This requires high rotational speeds and solution to the accompanying problems of fatigue and vibration control through balancing of the rotor. Demonstrated that composite flywheels, require significant balancing and expenses to meet the minimum balance requirements practiced in industry. Flywheels experience balance changes with speed changes. DOE

N82-10556# Argonne National Lab., Ill.
NEAR-TERM BATTERIES FOR ELECTRIC VEHICLES
C. C. Christianson, N. P. Yao, and F. Hornstra. 1981 9 p. refs. Presented at the 8th Energy Technol. Conf. and Expo., Washington, D.C., 9-11 Mar. 1981
(Contract W-31-109-eng-38)
(DE81-023543, CONF-810315-13) Avail. NTIS HC A02/MF A01

Major progress achieved in the lead-acid, nickel/iron and nickel/zinc battery technology development since the initiation of the Near-Term eV Battery Project in 1978 is reported. Against the specific energy goal of 56 wh/kg the demonstrated specific energies are 41 wh/kg for the improved lead-acid batteries, 48 wh/kg for the improved nickel/iron batteries, and 68 wh/kg for the improved nickel/zinc batteries. These specific energy values would allow an ETV-1 vehicle to have an urban range of 80 miles in the case of the improved lead-acid batteries, 96 miles for the improved nickel/zinc batteries, and 138 miles for the improved lead-acid batteries. All represent a significant improvement over the state-of-the-art lead-acid battery capability of about 30 wh/kg with approximately a 51 mile urban range for the ETV-1 vehicle. DOE

N82-10557# Argonne National Lab., Ill. Chemical Engineering Div.
RECENT PROGRESS IN LITHIUM/IRON SULFIDE BATTERY DEVELOPMENT
D. L. Barney, R. K. Steunenberg, and A. A. Chilenskes. 1980 28 p. refs. Presented at the 15th Intersoc. Energy Conversion Eng. Conf., Seattle, 18-22 Aug. 1980
(Contract W-31-109-eng-38)
(DE81-023127, CONF-800806-46) Avail. NTIS HC A03/MF A01

The development of high temperature lithium/iron sulfide batteries for electric vehicle propulsion and stationary energy storage is described. In the Mark 2 program, various improvements are made in the cells and battery hardware to eliminate the potential failure mechanisms. In the cell development effort, multiplate cells with three positive and four negative electrodes were fabricated. A charger equilizer concept is developed, in which the major portion of the charge is added to the battery as a whole and then the individual cells are charged to a predetermined cutoff voltage. DOE

N82-10574# Acres American, Inc., Columbia, Md.
PRELIMINARY DESIGN STUDY OF UNDERGROUND PUMPED HYDRO AND COMPRESSED-AIR ENERGY STORAGE IN HARD ROCK. VOLUME 12: PLANT DESIGN, CAES Final Report
Apr. 1981 285 p. Sponsored in part by Electric Power Research Inst. Prepared for Potomac Electric Power Company, Washington, D.C.
(Contract DE-AC02-77ET-28013, EPRI Proj 1081-1)
(DE81-028110, EPRI-EM-1589-Vol-12; DOE/ET-5047/12) Avail: NTIS HC A13/MF A01

Detailed designs were developed for the major components and systems of the CAES plant. These designs were based upon the preliminary economic and technical evaluations and alternative designs developed in Task 3C. The detailed project design drawings for the major plant systems and structures are presented. The site development report, updated cost estimate, cost/schedule risk study, reliability/availability, analysis, and recommendations for additional research and development are included. DOE

N82-10962# Argonne National Lab., Ill.
STATUS OF NICKEL/ZINC AND NICKEL/IRON BATTERY TECHNOLOGY FOR ELECTRIC VEHICLE APPLICATIONS
N. P. Yao, C. C. Christianson, R. C. Elliott, and J. F. Miller. 1980 43 p. refs. Presented at the 29th Power Sources Conf., Cherry Hill, N.J., 10-13 Jun. 1980
(Contract W-31-109-eng-38)
(DE81-023572, CONF-800612-6) Avail. NTIS HC A03/MF A01

Progress in nickel/zinc and nickel/iron technology was to achieve battery technical performance goals necessary for widespread use in electric vehicle applications is reviewed. Nickel/zinc module test data show a specific energy of nearly 70 Whr/kg and a specific power of 130 W/kg. Nickel/iron moduls demonstrate a specific energy of nearly 50 Wh/kg and a specific power of 100 W/kg. Energy efficiency is improved from less than 50 percent to over 65 percent. Cost reduction is emphasized in the development of both nickel/zinc and nickel/iron batteries to achieve the lowest possible life cycle cost to the battery user. DOE

N82-11368# Brookhaven National Lab., Upton, N.Y. Dept. of Energy and Environment
INVESTIGATION OF THE ZINC ELECTRODE REACTION Annual Report, 1 Oct. 1979 - 30 Sep. 1980
James McBreen. Dec. 1980 138 p. refs
(Contract DE-AC02-76CH-00016)
(DE81-030221, BNL-51370) Avail. NTIS HC A07/MF A01

In nickel-zinc batteries, with pasted zinc electrodes, zinc electrode shape change or redistribution of the active material from the edge of the electrodes toward the center is the major life-limiting factor. In batteries with soluble free electrolyte zinc electrodes, morphology changes, particularly under random cycling conditions, is a major operational problem. Insights and possible solutions to these two problems are considered. The areas covered include: (1) additive and substrate effects on zinc electrode morphology; (2) investigations of zinc electrodes of the second kind; (3) separator effects on zinc electrode shape change; and (4) investigation of the effect of modified charging methods on the morphology and behavior of both pasted and soluble free electrolyte zinc electrodes. DOE

N82-11547*# Munising Paper Div., Neenah, Wis.
DEVELOPMENT OF BATTERY SEPARATOR COMPOSITES Final Report, Oct. 1976 - Nov. 1981
George F. Schmidt and Robert E. Weber. Nov. 1981 56 p.

refs
(Contract NAS3-20583)
(NASA-CR-165508) Avail NTIS Hc A04/MF A01 CSCL 10C

Improved inorganic-organic separators developed by NASA were commercially prepared A single-ply asbestos substrate was developed, as well as alternative substrates based on cellulose and on polypropylene fibers The single-ply asbestos was bound with butyl rubber and was functionally superior to the formerly used polyphenylene oxide saturated sheet Commercially prepared separators exhibited better measured separator properties than the NASA standard Cycle life in Ni/Zn and Ag/Zn cells was related to substrate, decreasing in the order, asbestos > cellulose paper > nonwoven polypropylene The cycle life of solvent-coated separators was better than aqueous in Ni/Zn cells, while aqueous coatings were better in Ag/Zn cells T M

N82-11578# Argonne National Lab., Ill Chemical Engineering Div
CALCIUM/METAL SULFIDE BATTERY DEVELOPMENT PROGRAM Progress Report, Oct. 1979 - Sep. 1980
D L Barney, M F Roche, S K Preto, L E Ross, N C Otto, and F J Martino Mar. 1981 24 p refs Prepared for California Univ., Lawrence Berkeley Lab
(Contract W-31-109-eng-38)
(ANL-81-14) Avail NTIS HC A02/MF A01

Components needed to fabricate a high performance calcium cell were identified The components are (1) Ca-Al-Si negative electrode, (2) Fe sub 0 93 Co sub 0 075 sub 2 positive electrode, (3) Bn felt separator, (4) iron negative and molybdenum positive current collectors, and (5) LiCl-NaCl-CaCl2-BaCl2 electrolyte E A K

N82-11580# Varta Batterie A G., Kelkheim (West Germany)
RECENT ADVANCES IN LEAD-ACID CELL RESEARCH AND DEVELOPMENT
Ernst Voss 1980 38 p refs Presented at the EVA Conf., Adelia, Australia, 25-29 Aug 1980 Sponsored in part by Bundesministerium fuer Forschung und Technologie Prepared for Argonne National Lab., Ill
(Contract W-31-109-eng-38)
(DE81-023104, CONF-8008118-1) Avail NTIS HC A03/MF A01

During the last decade it was demonstate that the lead-acid system is capable of proving an attractive energy source of sufficient energy and power per unit weight and volume which allows its sucessful application for electric vehicle propulsion This is shown by a number of typical examples, such as the relationship between active-material properties and capacity at high rates of discharge the effect of acid stratification and others Simultaneously, the expenditure for the maintenance of lead-acid batteries was minimized by the development of peripheric equipment, as there are means for central-automatic water refill and recombination devices It is shown that there is still a considerable potential for further improvement which might again strengthen the unique position of the lead-acid system in the market in comparison to competitive systems T.M.

N82-11594# California Univ., Berkeley. Lawrence Berkeley Lab
OVERVIEW OF THE APPLIED BATTERY AND ELECTROCHEMICAL RESEARCH PROGRAM
F McLarnon Jun 1981 15 p Presented at the 4th DOE Battery and Electrochem. Contractors' Conf., Washington, D C, 2 Jun 1981
(DE81-027397; LBL-12690; CONF-810642-5) Avail. NTIS HC A02/MF A01

This purpose of this program is to provide the applied research base which supports all of DOE's electrochemical systems missions, and the general objective is to help provide batteries and electrochemical systems that can satisfy economic, performance and schedule requirements The specific goal is to identify the most promising electrochemical technologies and transfer them to industry and/or another DOE program for further development and scale-up DOE

N82-11595# California Univ., Berkeley. Lawrence Berkeley Lab
RECHARGEABLE MOLTEN-SALT CELLS
Elton J Cairns Oct 1980 23 p refs Presented at the 158th Meeting of the Electrochem Soc., 3rd Intern Symp on Molten Salts, Phys Electrochem Div., Hollywood, Fla., 5-10 Oct 1980
(Contract W-7405-eng-48)
(DE81-027091, LBL-11090, CONF-8010159-12) Avail NTIS HC A02/MF A01

Rechargeable molten-salt cells offer the opportunity for achieving higher specific energy than is available from ambient temperature cells (200 W-h/kg), and a specific power in excess of 100 W/kg Two main of rechargeable cells employing molten salts are statistical those with a molten salt as the sole electrolyte, and those with a combination of a solid electrolyte and a molten salt electroylte The status, recent research, and current problems for each of several systems in the above two categories are discussed DOE

N82-11596# California Univ., Livermore Lawrence Livermore Lab
MECHANICAL ENERGY STORAGE TECHNOLOGY (MEST) DEVELOPMENT
Thomas M. Barlow 22 Jun 1981 8 p refs Presented at the Mech., Magnetic, and Underground Energy Storage Ann Contractors' Rev., Washington, D C, 24-26 Aug 1981
(Contract W-7405-eng-48)
(DE81-026800, UCRL-86297) Avail NTIS HC A02/MF A01

The objectives, approaches, structure, and principal accomplishments of the flywheel technology program during FY 1981 are summarized International flywheel-related technology and complementary efforts in the United States are reviewed DOE

N82-11620# Potomac Electric Power Co., Washington, D C
PRELIMINARY DESIGN STUDY OF UNDERGROUND PUMPED HYDRO AND COMPRESSED-AIR ENERGY STORAGE IN HARD ROCK. VOLUME 8: DESIGN APPROACHES: UPH Final Report
Jun 1981 297 p Prepared in cooperation with Acres American, Inc., Buffalo, N Y Sponsored in part by Electric Power Research Inst
(Contract DE-AC02-77ET-28013, EPRI Proj 1081-1)
(DE81-030673, EPRI-EM-1589-Vol-8) Avail NTIS HC A11/MF A01

The development of the design approaches used to determine the plant and overall layout for a underground pumped hydroelectric (UPH) storage facility having a maximum generating capacity of 2000 MW and a storage capacity of 20,000 MWh is discussed Key factors were the selection of the high head pump-turbine equipment and the geotechnical considerations relevant to the underground cavern designs The comparison of pump-turbine alternatives is described leading to the selection for detailed study of both a single-step configurations, using multistage reversible pump-turbines, and a two-step configuration, with single-stage reversible pump-turbines DOE

N82-11621# Potomac Electric Power Co., Washington, D.C
PRELIMINARY DESIGN STUDY OF UNDERGROUND PUMPED HYDRO AND COMPRESSED-AIR ENERGY STORAGE IN HARD ROCK. VOLUME 9: DESIGN APPROACHES: CAES, APPENDIX C. MAJOR MECHANICAL EQUIPMENT Final Report
Apr 1981 108 p refs Prepared in cooperation with Acres American, Inc., Columbia, Md Sponsored in part by Electric Power Research Inst
(Contract DE-AC02-77ET-28013, EPRI Proj 1081-1)
(DE81-030672, EPRI-EM-1589-Vol-9-App-C) Avail NTIS HC A06/MF A01

The major mechanical equipment includes the turbine-motor/generator, compressor train, intercooler/aftercooler system, and exhaust gas recuperator The design criteria for each of these components is interrelated with, and dependent upon, each of the other components within the major mechanical equipment group Careful consideration of this dependency has resulted in an overall design approach which satisfies the requirements of the CAES operational cycle while providing for a conservative component design. DOE

N82-11997# Aerospace Corp., Los Angeles, Calif
ASSESSMENT OF FLYWHEEL SYSTEM BENEFITS IN SELECTED VEHICLE APPLICATIONS
L H Kubo and L. Forrest 1981 7 p refs Presented at IECEC Conf., 9 Aug. 1981
(Contract DE-AC08-79ET-26306)

(DE81-025976, CONF-810812-31) Avail NTIS HC A02/MF A01

The performance of vehicle systems incorporating energy storage flywheels was investigated The effort involved an indept assessment of flywheel system benefits in two vehicle applications a four-passenger commuter car with electric drive (flywheel range extension application) and a six-passenger family car with conventional heat engine drive (flywheel fuel conservation application) The special case of the six-passenger vehicle as used in taxicab service was also investigated A number of possible component design/selection alternatives for flywheel rotors, continuously variable transmissions, batteries, motors, and other propulsion elements were examined Results of the assessment are provided for the case of a series-configuration heat engine/flywheel drive train as used in the passenger car and urban taxi vehicle missions DOE

N82-12396# California Univ, Berkeley Lawrence Berkeley Lab Earth Sciences Div

STUDY OF ATES THERMAL BEHAVIOR USING A STEADY FLOW MODEL

Christine Doughty, Goeran Hellstroem, Chin Fu Tsang, and Johan Claesson (Lund Inst of Tech) Jan 1981 79 p refs (Contract W-7405-eng-48)

(DE81-030883, LBL-11029, PNL-3924) Avail. NTIS HC A05/MF A01

The thermal behavior of a single well aquifer thermal energy storage system in which buoyancy flow is neglected is studied A dimensionless formulation of the energy transport equations for the aquifer system is presented, and the key dimensionless parameters are discussed A simple numerical model is used to generate graphs showing the thermal behavior of the system as a function of these parameters Some comparisons with field experiments are given to illustrate the use of the dimensionless groups and graphs DOE

N82-12445*# Bales-McCoin Tractionmatic, Inc, El Paso, Tex

DESIGN STUDY OF A CONTINUOUSLY VARIABLE ROLLER CONE TRACTION CVT FOR ELECTRIC VEHICLES Final Report

Dan K McCoin and R D. Walker Sep 1980 197 p refs (Contract DEN3-115, EC-77-A-31-1044)

(NASA-CR-159841, DOE/NASA/0115-80/1, Bales-McCoin-80-BMT-002) Avail NTIS HC A09/MF A01 CSCL 13I

Continuously variable ratio transmissions (CVT) featuring cone and roller traction elements and computerized controls are studied The CVT meets or exceeds all requirements set forth in the design criteria Further, a scalability analysis indicates the basic concept is applicable to lower and higher power units, with upward scaling for increased power being more readily accomplished S L

N82-12574*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

PERFORMANCE OF ADVANCED CHROMIUM ELECTRODES FOR THE NASA REDOX ENERGY STORAGE SYSTEM Final Report

Randall F Gahn, JoAnn Charleston, Jerri S Ling, and Margaret A. Reid Nov 1981 23 p refs (Contract DE-AI04-80AL-12726)

(NASA-TM-82724; E-1025; DOE/NASA/12726-15) Avail. NTIS HC A02/MF A01 CSCL 10C

Chromium electrodes were prepared for the NASA Redox Storage System with meet the performance requirements for solar-photovoltaic, wind-turbine and electric utility applications Gold-lead catalyzed carbon felt electrodes up tp 930 sq cm were fabricated and tested in single cells and multicell stacks for hydrogen evolution, coulombic efficiency, catalyst stability and electrochemical activity Factors which affect the overall performance of a particular electrode include the carbon felt lot, the cleaning treatment and the gold catalyzation method Effects of the chromium solution chemistry and impurities on charge/discharge performance are also presented Author

N82-12586# Battelle Pacific Northwest Labs, Richland, Wash

BIBLIOGRAPHY OF THE SEASONAL THERMAL ENERGY STORAGE LIBRARY

L S Prater, G Casper (Midwest Research Inst), and R A Kawin (Control Data Corp) Aug 1981 310 p (Contract DE-AC06-76RL-01830)

(DE81-030470, PNL-3645) Avail NTIS HC A14/MF A01

Seasonal storage of thermal energy which contributes to the relief of the national energy storage is described Various forms of surplus energy (winter chill, summer heat, and industrial waste heat) are stored till needed Potential storage media include aquifers, lakes, ponds, and earth Storage of thermal energy in aquifers is chosen for initial development Other methods of seasonal storage are also evaluated DOE

N82-13377 Purdue Univ, Lafayette, Ind

APPLICATION OF A GRAVITY-DRIVEN WICKLESS HEAT PIPE FOR ICE PRODUCTION IN A COLD ENERGY STORAGE SYSTEM Ph.D. Thesis

Shun-Lung Chao 1981 255 p

Avail Univ Microfilms Order No 8123621

Use of seasonal cold storage for space cooling is considered A simplified analytical model, simulated by a computer program, was developed to predict the system performance Experiments were performed to study the effects of various parameters on the ice formation Parameters studied include the quantity of working fluid, condenser length, coolant inlet temperature, cooling time, type of working fluid, and inclination of the heat pipe The effects of these parameters on the volume and shape of the resulting ice formation and on the wall temperature distribution along the heat pipe are illustrated Evaporation and condensation phenomena within the heat pipe were investigated The influence of natural convection on the geometry and structure of the ice is also discussed The analytical model was found to be adequate for predicting the rate of ice formation and the geometry associated with the ice-water interface, and was verified by comparisons with experimental observations Dissert Abstr

N82-13544# Public Service Co of Indiana, Plainfield

COMPRESSED AIR ENERGY STORAGE: PRELIMINARY DESIGN AND SITE DEVELOPMENT PROGRAM IN AN AQUIFER. VOLUME 2: UTILITY SYSTEM PLANNING Final Report

31 Jul 1981 112 p refs Sponsored in part by EPRI (Contracts DE-AC02-78ET-29232, ET-78-C-01-2159, EPRI Proj 1081-3)

(DE82-000466, DOE/ET-29232/T4-Vol-2) Avail NTIS HC A06/MF A01

The performance of an aquifer compressed air energy storage system was studied The benefits derived from the integration of a compressed air energy storage facility with a hypothetical electrical network are analyzed Scenarios of 100 percent coal, 50 percent coal and 50 percent nuclear, and 100 percent nuclear base load capacity additions were examined Favorable economics are indicated when compressed air energy storage is installed as an alternative to combustion turbine peaking capacity on a system with a significant amount of oil fired generation DOE

N82-14652# Battelle Pacific Northwest Labs, Richland, Wash Office of Seasonal Thermal Energy Storage Program

WASTE HEAT AND CHILL STORAGE IN AQUIFER SYSTEMS

Jay R Eliason 1981 10 p refs Presented at the 3rd Conf on Waste Heat Management and Utilization, Miami, Fla, 12 May 1981

(Contract DE-AC06-76RL-01830)

(DE81-028016, PNL-SA-9164, CONF-810545-6) Avail NTIS HC A02/MF A01

Seasonal storage of thermal energy in aquifers is discussed Winter chill, summer heat, and various forms of industrial waste heat and chill can be stored for future demand, reducing the need for generating primary energy This seasonal storage of heat and chill in aquifer systems is assessed DOE

N82-14655# California Univ, Livermore Lawrence Livermore Lab

FLYWHEEL ROTOR AND CONTAINMENT TECHNOLOGY DEVELOPMENT

S V Kulkarni 11 Aug 1981 14 p refs Presented at the Mech, Magnetic, and Underground Energy Storage 1981 Ann Contractors' Rev Meeting, Washington, D C, 24-27 Aug 1981 (Contract W-7405-eng-48)

(DE81-028047, UCRL-86557, CONF-810833-7) Avail NTIS HC A02/MF A01

An economical and practical composite flywheel with an energy density of 88 Wh/kg at failure, an operational energy density of 44 to 55 Wh/kg, and an energy storage capacity of approximately 1 kWh was developed The suitability of various manufacturing processes for low cost rotor fabrication is determined, flywheel and flywheel systems dynamics are investigated Prototype rotors for use in transportation and stationary applications and a fail safe, lightweight, and low cost flywheel containment are evaluated DOE

N82-15510# Battelle Pacific Northwest Labs, Richland, Wash
RESERVOIR STABILITY STUDIES
T J Doherty Jul 1981 9 p refs Presented at Mech Magnetic and Energy 1981 Ann Contractors Review Meeting, Washington, D C, 24 Aug 1981
(Contract DE-AC06-76RL-01830)
(DE81-030099, PNL-SA-9782; CONF-810833-9) Avail NTIS HC A02/MF A01

Stability criteria for large underground reservoirs in salt domes, hard rock caverns, and porous rock structures for air storage in utility applications were studied Reservoir stability commercialization of compressed air energy storage (CAES) systems was emphasized A state-of-the-art assessment, numerical model development and experimental studies culminating in field research, was formulated Site specific geotechnical design evaluations using methodologies to assess hard rock carvern stabilty, implementation of in-mine research on the response of domal salt, integrated laboratory and field study facilities to assess developed predictive methods and determine in situ response of a porous media reservoir to air injection are completed DOE

N82-15548# Battelle Pacific Northwest Labs, Richland, Wash.
COMPRESSED-AIR ENERGY-STORAGE TECHNOLOGY: PROGRAM OVERVIEW
L D Kannberg Jul. 1981 7 p Presented at the Mech., Magnetic and Underground Energy Storage Ann. Contractor's Rev. Meeting, Washington, D C, 24 Aug 1981
(Contract DE-AC06-76RL-01830)
(DE81-030103, PNL-SA-9780; CONF-810833-8) Avail: NTIS HC A02/MF A01

A new technology designed to reduce the consumption of oil in the generation of electric power was developed The program has two major elements reservoir stability studies and second generation concepts studies The reservoir stability studies are aimed at developing stability criteria for long term operation of large underground reservoirs used for compressed air storage. The second generation concepts studies are aimed at developing new concepts that will require little or no petroleum fuels for operation The program efforts are outlined and major accomplishments towards the objectives of the program are identified. DOE

N82-15558# Midwest Research Inst, Golden, Colo Solar Energy Research Inst
DESIGN AND ECONOMICS OF DIRECT-CONTACT SALT HYDRATE STORAGE SYSTEMS
John D Wright May 1981 9 p refs Presented at the 2nd World Congr of Chem Eng, Montreal, 4-9 October 1981
(Contract EG-77-C-01-4042)
(SERI/TP-631-1163, CONF-811007-3) Avail NTIS HC A02/MF A01

A salt hydrate latent heat storage system in which oil is injected at the bottom of the container and exhanges heat as it floats to the top where it is pumped back to the heat source is described Two experiments are described (1) to reliably inject the oil into the salt phase, and (2) to minimize the carryover of salt hydrate into the oil, which can be done using two stage coalescer filters Three systems are described and compared, a standard liquid based sensible heat storage system, a latent heat storage design where oil is the heat transfer fluid throughout the system, and a latent heat storage system where ethylene glycol/water is used in the collectors and oil in the storage tank DOE

N82-15579# Ames Lab, Iowa
TRANSWALL: A MODULAR VISUALLY TRANSMITTING THERMAL STORAGE WALL Status Report
J F McClelland, R W Mercer, L Hodges, R F Szydlowski, P H Sidles, R G Struss, J R Hull (Argonne National Lab, Ill), and D A Block 1980 8 p refs Presented at the Intern Solar Energy Soc Conf, Brighton, England, 24-27 Aug 1980
(Contract W-7405-eng-82)
(DE81-029821; IS-M-345, CONF-8008123-1) Avail NTIS HC A02/MF A01

The Transwall a semitransparent thermal storage wall system that offers a number of advantages over conventional direct gain and Trombe wall approaches is examined Progress is reported in the design, fabrication, installation, and operation of a glass and aluminum prototype system A facility for year round performance testing of the system is described and preliminary summer season thermal test data are presented Thermal performance modeing results that predict heat loss reduction with a heat mirror coating on Transwall to be comparable to that obtained with R6 night insulation are reported DOE

N82-15584# Institut fuer Kemtechnik und Energiewandlung e.V, Stuttgart (West Germany).
DEVELOPMENT OF A MODULAR HEAT EXCHANGER WITH INTEGRATED LATENT HEAT ENERGY STORE Final Report, Dec. 1979
Ashok Abhat, Dietmar Heine, Manfred Heinisch, Nikolaus A Malatidis, and Guenther Neuer Bonn Bundesministerium fuer Forschung und Technologie Feb 1981 247 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(Contract BMFT-PLE-ET-4060-A)
(BMFT-FB-T-81-050, ISSN-0340-7608) Avail NTIS HC A11/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 41,10

Latent heat storage materials and appropriate heat exchangers for solar heating applications, such as house heating and domestic hot water production were investigated The melting and freezing characteristics and the effects of thermal cycling on a total of 12 substances, including paraffins, fatty acids and salt hydrates, were investigated and their corrosive interaction with five conventional construction materials was determined The poor thermal conductivity of the heat storage materials requires the development of a modular finned heat pipe heat exchanger with increased heat transfer characteristics A cost analysis is provided and comparisons with hot water storage indicate that latent heat storage has the potential of becoming economically more attractive than the former for domestic hot water production Author (ESA)

08
GENERAL

A82-15377 **Research opportunities in new energy-related materials.** J. L. Warren (Los Alamos National Laboratory, Los Alamos, NM) and T. H. Geballe (Stanford University, Stanford, CA). *Materials Science and Engineering*, vol. 50, Oct. 1981, p. 149-198. 235 refs. Research supported by the U.S. Department of Energy.

The needs and opportunities in basic research on new materials are reviewed with a view to providing a basis for planning future research programs. The review covers polymers, intermetallic compounds, amorphous solids, thin films, solid state ionics, catalysts, and semiconductors. It is concluded that (1) a large number of new materials can be prepared by imaginative application of established techniques, (2) a close coupling of synthesis, characterization, and measurement of properties is essential, and (3) new phases of well-known materials, e.g. amorphous materials and thin films, provide a better understanding of these materials and promise solutions to a number of technical problems. V.L.

A82-17251 **Metallurgical coatings 1980; Proceedings of the Seventh International Conference, San Diego, CA, April 21-25, 1980. Volumes 1 & 2.** Conference supported by the Energy Research, Inc., High Vacuum Equipment Corp., Kinney Vacuum Co., et al. Edited by J. N. Zemel. Lausanne, Elsevier Sequoia, S.A., 1980 Vol. 1, 567 p., vol. 2, 510 p. Price of two volumes, $129.75.

Among the topics discussed are: (1) metallurgical coatings for solar energy applications, such as highly reflecting molybdenum thin films, the nucleation and growth characteristics of zinc oxide overgrowths, and the oxidation of electrodeposited black chromium selective solar films, (2) the characterization of coating defects, including aluminum film vapors deposited onto plastic, plasma-sprayed ferrous alloys, and chemisorption monolayer coatings; (3) metal and alloy coatings, among which are those of tungstate on tin, molybdenum on graphite, aluminum-zinc coatings for the corrosion protection of steel and aluminum-silver alloy films for solar reflectors, (4) metallurgical aspects of microelectronics, including recent advances in solder bond technology for microelectronic packaging, (5) semiconductor and dielectric coatings, and (6) refractory compound coatings O.C.

N82-10565# *Midwest Research Inst., Golden, Colo* Solar Energy Research Inst
MEASURED PERFORMANCE OF FALLING-JET FLASH EVAPORATORS
H. J. Green, D. A. Olson, D. Bharathan, and D. H. Johnson Jun. 1981 9 p refs *Presented at the 8th Ocean Energy Conf., Washington, D.C., 7 Jun. 1981*
(Contract EG-77-C-01-4042)
(DE81-024355, SERI/TP-631-1270, CONF-810622-3) Avail NTIS HC A02/MF A01

The rates of heat transfer and approach to thermal equilibrium of flash evaporators operating at pressures of 2 to 4 kPa were investigated. Heat and mass transfer rates from falling jet evaporators operating in the temperature range of 18 to 30 C are measured. The initial experimental results are given and the apparatus is described DOE

N82-11012# Ames Lab., Iowa
AMES LABORATORY RESEARCH REPORT, 1980
1980 100 p
(Contract W-7405-eng-82)
(DE81-027399, IS-4767) Avail: NTIS HC A05/MF A01

Some of the research activities at Ames Laboratory described include coal research, solar cells, solar space heating of buildings, superconducting wires, coal carcinogens, lasers, solid waste recovery, nuclear physics, and high energy physics. Publications are listed DOE

N82-14649# California Univ., Livermore. Lawrence Livermore Lab
FIRE-PROTECTION RESEARCH FOR ENERGY TECHNOLOGY: FY 80 YEAR END REPORT
H. K. Hasegawa, N. J. Alvares, A. E. Lipska, H. Ford, S. Priante, and D. G. Beason 26 May 1981 118 p refs
(Contract W-7405-eng-48)
(DE82-000970, UCRL-53179) Avail NTIS HC A06/MF A01

This continuing research program was initiated in order to advance fire protection strategies for Fusion Energy Experiments (FEE). The program expanded to encompass other forms of energy research. Accomplishments for fiscal year 1980 were finalization of the fault-free analysis of the Shiva fire management system, development of a second-generation, fire-growth analysis using an alternate model and new LLNL combustion dynamics data, improvements of techniques for chemical smoke aerosol analysis, development and test of a simple method to assess the corrosive potential of smoke aerosols, development of an initial aerosol dilution system, completion of primary small-scale tests for measurements of the dynamics of cable fires, finalization of primary survey format for non-LLNL energy technology facilities; and studies of fire dynamics and aerosol production from electrical insulation and computer tape cassettes DOE

N82-14981# Strasbourg Univ. (France) Bureau d'Economie Theorique et Appliquee
ECONOMIC EFFECTS INDUCED BY ESA CONTRACTS, PHASE 2. VOLUME 1: SUMMARY [LES EFFETS ECONOMIQUES INDUITS DES CONTRATS DE L'ESA. PHASE 2. VOLUME 1: RESUME]
Patrice Brendle, Patrick Cohendet, Jean-Alain Heraud, Regis LaruedeTournemine, Helwig Schmied, Daniel Vitry, and Ehud Zuscovitch Paris ESA Jun. 1980 22 p In FRENCH 3 Vol
(Contract ESA-3702/78/F-DKR(SC))
(ESA-CR(P)-1462-Vol-1) Avail NTIS HC A02/MF A01

Different effects are classified by technological advantages, commercial gains, organization and methodological advances, and impact on employment. Exports and limiting, or substitution for, imports are considered. Advantages other than space research were estimated for each sector of the economy and by country. Project Meteosat is shown to be of particular value. Results show that innovations due to ESA funding center on two essential activities: processing, storage and dissemination of information, and conditioning, storage and distribution of energy.
Author (ESA)

N82-15008* National Aeronautics and Space Administration, Washington, D.C.
HIGHLIGHTS OF 1981 ACTIVITIES
23 Dec. 1981 20 p
(NASA-News-Release-81-199, P81-10203) Avail NTIS Avail NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22B

The highlights of NASA's 1981 activities are presented, including the results of the two flights of the space shuttle Columbia and the Voyager 2 encounter with Saturn. Accomplishments in the areas of space transportation operations, space science, aeronautical, energy, and space research and development, as well as space tracking, international activities, and 1981 launch activities are discussed. S.L.

N82-15436# *National Bureau of Standards, Washington, D.C.*
DIMENSIONS, VOLUME 65, NUMBER 3
Apr. 1981 29 p refs
(PB81-235053; NBS-DIM-65-3) Avail NTIS HC A03/MF A01 CSCL 14B

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. Topics discussed are issue swinging to the Earth's tilt, testing for technical competence, physics at the measurement limits, new parameter proposed for fracture toughness, evaluation of solar collector cover plates, and improved modeling of cement and concrete, fire development in basement rooms, and generation and measurement of DC electric field with space charges. Author

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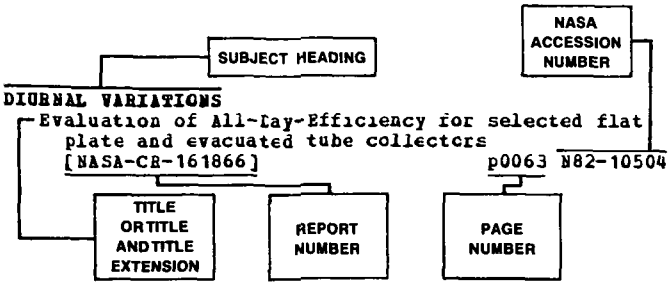

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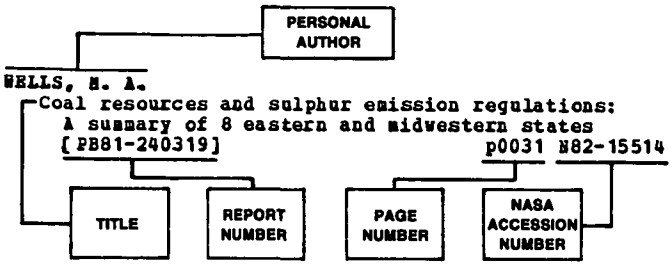

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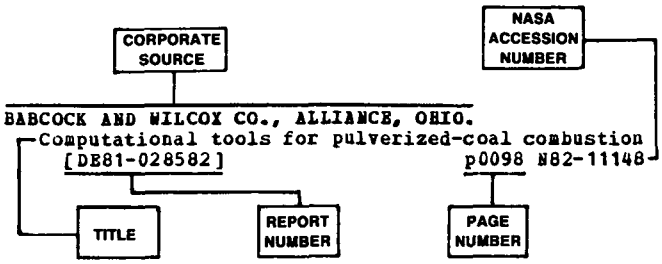

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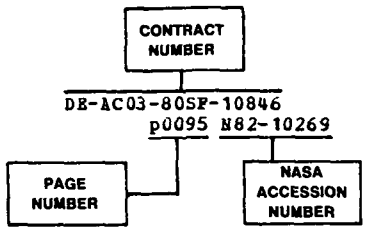

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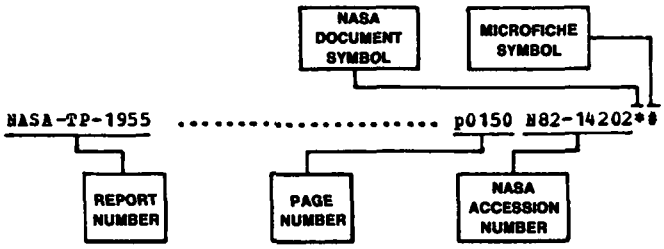

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