NASA SP-7043 (06)

ENERGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

OCTOBER 1975

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

ACCESSION NUMBER RANGES

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

IAA (A-10000 Series)	A75-19577—A75-29188
STAR (N-10000 Series)	N75-15601—N75-21218

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DOCUMENT	*DATE*	*COVERAGE*
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NASA SP-7043(01)	May 1974	January 1, 1974—March 31, 1974
NASA SP-7043(02)	November 1974	April 1, 1974—June 30, 1974
NASA SP-7043(03)	February 1975	July 1,1974—September 30, 1974
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NASA SP-7043 (06)

ENERGY

A Continuing Bibliography

With Indexes

Issue 6

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced from April 1 through June 30, 1975 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(06)) lists 505 reports, journal articles, and other documents announced between April 1, 1975 and June 30, 1975 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of this continuing bibliography was published in May 1974 and succeeding issues are published quarterly.

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

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

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

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

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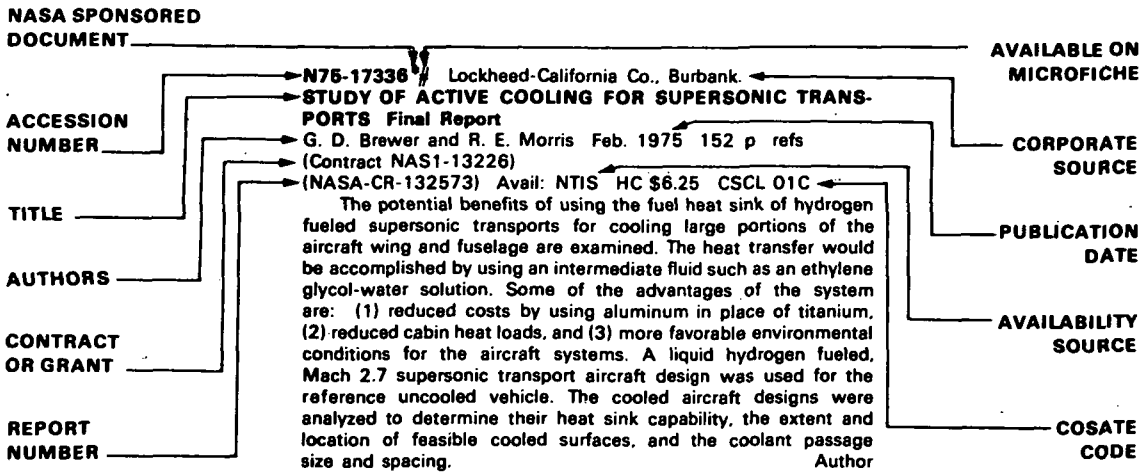

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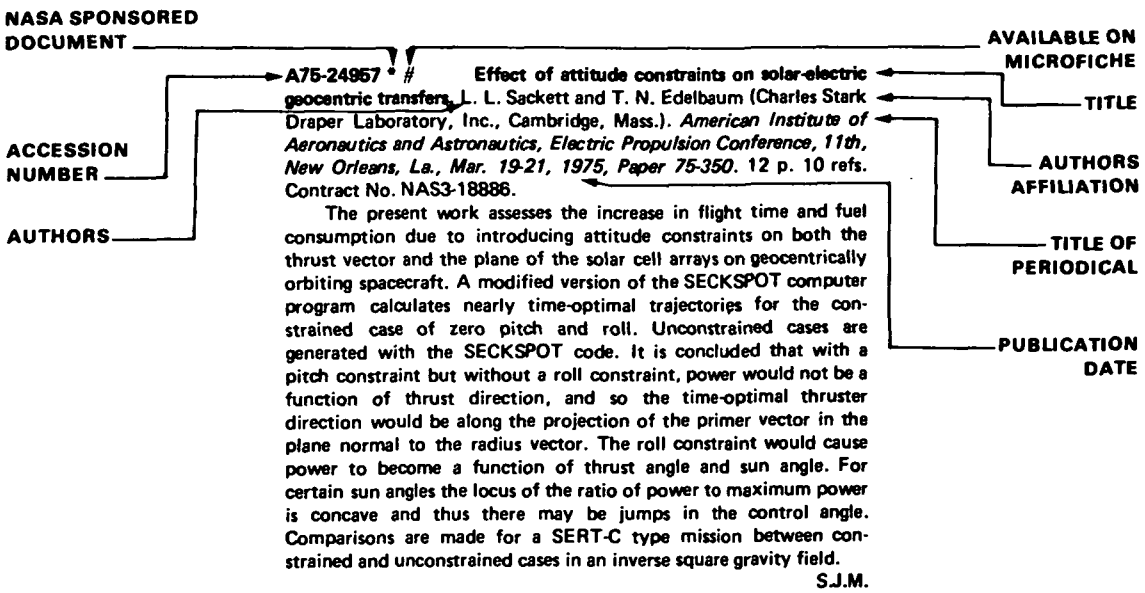


A Listing of Energy Bibliographies Contained in This Publication:

NASA

ENERGY

A Continuing Bibliography (Issue 6) OCTOBER 1975

IAA ENTRIES

A75-19631 Thermodynamic considerations of 'solid state engines' based on thermoelastic martensitic transformations and the shape memory effect. H. C. Tong (IBM Corp., General Product Div., San Jose, Calif.) and C. M. Wayman (Illinois, University, Urbana, Ill.). *Metallurgical Transactions A - Physical Metallurgy and Materials Science,* vol. 6A, Jan. 1975, p. 29-32. 18 refs. AEC-NSF-supported research.

Engine applications of the shape memory ('Marmem') effect associated with thermoelastic transformations are discussed. Such devices potentially enable the direct conversion of heat (i.e., solar energy or waste heat) into mechanical work. It is shown that efficiencies of the order of 20% may be expected and can be improved with alloys having certain transformation hysteresis loop characteristics. (Author)

A75-19657 An electron beam initiated fusion neutron generator. T. G. Roberts, R. A. Shatas, and J. D. Stettler (U.S. Army, Missile Command, Redstone Arsenal, Ala.). *IEEE Transactions on Plasma Science,* vol. PS-2, Dec. 1974, p. 257-260. 19 refs.

An experimental scheme is proposed which seems to satisfy all the requirements for use of a high energy electron beam to initiate a thermonuclear plasma. One-dimensional expansion is utilized to obtain confinement times longer than the pulse length of the electron beams. A magnetic field is used to limit the radial heat conductivity, and this magnetic field also serves as a guiding field for the electron beams when they are in the vicinity of the target. Two opposing electron beams are employed and the forces produced by these counterstreaming currents in the overlap region of the beams are sufficient to stop the beams within the target. Estimates made of all the critical factors indicate that beams achievable with current technology can be focused and stopped in T-D targets 6 cm long with densities as low as 10 to the 21st power particles per cu cm. Furthermore a positive fusion energy yield relative to the energy delivered to the target is predicted. (Author)

A75-19660 Numerical simulation of direct energy conversion. S. J. Gitomer (California, University, Los Alamos, N. Mex.) and C. K. Krishnan (Pennsylvania, University, Philadelphia, Pa.). *IEEE Transactions on Plasma Science,* vol. PS-2, Dec. 1974, p. 277-282. 12 refs. AEC-NSF-sponsored research.

Use of numerical simulation to study Post's (1970) electrostatic scheme for direct conversion of fusion energy to electricity. Using a two-dimensional electrostatic approach, it is shown that useful efficiency information may be obtained from monoenergetic low-density (ratio of ion number density to critical density much less than 1) ion beams. Using the generated efficiency function, it is possible to find optimum parameters for the direct converter for any distribution of input ion energies. As an example of this, a flat top ion energy distribution was simulated, yielding optimum parameters. In the high-density regime (where the above-mentioned ratio is about equal to 1) the collection efficiency decreases with an increase in this ratio from a maximum efficiency of not quite 60%. The significant degradation of efficiency for a ratio equal to 1 is shown to be in good agreement with the results of other investigators. The dynamic instability which occurs as the ratio increases is found to be brought about by the formation of an increasingly steep potential hill near the entrance to the direct converter. This space charge caused potential hill effectively disperses the incoming ion beam and degrades the collection efficiency. A.B.K.

A75-19959 Possible development of acoustical instability in a system consisting of a combustion chamber and a subsonic MHD generator. V. K. Kolesnikov, A. V. Nedospasov, and L. P. Poberezhskii (Akademiia Nauk SSSR, Nauchno-Issledovatel'skii Institut Vysokikh Temperatur, Moscow, USSR). *(Teplofizika Vysokikh Temperatur,* vol. 12, May-June 1974, p. 614-618.) *High Temperature,* vol. 12, no. 3, Jan. 1975, p. 528-532. 6 refs. Translation.

A75-20066 Energy. Volume 1 - Demands, resources, impact, technology, and policy. S. S. Penner and L. Icerman (California, University, La Jolla, Calif.). Reading, Mass., Addison-Wesley Publishing Co., Inc., 1974. 393 p. $14.50.

Details concerning energy demands are considered, giving attention to forms of energy, fossil fuels, nuclear fuels, and natural-gas demands. Available energy resources are discussed along with questions of energy consumption, the economic value of energy utilization, energy-utilization efficiencies, waste recovery, geophysical implications of energy consumption, and the past societal costs of coal use in electricity generation. A commentary on U.S. energy policy and resource development is also presented, taking into account energy needs and supplies for the years 1985 and 1995. G.R.

A75-20300 Efficiencies of electrolytic and thermochemical hydrogen production. A. J. Appleby (Compagnie Générale d'Electricité, Marcoussis, Essonne, France). *Nature,* vol. 253, Jan. 24, 1975, p. 257, 258. 7 refs.

An investigation is conducted concerning the relative efficiency of a system constructed on the basis of a sequence of chemical reactions and a system based on a heat engine producing electricity, followed by electrolysis. Taking all factors into account, it appears that processes based on thermochemical conversion may prove to be less efficient than projected electrolyzers. G.R.

A75-20686 Progress in heat pipe and porous heat exchanger technology. A. V. Luikov and L. L. Vasiliev (Akademiia Nauk Belorusskoi SSR, Institut Teplo- i Massoobmena, Minsk, Belorussian SSR). *International Journal of Heat and Mass Transfer,* vol. 18, Feb. 1975, p. 177-190. 32 refs.

This is a review of the papers presented at the 1st International Heat Pipe Conference held in Stuttgart, 15-17 October 1973. The review deals with heat pipe application in different branches of technology, heat- and mass-transfer processes in heat pipes, design of variable-conductance heat pipes, optimization of their parameters, operation of heat pipes under weightlessness and in the field of gravity. Main principles of theoretical analysis of energy and substance transfer in heat pipes are presented; centrifugal and coaxial heat pipes, heat pipes with twisted tape, noncondensing gas, electric, magnetic and ultrasonic fields applied, etc. are described. (Author)

A75-21150 # Meteorological factors and dispersion of pollutants in the atmosphere - A preliminary study about a large power

plant (Fattori meteorologici e diffusione di inquinanti nell'atmosfera - Uno studio preliminare relativo ad una grande centrale termoelettrica). S. Palmiera, F. Nucciotti, and G. Simonini (Aeronautica Militare, Servizio Meteorologico, Rome, Italy). *Rivista di Meteorologia Aeronautica,* vol. 34, Apr.-June 1974, p. 95-112. 6 refs. In Italian.

A75-21274 # Soil burial of radioisotopic fuel capsules. W. H. McCulloch (Sandia Laboratories, Albuquerque, N. Mex.). In: Advances in thermal conductivity; Proceedings of the Thirteenth International Conference, Lake of the Ozarks, Mo., November 5-7, 1973. Rolla, Mo., University of Missouri, 1974, p. 377-385.

The safety parameters of soil burial of cylinders with length-diameter ratios of from two to five, having hemispherical ends, is investigated. The burial of these radioisotopic space vehicle fuel source capsules is assumed to occur as part of a mission plan or due to an abort. Thermal conductivity of soil as a function of capsule hot-side temperature, capsule temperature versus soil thermoconductivity, and capsule temperature versus burial depth are plotted for the cases of a sphere and a section of an infinitely long cylinder. Actual results should lie between these two cases. It is proposed that previous safety estimations based on diatomaceous earth are unwarranted; a more appropriate 'worst case' thermoconductivity is graphed based on natural soil composition. S.J.M.

A75-21465 Thermal performance characteristics of heat pipes. K. H. Sun and C. L. Tien (California, University, Berkeley, Calif.). *International Journal of Heat and Mass Transfer,* vol. 18, Mar. 1975, p. 363-380. 24 refs.

Theoretical and experimental studies are conducted to evaluate the overall thermal performance of single-component and gas-loaded heat pipes. In the analysis, the simple conduction model developed recently for the single-component heat pipes has been extended to predict the wall temperature profiles of gas-loaded heat pipes with phase change occurring in the evaporator wick. Experimental evaluation of the thermal performance is made with two working fluids (water and acetone) under two corresponding sink environments (boiling water and boiling alcohol). The heat pipe system is designed with variable-length heat input and output sections under a wide range of heat input conditions. Measured results agree well with theoretical predictions. (Author)

A75-21713 Foreseeable thermal, mechanical, and materials engineering problems of fusion reactor power plants. A. P. Fraas (Oak Ridge National Laboratory, Oak Ridge, Tenn.). *(International Conference on Structural Mechanics in Reactor Technology, 2nd, Berlin, West Germany, Sept. 10-14, 1973, Paper A2/1.) Nuclear Engineering and Design,* vol. 29, no. 3, 1974, p. 295-310. 25 refs. AEC-sponsored research.

The engineering problems that will be posed by full-scale reactor power plants are illustrated by examining a representative conceptual design. The temperature extremes that must be accommodated run from 4 K in superconducting magnets to 100 million K in the plasma. These temperature differences lead to difficult problems with differential thermal expansion, high heat fluxes, and stringent thermal insulation requirements. The magnetic fields that must be provided run from 25 to 100 kG, and these fields induce forces on elements of the structure of the order of 20,000 tons. The walls of the chamber containing the plasma must withstand intense radiation by 14 MeV neutrons and 1-50 keV ions. Unusual fluid flow and heat transfer problems include two-phase boiling flow of helium in the superconducting magnets, and the magnetohydrodynamic effects on the flows of red hot lithium and boiling potassium in a high magnetic field. (Author)

A75-22041 Energy, hydrogen, and pollution (Energie, hydrogène, pollution). B. Cochet-Muchy (Ugine-Kuhlmann, Paris, France). *Sciences et Techniques,* Dec. 15, 1974-Jan. 15, 1975, p. 10-16. In French.

The article surveys topics related to the future use of hydrogen for energy, including the methods of producing hydrogen, the means for transporting and storing it, and the ways in which it could be used. Several thermochemical methods for producing hydrogen, possibly using the heat from nuclear reactors, are outlined. Methods for producing hydrogen by electrolysis are also under study. Hydrogen could be transported and stored in gaseous form and used in heat production with modified natural-gas techniques. In solid form, metallic hydrides such as MgH2 could be used to power vehicle motors. Storage and transport could also be in liquid form, with evaporation for use. Hydrogen could be used for storing electrical energy in chemical form, for fueling transport engines, and for reducing iron oxides. A.T.S.

A75-22042 Hydrogen fuel cells and motors (Piles et moteurs à hydrogène). Y. Bréelle (Institut Français du Pétrole, des Carburants, et Lubrifiants, Paris, France). *Sciences et Techniques,* Dec. 15, 1974-Jan. 15, 1975, p. 21-26. In French.

Internal-combustion engines can be adapted to use hydrogen as a fuel, but the weight of the reservoir necessary to hold the hydrogen makes this system less efficient than the gasoline engine in terms of energy produced. Fuel cells, which transform chemical energy directly into electrical energy with a practical efficiency of 40-80 per cent, are discussed in detail. Three types of hydrogen-air fuel cells are presently under study: the high-temperature cell with solid electrolyte, the low-temperature cell with acid electrolyte, and the low-temperature cell with basic electrolyte. Experiments with fuel cells have succeeded in considerably increasing their lifetime and specific power. Hydrogen fuel cells can be used to generate energy in many situations, including both small-scale and large-scale generation of electricity. Fuel cells can produce high specific power more efficiently than internal-combustion engines, so they are attractive as a source of propulsion for vehicles. A.T.S.

A75-22043 Liquid hydrogen (L'hydrogène liquide). G. Gistau (L'Air Liquide, Paris, France). *Sciences et Techniques,* Dec. 15, 1974-Jan. 15, 1975, p. 27-39. In French.

The properties of hydrogen in gaseous and liquid forms are described. The operation of low-temperature hydrogen purifiers used in the liquefaction process is explained. The liquefaction cycle is organized depending on the desired capacity and the economics of operation. Several liquefaction schemes using free expansion of hydrogen or a helium cycle, with capacities of 35-3600 liters/h, are described. The storage of liquid hydrogen is complex and delicate, requiring excellent thermal insulation. The problems involved in limiting heat convection, conduction, and radiation are considered, and a 100-liter liquid-hydrogen reservoir is described. The technology and specific aspects of transporting liquid hydrogen are discussed. Liquid hydrogen can be used directly in applications such as bubble chambers or space programs, or it can be used as a source of gaseous hydrogen of high purity. A.T.S.

A75-22044 Production of hydrogen by the electrolysis of water (Production d'hydrogène à partir de l'électrolyse de l'eau). C. Gales and P. Perroud (Commissariat à l'Energie Atomique, Laboratoire d'Applications Spéciales de la Physique, Grenoble, France). *Sciences et Techniques,* Dec. 15, 1974-Jan. 15, 1975, p. 40-44. In French.

Experiments have been performed on the use of metallic hydrides as a means of storing hydrogen for use in energy production. Magnesium hydride (MgH2) is more attractive than hydrides of LaNi5, V, or FeTi for this purpose. The main disadvantages of this mode of storage are weight and volume. Economic factors, safety factors, and special applications, such as in internal-combustion and gas-turbine engines, are considered. A.T.S.

A75-22352 Laser compression of matter - Optical power and energy requirements. R. E. Kidder (California, University, Livermore, Calif.). *Nuclear Fusion,* vol. 14, Dec. 1974, p. 797-803. 11 refs. AEG-sponsored research.

The optical power required to achieve a given measure of inertial

confinement of a laser-compressed DT pellet is found to be approximately proportional to the square of the inertial confinement. This result is based on a model of self-regulating pellet ablation by hot electrons of the pellet corona that is relatively insensitive to the details of the pellet ablation process. To achieve values of inertial confinement believed necessary in the application of laser fusion to commercial power production, 3,000 Terawatts of optical power is found to be required, implying a total laser output aperture of 30 sq m. The same power requirement would appear to apply to pellet compression by charged-particle beams. An estimate of the required laser-pulse energy, assuming corona-core decoupling to be the controlling limitation, is also given. In the application to commercial power production, the required pulse energy is found to range from 70 kJ at 0.265 micron to 3 MJ at 10.6 microns. (Author)

A75-22508 * # Conceptual design of reduced energy transports. M. D. Ardema, M. Harper, C. L. Smith, M. H. Waters, and L. J. Williams (NASA, Ames Research Center, Moffett Field, Calif.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 11th, Washington, D.C., Feb. 24-26, 1975, Paper 75-303.* 8 p. 6 refs.

This paper reports the results of a conceptual design study of new, near-term fuel-conservative aircraft. A parametric study was made to determine the effects of cruise Mach number and fuel cost on the 'optimum' configuration characteristics and on economic performance. Supercritical wing technology and advanced engine cycles were assumed. For each design, the wing geometry was optimized to give maximum return on investment at a particular fuel cost. Based on the results of the parametric study, a reduced energy configuration was selected. Compared with existing transport designs, the reduced energy design has a higher aspect ratio wing with lower sweep, and cruises at a lower Mach number. It yields about 30% more seat-miles/gal than current wide-body aircraft. At the higher fuel costs anticipated in the future, the reduced energy design has about the same economic performance as existing designs. (Author)

A75-22513 # Energy efficiency of current intercity passenger transportation modes. M. P. Miller and G. J. Schott (Boeing Commercial Airplane Co., Seattle, Wash.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 11th, Washington, D.C., Feb. 24-26, 1975, Paper 75-314.* 11 p. 26 refs.

A detailed study was conducted to compare three public modes (aircraft, train, and bus) and one private mode (automobile). The comparison represented Spring 1974 conditions and was conducted in two parts. The first one collected or developed basic energy efficiency data for each mode. In the second one this data was applied to passenger transportation between 10 city pairs. These results were extended using national system trends to obtain a comparison for the total city pair population. The paper presents results from the study and emphasizes the importance of establishing clear groundrules to ensure fair comparisons through consistent data. Many earlier papers show deficiencies in this respect. Some of these deficiencies will be specifically pointed out in order to explain why this paper's results differ from those of previous papers. (Author)

A75-22514 * # Future long-range transports - Prospects for improved fuel efficiency. A. L. Nagel, W. J. Alford, Jr. (NASA, Langley Research Center, Hampton, Va.), and J. F. Dugan, Jr. (NASA, Lewis Research Center, Wind Tunnel and Flight Div., Cleveland, Ohio). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 11th, Washington, D.C., Feb. 24-26, 1975, Paper 75-316.* 18 p. 52 refs.

A status report is provided on current thinking concerning potential improvements in fuel efficiency and possible alternate fuels. Topics reviewed are: historical trends in airplane efficiency; technological opportunities including supercritical aerodynamics, vortex diffusers, composite materials, propulsion systems, active controls, and terminal-area operations; unconventional design concepts, and hydrogen-fueled airplane. (Author)

A75-22515 * # Air transportation energy consumption - Yesterday, today, and tomorrow. A. C. Mascy and L. J. Williams (NASA, Ames Research Center, Moffett Field, Calif.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 11th, Washington, D.C., Feb. 24-26, 1975, Paper 75-319.* 9 p. 29 refs.

The energy consumption by aviation is reviewed and projections of its growth are discussed. Forecasts of domestic passenger demand are presented, and the effect of restricted fuel supply and increased fuel prices is considered. The most promising sources for aircraft fuels, their availability and cost, and possible alternative fuels are reviewed. The energy consumption by various air and surface transportation modes is identified and compared on typical portal-to-portal trips. A measure of the indirect energy consumed by ground and air modes is defined. Historical trends in aircraft energy intensities are presented and the potential fuel savings with new technologies are discussed. (Author)

A75-22522 Material considerations involved in solar energy conversion. R. L. Gervais, H. Taketani, H. W. Babel, and G. F. Pittinato (McDonnell Douglas Astronautics Co., Huntington Beach, Calif.). *SAMPE Quarterly,* vol. 6, Jan. 1975, p. 14-22. 14 refs.

Recent investigations of the application of solar energy to electrical power generation which have proved encouraging in certain geographic locations in the United States are discussed. These encouraging findings have been due, in part, to the application of aerospace-related technology and systems engineering to critical elements of the solar energy system which have heretofore proven economically unrealistic. Results to date are given on two specific material areas that have benefited from this technology transfer, the heat pipe and the solar mirror (concentrator) subsystems. (Author)

A75-22523 Metals and composites in superflywheel energy storage systems. D. W. Rabenhorst (Johns Hopkins University, Silver Spring, Md.). *(American Society of Mechanical Engineers, Annual Symposium, 14th, Albuquerque, N. Mex., Feb. 28-Mar. 1, 1974.) SAMPE Quarterly,* vol. 6, Jan. 1975, p. 23-28. 12 refs.

The use of flywheel storage systems has been limited until recently due to their poor energy storage capability and efficiency and the danger of catastrophic failure. Superflywheels offering improved safety and better performance than even the best optimized steel flywheels are being studied now because of the materials used in their manufacture. Superflywheels are kinetic energy storage systems of either fanned brush or multi-rim configuration which make use of modern super materials, such as anisotropic boron, carbon, fiberglass or Kevlar. Basic criteria for selecting materials used in superflywheels are strength, density, cost and usability factors. These criteria are discussed and applied to the materials mentioned above, as well as to bulk glass, wood and bamboo. F.G.M.

A75-22734 The economics of nuclear power. I. C. Bupp (Harvard University, Cambridge, Mass.), J.-C. Derian, M.-P. Donsimoni, and R. Treitel (MIT, Cambridge, Mass.). *Technology Review,* vol. 77, Feb. 1975, p. 14-25. 7 refs.

Present trends in nuclear reactor costs are interpreted as the economic result of a fundamental debate regarding the social acceptability of nuclear power. Rising capital costs for nuclear power plants are evaluated through statistical analysis of time-related factors, characteristics of licensing and construction costs, physical characteristics of reactors, and geographic and site-related factors. A strong correlation between costs and project length is found. Longer licensing periods, necessitated by environmental reviews, quality assurance programs, and safety related design changes, result in shorter construction periods which, in turn, generate higher costs. No evidence is found, however, to support a direct relationship between delays in construction and higher costs. Conclusions are drawn regarding the impact of social acceptability on reactor costs, engineering estimates of future costs, and the possibility of increased potential relative competitiveness for coal-fueled plants. F.G.M.

A75-22913 **Technology utilization - Incentives and solar energy.** A. A. Ezra (National Science Foundation, Washington, D.C.). *Science*, vol. 187, Feb. 28, 1975, p. 707-713. 15 refs.

A technology delivery system is used to explain the role of incentives in stimulating public use of solar energy. The discussion is in the context of federally funded research and development. Incentives described include federal procurement, demonstration projects, information dissemination, construction grants, federal patents and licenses, federal cost sharing and leasing, federal testing and standardization, and loan guarantees and loan insurance. The energy utilization example of heating and cooling of homes is considered. It is stressed that the responsibility for bringing about technology utilization cannot be borne alone by the federal agency funding the R & D. S.J.M.

A75-22948 **F-15 secondary power systems.** H. S. Ostroff (McDonnell Aircraft Co., St. Louis, Mo.). *Society of Automotive Engineers, National Aerospace Engineering and Manufacturing Meeting, San Diego, Calif., Oct. 1-3, 1974, Paper 740885.* 6 p. Members, $1.75; nonmembers, $2.75.

A description is given of innovations in fighter aircraft secondary power systems, taking into account the reasons which led to the use of these systems in the F-15. The F-15 accessory drive system is discussed along with accessory drive improvements for future fighters, questions of secondary power distribution protection, and aspects of secondary power integrity. Hydraulic leakage problems can be significantly reduced by the employment of the newly developed swaged hydraulic fitting. Operating experience with the F-15 has borne out the predicted maintenance-free nature of the permanent joints. G.R.

A75-23018 **Simulation of a solar heating and cooling system.** L. W. Butz, W. A. Beckman, and J. A. Duffie (Wisconsin, University, Madison, Wis.). *(International Solar Energy Society, Meeting, Cleveland, Ohio, Oct. 1973.) Solar Energy*, vol. 16, Dec. 1974, p. 129-136. 6 refs. NSF Grant No. GI-34029.

This paper presents thermal and economic analyses of a solar heated and air conditioned house in the Albuquerque climate. The system includes the following components: water heating collector, a water storage unit, a service hot water facility, a lithium bromide-water air conditioner (with cooling tower), an auxiliary energy source, and associated controls. The analysis of the thermal performance indicates the dependence of output on collector area (considered as the primary design variable) and shows, for example, the manner in which annual system efficiency decreases as collector area increases. Based on the computed thermal performance, cost estimates are made which show variations in annual cost as functions of collector area and costs of collector and fuel. (Author)

A75-23021 **Solar operation of ammonia-water multistage air conditioning cycles in the tropics.** J. C. V. Chinnappa (P.N.G. University of Technology, Lae, New Guinea). *(UNESCO, International Congress on the Sun in the Service of Mankind, Paris, France, July 2-6, 1973.) Solar Energy*, vol. 16, Dec. 1974, p. 165-170. 8 refs.

An assessment is made of the performance of four types of ammonia-water refrigeration cycles when supplied with solar heat. The cycles compared are: a single-effect condensing, or conventional, (1-C) cycle; a single-effect resorption (1-R) cycle; a double-effect condensing (2-C) cycle; and a double-effect resorption (2-R) cycle. It is found that the 1-R cycle is superior to the 1-C cycle for all values of daily insolation, due to a higher performance coefficient and lower generator operating temperatures. The relative costs of solar collectors and refrigerating plants are considered. A.T.S.

A75-23229 **Fundamentals of automatic control of space nuclear power plants (Osnovy avtomaticheskogo upravleniia iadernymi kosmicheskimi energeticheskimi ustanovkami).** Edited by B. N. Petrov. Moscow, Izdatel'stvo Mashinostroenie, 1974. 380 p. In Russian.

The present work is devoted mainly to generalizing the theories of the dynamics and control of space power plants. A presentation is made of the mathematical apparatus, methods, and algorithms for studying the dynamics of distributed systems as applied to the control of space power plants. Approximate methods are given for determining the dynamic characteristics of heat exchangers and the basic elements of power plants. Attention is given to control in the nominal and start-up regimes for two types of power plants: those which convert nuclear energy directly to electrical energy, and those which utilize mechanical energy conversion. The optimal-control problem is formulated and solution methods are presented. A.T.S.

A75-23236 **Some LNG vehicle developments.** C. J. Gibson (Kaiser Brencar, El Cajon, Calif.). In: Cryogenic Society of America, National Symposium and Exhibition, 6th, Los Angeles, Calif., October 2-4, 1973, Proceedings. Flushing, N.Y., Scholium International, Inc., 1974, p. 94-109.

The design factors, problem areas, development history and state-of-the-art for liquefied natural gas (LNG) automotive conversion systems and fueling stations are presented. Focus is on the cryogenic technology involved rather than on the automotive engineering aspects of the problem. Auto emissions test results are reported, and it is concluded that as a low emission alternative to gasoline, LNG has a definite place as an automotive fuel. S.J.M.

A75-23237 **Stirling engines - Capabilities and prospects.** A. Daniels (North American Philips Corp., Briarcliff Manor, N.Y.). In: Cryogenic Society of America, National Symposium and Exhibition, 6th, Los Angeles, Calif., October 2-4, 1973, Proceedings. Flushing, N.Y., Scholium International, Inc., 1974, p. 190-210. 8 refs.

The present paper reviews the state-of-the-art of the Stirling engine and assesses its potential. A description of the engine's working principles is included. Working gas selection, i.e., of helium, hydrogen, or air, is discussed in detail. Typical engine performance characteristics are given and various applications are discussed. A review of the prospects for Stirling engine use in view of a limited helium supply concludes the work. S.J.M.

A75-23238 **Liquid hydrogen as an automotive fuel.** J. G. Finegold (California, University, Los Angeles, Calif.). In: Cryogenic Society of America, National Symposium and Exhibition, 6th, Los Angeles, Calif., October 2-4, 1973, Proceedings.
Flushing, N.Y., Scholium International, Inc., 1974, p. 224-244. 32 refs.

Hydrogen can be efficiently burned in automobile engines yielding very low emissions levels. This paper presents a history of the use of gaseous and liquid hydrogen in internal combustion engines. The combustion, storage, and handling properties of liquid hydrogen are compared to other synthetic fuels and to current hydrocarbon fuels. The methods and economics of liquid hydrogen production and distribution are examined in some detail. Since the viability of liquid hydrogen automobiles depends upon the development of efficient onboard storage, various types of contemporary dewars are examined and future designs are proposed. Finally, ancillary automotive liquid hydrogen systems such as instrumentation and vaporizers are presented and discussed briefly. (Author)

A75-23239 **The application of aerospace technology in the cryogenics field.** J. J. Rusnak (Denver, University, Denver, Colo.). In: Cryogenic Society of America, National Symposium and Exhibition, 6th, Los Angeles, Calif., October 2-4, 1973, Proceedings. Flushing, N.Y., Scholium International, Inc., 1974, p. 251-265. 8 refs.

Drawing from a continuing study of NASA mission-oriented research activity and an evaluation of the programs conducted by the NASA Technology Utilization Office, the current work focuses on three questions: (1) what kinds of technological gains from federal R & D are considered most valuable by the cryogenics industry, (2) how do these important gains relate to improved cryogenic products

and practices, and (3) what is the nature of the process for adapting these gains to secondary uses. A perspective on the broader issue of secondary benefits from federal R & D programs is presented. S.J.M.

A75-23251 # Advanced subsonic transports - A challenge for the 1990's. R. E. Black and J. A. Stern (Douglas Aircraft Co., Long Beach, Calif.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 11th, Washington, D.C., Feb. 24-26, 1975, Paper 75-304.* 16 p.

An attempt is made to assess the world subsonic transportation system in 1990s. Trends in world traffic growth, aircraft productivity, acoustics, aerodynamics, propulsion, structures, advanced composite materials, avionics, and advanced subsonic transport are reviewed. Design requirements for subsonic aircraft are seen to be determined by future economic, social, and political conditions, rather than technology. The text is illustrated by numerous graphs and diagrams. S.D.

A75-23291 Environmental impact of a geothermal power plant. R. C. Axtmann (Princeton University, Princeton N.J.). *Science,* vol. 187, Mar. 7, 1975, p. 795-803. 39 refs. Research supported by the Engineering Foundation of New York and Princeton University; NSF Grant No. GF-41575.

Environmental impact of New Zealand's Wairakei geothermal power plant is studied. The plant contaminated the Waikato River with H2S, CO2, As, and Hg, which have adverse but not disastrous effects on the environment. Reinjection of hot waste water would greatly reduce the plant's environmental impact. Pollutant f rmation is said to be independent of the power production rate, effluent pathways may change abruptly, preoperational testing and wild bores strongly contribute to the overall impact, and high-temperature waste water may be so discharged that utilization of the waste heat becomes profitable. Ground subsidence is not a severe problem at Wairakei. Data are diagrammed and tabulated. S.D.

A75-23402 Thermodynamic analysis of a solar energy system with a closed-cycle gas-turbine converter. L. M. Drabkin (Tashkentskii Institut Inzhenerov Zheleznodorozhnogo Transporta, Tashkent, Uzbek SSR). *(Geliotekhnika,* no. 3, 1974, p. 13-22.) *Applied Solar Energy,* vol. 10, no. 3-4, 1974, p. 4-11. 6 refs. Translation.

A75-23407 Energy distribution in the concentration field of a solar installation with a hyperboloidal counter-reflector. D. A. Kirgizbaev and R. A. Zakhidov (Akademiia Nauk Uzbekskoi SSR, Fiziko-Tekhnicheskii Institut, Tashkent, Uzbek SSR). *(Geliotekhnika,* no. 4, 1974, p. 13-19.) *Applied Solar Energy,* vol. 10, no. 3-4, 1974, p. 71-76. 6 refs. Translation.

A75-23408 A study of channel systems for radiative solar-heat transfer. A. A. Khudenko (Gosudarstvennyi Komitet po Delam Stroitel'stva Ukrainskoi SSR, Nauchno-Issledovatel'skii Institut Stroitel'nogo Proizvodstva, Ukrainian SSR). *(Geliotekhnika,* no. 4, 1974, p. 23-28.) *Applied Solar Energy,* vol. 10, no. 3-4, 1974, p. 80-83. Translation.

A75-23501 Nonconventional energy systems; Meeting, Düsseldorf, West Germany, June 20, 21, 1974, Reports (Nichtkonventionelle Energiesysteme; Tagung, Düsseldorf, West Germany, June 20, 21, 1974, Vorträge). Conference sponsored by the Verein Deutscher Ingenieure. *VDI-Berichte,* no. 224, 1974. 145 p. In German.

Novel gaseous energy carriers are discussed, giving attention to the production of gaseous fuels from fossil fuels, questions of energy supply in a closed cycle, and the thermal decomposition of water for the generation of hydrogen. The application of nonconventional secondary energy carriers is investigated, taking into account the use of hydrogen in industry and household, the employment of methanol as fuel for vehicle engines, the use of methane gas engines for commercial vehicles and buses, the utilization of hydrogen as fuel for internal combustion engines, and the Stirling engine for vehicle propulsion. Applications of nonconventional primary energy sources and effects on the environment are also considered. G.R.

A75-23502 The production of gaseous energy carriers from fossil fuels (Herstellung gasförmiger Energieträger aus fossilen Brennstoffen). H. Jüntgen. *(Verein Deutscher Ingenieure, Tagung über Nichtkonventionelle Energiesysteme, Düsseldorf, West Germany, June 20, 21, 1974.) VDI-Berichte,* no. 224, 1974, p. 13-22; Discussion, p. 22, 23. 18 refs. In German.

It is pointed out that the complete transformation of solid fossil fuels, such as lignite and coal, into gases will enhance the supply of gaseous fuels. The basic reactions involved in the processes leading to such a transformation are examined, taking into account the formation of CO, hydrogen, methanol, and methane. Questions of process thermodynamics and kinetics are examined. Conventional processes which already exist for the transformation of lignite or coal into gaseous fuels are discussed along with novel procedures utilizing the heat of nuclear reactors. G.R.

A75-23503 Energy supply in a closed cycle (Energieversorgung in geschlossenem Kreislauf). R. Schulten and H. Barnert. *(Verein Deutscher Ingenieure, Tagung über Nichtkonventionelle Energiesysteme, Düsseldorf, West Germany, June 20, 21, 1974.) VDI-Berichte,* no. 224, 1974, p. 25-32; Discussion, p. 32-35. In German.

The enhanced use of nuclear energy for nonelectric energy requirements is considered, giving attention to the transformation of nuclear energy into transportable and usable forms of energy. It is proposed to transform the nuclear energy into the chemical latent energy of a gas which circulates between high-temperature reactors and energy consumers. A specific chemical system for such a transportation of energy is discussed. Nuclear heat energy is to be used to transform a mixture of methane and water into hydrogen and CO. In order to obtain this heat again at the place of energy consumption, the hydrogen-CO mixture is converted in the original methane-water system. Operational details of the process are discussed along with questions concerning the implementation of the proposed energy transportation system. G.R.

A75-23504 Thermolysis of water for the generation of hydrogen (Thermolyse des Wassers zur Erzeugung von Wasserstoff). H. Barnert. *(Verein Deutscher Ingenieure, Tagung über Nichtkonventionelle Energiesysteme, Düsseldorf, West Germany, June 20, 21, 1974.) VDI-Berichte,* no. 224, 1974, p. 37-44; Discussion, p. 44-46. 15 refs. In German.

The heat of high-temperature nuclear reactors is to be used to obtain hydrogen from water. The decomposition of water is to take place in a thermochemical cycle. Only heat energy is required for the decomposition of the water. The basic characteristics of the thermal water decomposition process are discussed along with details regarding the proposed cycles and questions of economic feasibility. G.R.

A75-23505 Hydrogen as energy carrier in industry and household (Wasserstoff als Energieträger in Industrie und Haushalt). K. Kugeler. *(Verein Deutscher Ingenieure, Tagung über Nichtkonventionelle Energiesysteme, Düsseldorf, West Germany, June 20, 21, 1974.) VDI-Berichte,* no. 224, 1974, p. 47-56; Discussion, p. 56, 57. In German.

The various uses of hydrogen are considered, giving attention to the employment of hydrogen as fuel in normal and in catalytic combustion processes which are to supply heat, the use of hydrogen in the generation of electricity, and a utilization of hydrogen gas in a reaction with coal to obtain methane. Other uses of hydrogen are related to the production of liquid fuels from coal, hydrocracking,

the direct reduction of iron ore, the Fischer-Tropsch process, and the production of food materials. Approaches for obtaining hydrogen are discussed along with questions of hydrogen transportation, hydrogen distribution, and the storage of hydrogen. G.R.

A75-23506 **Methanol as fuel for vehicle engines (Methanol als Brennstoff für Fahrzeugmotoren).** F. Pischinger. *(Verein Deutscher Ingenieure, Tagung über Nichtkonventionelle Energiesysteme, Düsseldorf, West Germany, June 20, 21, 1974.) VDI-Berichte,* no. 224, 1974, p. 59-64; Discussion, p. 64-66. 17 refs. In German.

An investigation is conducted concerning possible advantages related to a replacement of gasoline by methanol as principal fuel for automotive engines. Approaches for obtaining methanol are considered, giving attention to the availability of needed raw materials. Questions regarding the transportation and storage of methanol are discussed along with problems of energy density and environmental factors. The suitability of methanol as fuel for the internal-combustion engine is examined and problems connected with an engine conversion to methanol use are explored. G.R.

A75-23507 **Methane gas engines for commercial vehicles and busses (Methangasmotoren für Nutzfahrzeuge und Omnibusse).** H. Hardenberg and V. Rubi. *(Verein Deutscher Ingenieure, Tagung über Nichtkonventionelle Energiesysteme, Düsseldorf, West Germany, June 20, 21, 1974.) VDI-Berichte,* no. 224, 1974, p. 67-77; Discussion, p. 77, 78. In German.

It is shown that a use of methane in place of Diesel fuels can have a number of significant advantages. These advantages include a decrease in carbon dioxide emission, the absence of exhaust gas odor and black smoke, and a lowering of engine noise. There are, however, drawbacks related to fuel consumption and economy. Problems are also related to gas storage requirements. G.R.

A75-23508 **Hydrogen as fuel for internal-combustion engines (Wasserstoff als Treibstoff für Verbrennungsmotoren).** M. Schaffrath. *(Verein Deutscher Ingenieure, Tagung über Nichtkonventionelle Energiesysteme, Düsseldorf, West Germany, June 20, 21, 1974.) VDI-Berichte,* no. 224, 1974, p. 79-83; Discussion, p. 83-85. In German.

The operational characteristics of engines using hydrogen as fuel are compared with the conditions in the case of the conventional gasoline-consuming engine. Approaches for hydrogen storage in the motor vehicle are discussed, giving attention to pressure tanks, cryogenic storage, and the storage of hydrogen in the form of metal hydrides, ammonia, or hydrazine. It is concluded that, in principle, engine operation with hydrogen is possible. There are, however, a number of problems which have to be solved before a widespread employment of hydrogen as engine fuel becomes feasible. G.R.

A75-23509 **The Stirling engine for vehicle propulsion (Der Stirlingmotor als Fahrzeugantrieb).** P. Kuhlmann. *(Verein Deutscher Ingenieure, Tagung über Nichtkonventionelle Energiesysteme, Düsseldorf, West Germany, June 20, 21, 1974.) VDI-Berichte,* no. 224, 1974, p. 87-90; Discussion, p. 91. In German.

The performance data of current experimental Stirling engines are considered along with questions of exhaust-gas composition, engine noise, engine volume and weight, engine control, and the engine-starting process. The Stirling engine can use practically any liquid or gaseous fuel for its operation. It is found that technically a use of the Stirling engine in motor vehicles is feasible. Economic questions related to an introduction of the Stirling engine are discussed along with possible new developments which could improve the economic situation in favor of a use of Stirling engine. G.R.

A75-23510 **Considerations regarding a utilization of solar energy (Betrachtungen über die Nutzanwendung der Sonnenenergie).** S. M. Scala and K. Sittel. *(Verein Deutscher Ingenieure, Tagung über Nichtkonventionelle Energiesysteme, Düsseldorf, West Germany, June 20, 21, 1974.) VDI-Berichte,* no. 224, 1974, p. 93-106; Discussion, p. 106-110. 41 refs. In German.

The characteristic data regarding solar energy are considered, giving attention to solar radiation intensity at the boundary of the terrestrial atmosphere and at the surface of the earth. Questions of spectral distribution are examined along with aspects of radiation absorption, the latitude dependence of radiation, and temporal variations in radiation intensity. Systems for the utilization of solar energy are discussed, taking into account the current state of development of the available utilization methods and approaches for overcoming existing technical problems. Attention is given to the utilization of solar energy in buildings, the generation of electric power from solar energy, and the use of wind energy. G.R.

A75-23511 **The introduction of the principles of biological energy supply in future technical systems (Über die Einführung der Prinzipien biologischer Exergieversorgung in zukünftige technische Systeme).** R. Radebold. *(Verein Deutscher Ingenieure, Tagung über Nichtkonventionelle Energiesysteme, Düsseldorf, West Germany, June 20, 21, 1974.) VDI-Berichte,* no. 224, 1974, p. 111-115. In German.

Biological approaches in energy questions are compared with the current technological energy system, taking into account the ATP reactions of biology and the consumption of irreplaceable fossil fuels by human technology. Attention is given to the organization of an energy technology which, similar to biological systems, could exist in a stationary condition for long periods of time. The new technology is to be based exclusively on solar energy. The systems of this technology are to absorb solar energy and store it in form of a universal energy carrier which is to have the same function as ATP in biology. A use of hydrazine as energy carrier is considered. The implementation of the approaches of the new technology is discussed. G.R.

A75-23512 **Other primary energy resources (Andere Primärenergiequellen).** A. Voss, V. Bundschuh, M. Meliss, and D. Oesterwind. *(Verein Deutscher Ingenieure, Tagung über Nichtkonventionelle Energiesysteme, Düsseldorf, West Germany, June 20, 21, 1974.) VDI-Berichte,* no. 224, 1974, p. 117-125. 18 refs. In German.

Approaches for the utilization of geothermal energy are discussed along with possibilities to employ tidal energy, wind energy, the energy of waves on the surface of the sea, and the energy of glaciers. Attention is also given to installations which use the temperature difference between the water at the surface of the sea and the water at a greater depth as a basis to supply power. It is pointed out that in general a utilization of the indicated energy resources will require the solution of problems related to the transportation of energy to the power-consumer locations. It is concluded that the energy resources examined will, in the near future, not provide a solution to the current energy crisis. G.R.

A75-23790 **Laser induced luminescence signatures of refined and virgin crude petroleum - Their composition and remote sensing implications.** H. G. Gross and M. Muramoto (McDonnell Douglas Astronautics Co., Huntington Beach, Calif.). In: Remote sensing of earth resources. Volume 3 - Proceedings of the Third Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 25-27, 1974. Tullahoma, University of Tennessee, 1974, p. 783-803. 9 refs. Research supported by the McDonnell Douglas Astronautics Independent Research and Development Funds.

A75-23817 **Thermodynamics of multistage air-cooled gas turbine.** E. N. Bogomolov. *(Aviatsionnaia Tekhnika,* vol. 17, no. 2, 1974, p. 132-140.) *Soviet Aeronautics,* vol. 17, no. 2, 1974, p. 116-123. Translation.

A75-24182 # **Investigations and selection of components and materials for flexible solar generator.** H. Braasch (Telefunken AG, Wedel, West Germany), Mr. Rukwied (Telefunken AG, Frank-

furt am Main, West Germany), and H. Rentsch (Telefunken AG, Kassel, West Germany). In: Evaluation of the effect of the space environment on materials; International Conference, Toulouse, France, June 17-21, 1974, Proceedings. Paris, Centre National d'Etudes Spatiales, 1974, p. 375-411.

The investigations performed during the development of flexible, lightweight, fold-up solar generators are described. Peel strength and low cycle fatigue of several solders are examined. An analysis of breakage rates of various coverglass types is carried out. (Author)

A75-24197 # **Radiation effects on high efficiency silicon-solar cells.** W. Luft (TRW Systems Group, Redondo Beach, Calif.). In: Evaluation of the effect of the space environment on materials; International Conference, Toulouse, France, June 17-21, 1974, Proceedings. Paris, Centre National d'Etudes Spatiales, 1974, p. 627-638. 8 refs.

Three manufacturers in the U.S. are producing high-efficiency cells with enhanced response for short-wave radiation (0.3-0.5 micron). These cells differ in design (base resistivity, backfield, grid lines, etc.) and manufacturing processes. Basic characterizations of the electrical parameters are presented, including current-voltage characteristics, spectral response, and temperature coefficients. The performance data are given for two types of covers, namely, fused silica with a 350-nm ultraviolet reflection filter and 5-%-CeO-doped glass. The cells were subjected to 1-MeV electron irradiation to determine the degradation characteristics of the short-circuit current, the open-circuit voltage, and the maximum power. These data are compared to silicon solar-cell characteristics. In a study of such degradation, the spectrum of the light source and its calibration are of paramount importance for accuracy in the data. High-efficiency cells were calibrated by a high-altitude balloon flight. These cells were then used for light-flux calibration using both continuous and pulsed Xenon solar simulators. The spectra were measured with a spectroradiometer. (Author)

A75-24199 # **The effects of irradiation on high-efficiency silicon solar cells (Les effets de l'irradiation sur les cellules solaires Si haut rendement).** T. Nguyen Duy, D. Amingual, P. Colardelle (Société Anonyme des Télécommunications, Paris, France), and J. Bernard (Toulouse, Centre d'Etudes et de Recherches, Toulouse, France). In: Evaluation of the effect of the space environment on materials; International Conference, Toulouse, France, June 17-21, 1974, Proceedings. Paris, Centre National d'Etudes Spatiales, 1974, p. 651-657. 6 refs. In French.

By optimizing the diffusion parameters, high-efficiency cells were obtained from 2 ohm-cm (13.5 per cent AMO) and 10 ohm-cm (12.5 per cent AMO) silicon material. These new cells have been subjected to irradiation by 1-MeV and 2-MeV electrons and 2.5-MeV protons. Their behavior under irradiation is found to depend only on the bulk material. When silicon of the same resistivity is used, the rate of degradation is exactly the same as that of conventional cells. The power increase, due to better superficial response of the cell, is maintained after irradiation. These results show that new high-efficiency cells offer an end-of-life power higher than that of conventional cells. (Author)

A75-24203 # **Optimisation of solar cell shielding for geostationary missions.** M. W. Walkden. In: Evaluation of the effect of the space environment on materials; International Conference, Toulouse, France, June 17-21, 1974, Proceedings. Paris, Centre National d'Etudes Spatiales, 1974, p. 697-715; *Comments*, p. 717-720. 11 refs.

Equivalent 1-MeV electron fluences, end-of-life output powers, and power-to-weight ratios are estimated for solar cells in a five-year geostationary mission beginning in 1975. The study covers cell thicknesses from 125 microns to 300 microns, coverslip thicknesses from 25 microns to 300 microns, rear shielding typical of rigid and lightweight flexible arrays, and infinite rear shielding. It is concluded that the thinnest cells and shielding give the best power-to-weight ratio, although the choice for a particular spacecraft will be influenced by considerations of availability, cost, fragility, and array area. (Author)

A75-24213 **Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974.** Conference sponsored by the Deutsche Gesellschaft für Luft- und Raumfahrt and UNESCO. Edited by H. R. Lösch (Gesellschaft für Weltraumforschung mbH, Porz-Wahn, West Germany). Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974. 739 p. In English and French. $42.72.

Papers are presented describing the latest developments in the technology of photovoltaic conversion of solar energy, with both space and terrestrial applications examined. Some of the topics covered include investigation of the technology and performance of lithium doped solar cells, progress in the development of cadmium sulphide terrestrial solar batteries, electron and proton irradiation of high-efficiency silicon solar cells, solar arrays for geostationary communication satellites, design of magnetically clean solar arrays, requirements and design of an ultralight solar array, and results obtained during the first year of operation of the Delaware Solar House. P.T.H.

A75-24214 ***Report on photovoltaics research and technology* in the United States.** L. O. Herwig (National Science Foundation, Washington D.C.). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 29-42.

Various aspects of the present status of photovoltaics research and technology in the U.S. are reviewed. Interest in and federal support of photovoltaics has increased dramatically over the past few years. The National Science Foundation solar energy program and its different program elements are discussed. The principal disadvantage of photovoltaic power is its high cost. Early emphasis in the photovoltaic program is on the development of the low-cost, single crystal silicon array technology and analysis of photovoltaic conversion power system designs to determine the most effective ways to apply this technology. Implementation of the program and the primary achievements thus far are presented. S.J.M.

A75-24215 **Historic development of photovoltaic power generation.** M. Wolf (Pennsylvania, University, Philadelphia, Pa.). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 49-65.

Emphasis in the present work is placed on recent occurrences, on data which are not generally available, and on the unexpected events in the course of the development of photovoltaic power generation. The prominence of the space program in this development is discussed. A number of reproductions of terrestrial solar electric energy advertisements from the 1950's are included. It is concluded that cost-effective solutions to the photovoltaic power problem will have to be found in order for solar electric energy to have wide terrestrial application. Economic development is also described in the text and graphically. S.J.M.

A75-24216 **Improvements in analysis and technology of silicon solar cells with increased efficiency.** H. Fischer and W. Pschunder (Telefunken AG, Heilbronn, West Germany). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 69-84. 13 refs. Bundesministerium für Forschung und Technologie Contract No. RV11-V59/73(2)-TO-20.

A practical concept of a high-efficiency cell is described which incorporates both space-proven and recently innovated technologies. Performance data on various standard-type cells and on the new high-efficiency cell (HEC) before and after particle irradiation are prevented. The crucial role played in this improvement by the new violet cell is demonstrated. S.J.M.

A75-24217 High efficiency silicon solar cells. D. Amingual, P. Colardelle, and T. N. Duy (Société Anonyme des Télécommunications, Paris, France). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 85-101. 5 refs. Research supported by the Centre National d'Etudes Spatiales.

A new diffusion process coupled with a change in grid geometry and a new antireflective coating has produced a noticeable improvement in the short wavelength response of n-p junction solar cells. Cell performance graphs are presented. Efficiencies of up to 13.5 percent were obtained. The new cells are characterized by a thinner N layer and a better surface spectral response than conventional cells. Electron-photon and proton-photon irradiation tests are described. S.J.M.

A75-24218 Development and space qualification of new high-efficiency silicon solar cells. E. L. Ralph and J. Scott-Monck (Textron, Inc., Sylmar, Calif.). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 103-115. 6 refs.

Two new advanced solar cells have been developed and have successfully been placed into production. These cells have been tested to insure that they are qualified for use on flight programs. The average output power of the Helios cell is 68 mW in air mass zero sunlight compared to an average output power for the conventional cell of 57 mW. This represents a 20% increase in power output along with a 30% decrease in the weight. Both effects will provide the spacecraft designer with substantial improvements in their power system designs. The first operational flights of these new cells are scheduled for launch in mid-1975. (Author)

A75-24219 Investigation of the technology and performance of lithium doped solar cells. J. C. Larue, A. Atzei (ESRO, European Space Research and Technology Centre, Noordwijk, Netherlands), and G. Schmalhofer (Siemens AG, Munich, West Germany). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 117-137. 10 refs.

An investigation into the technological feasibility of lithium doping of silicon solar cells was undertaken in view of the annealing of radiation damage known to be achievable by lithium doping. The investigation was limited to the following parameters: (1) silicon starting material, (2) p-n junction variables, (3) lithium concentration and distribution, and (4) front and rear contacts. The cells were comparable in performance to the latest U.S. cells. For missions with high radiation exposure, these cells would offer a substantial advantage over conventional cells, e.g. 12% more power at 55 C after a fluence of 10 to the fifteenth power MeV e-/sq cm. However, a number of technological problems have yet to be solved before mass production can take place. S.J.M.

A75-24222 High-speed silicon processing for low cost solar cells - A comparative analysis. A. Kran (IBM East Fishkill Laboratories, Hopewell Junction, N.Y.). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 177-189. 8 refs.

Computer analysis shows that silicon ribbon growth techniques as well as high speed Czochralski crystal pulling have potential for low cost silicon production. Requirements of $3.77 per square meter silicon, corresponding to an energy cost at the array level of $25 per peak KW, can only be met through successful development of multiple ribbon, single crystal silicon growth. (Author)

A75-24223 CdS-Cu2S cells - An outlook for terrestrial applications. A. Gauthier, T. Nguyen-Duy, G. Pichard (Société Anonyme des Télécommunications, Paris, France), and J. Vedel (Ecole Nationale Supérieure de Chimie et Physique, Paris, France). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 193-203. 8 refs. Research sponsored by the Centre National d'Etudes Spatiales.

The technology of thin-film solar cells and the performance achievable by such cells are considered. For terrestrial applications, the cost of such cells must be reduced, while their stability is maximized. Progress being made in the gridding, encapsulation, and CdS-deposition processes is discussed. A.T.S.

A75-24224 Progress in the development of cadmium sulphide terrestrial solar batteries. R. J. Mytton (International Research and Development Co., Ltd., Newcastle-upon-Tyne, England). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 205-215. Research supported by the International Research and Development Co.

Recent progress in the development of a robust economical CdS solar panel for terrestrial use is described. Following a discussion of the economic reasons behind the proposed design (one which is intended to bridge the gap between individual space cells and large volume production for terrestrial power), the construction of the panel is described in detail. Particular features of the design are (1) a modular approach wherein 5 cells are produced simultaneously already series-connected on a single 120-mm square substrate, (2) these modules are connected in fours within one package to form a 2-W panel, and (3) screen printing is used to achieve low cost base and grid contacts to the cells. (Author)

A75-24225 Further progress in the technology of silk screened CdS solar cells. S. Vojdani, M. Doroudian, and A. Parvizi (Arya Mehr University of Technology, Teheran, Iran). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 217-220.

A75-24226 Development of very low cost solar cells for terrestrial power generation. J. F. Jordan (D. H. Baldwin Co., Cincinnati, Ohio). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 221-237. 11 refs.

Thin-film solar cells with CdS/Cu2S heterojunctions were produced by spraying the appropriate chemicals on a substrate of float glass. The laboratory tests indicate that this technique could be used for low-cost production of photovoltaic cells in a float-glass production plant. The cells produced so far have efficiencies of approximately 4%, deliver 3.75 mW per sq cm, and produce open-circuit voltages of about 400 mV. Cells having 5% efficiency, if produced on a large scale, would cost less than 6 cents per watt. A.T.S.

A75-24232 Performance of advanced silicon solar cells in a space environment. R. W. Opjorden, L. J. Goldhammer, and G. S. Goodelle (Hughes Aircraft Co., El Segundo, Calif.). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974.

Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 313-319.

An advanced, high efficiency, silicon solar cell has been developed and extensively tested to determine the effects of exposure to a space environment. These cells, now available in production quantities, provide an average power of 69.1 mW for 2 x 2 cm sizes at 25 C - a 2% improvement in performance at beginning of life. This new type of silicon cell was exposed to a simulated orbit environment to determine the performance degradation that would be expected for an extended period of time; the environments simulated included electrons, high energy protons, low energy protons, and ultraviolet radiation. Cell performance was also measured during high altitude balloon flights for comparison with test values obtained during exposure to a xenon light source. (Author)

A75-24233 Electron and proton irradiation of high-efficiency silicon solar cells. D. J. Curtin and R. W. Cool (COMSAT Laboratories, Clarksburg, Md.). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 321-335. 8 refs. Research sponsored by the International Telecommunications Satellite Organization.

High-efficiency silicon solar cells from two U.S. manufacturers were tested with electron and proton irradiation. They were compared to COMSAT Laboratories produced violet cells and conventional solar cells. The best new cells had initial power outputs comparable to those included in the published data on COMSAT produced cells. The high-efficiency cells degraded faster than conventional 10-ohm-cm cells under electron irradiation. However, a comparison of unannealed cells data at one quadrillion electrons/sq cm indicated that the 2-ohm-cm high-efficiency cells had a 27-percent power advantage over conventional cells; the 10-ohm-cm high-efficiency cells retained a 15-percent power margin. (Author)

A75-24237 The technology of the solar generator on the Symphonie satellite. M. Berniere (Société Anonyme des Télécommunications, Paris, France). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 381-396.

The solar array of the three-axes-stabilized synchronous communications satellite, Symphonie, will experience daily two shadow periods produced by the satellite fittings. The resulting thermal cycles range from plus 55 C to minus 170 C. An array design developed to resist the stringent thermal stresses is described. The interconnection system of silver-plated molybdenum allows conventional solar cells to be assembled into a series-parallel array. A loop geometry characterized by changes in camber radius is helpful in reducing thermal stresses. V.P.

A75-24243 An analysis of photovoltaic power generation and thermal control interfaces. R. M. Jenkins (British Aircraft Corp., Ltd., Bristol, England). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 461-476.

The various ways in which power-generation and thermal-control subsystems interact are studied with the aim of identifying the requirements of each subsystem, and determining the influence of the characteristics of a subsystem on the design of the other subsystem. Analysis of the generated power shows how to derive the correct figures from the array specification. The principal factors which determine the temperature variations during sunlight and eclipse periods are identified from a discussion of the operation temperature of deployable rigid arrays. V.P.

A75-24245 The COMSAT non-reflective silicon solar cell - A second generation improved cell. J. Haynos, J. Allison, R. Arndt, and A. Meulenberg (COMSAT Laboratories, Clarksburg, Md.). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 487-500. Research sponsored by the Communications Satellite Corp.

This paper describes a second generation of improved silicon solar cells based in part upon Violet Cell technology, but additionally employing a new surface structure to reduce reflection losses markedly. The surface comprises myriads of tetradedra to promote multiple interactions between the surface and the light beam. In its present state of development the new cell exhibits a power output of 85 mW for a 2- x 2-cm size under AM0 conditions (Johnson spectrum), corresponding to an efficiency of 15 percent relative to total area. The paper will describe the surface geometry and will provide the theoretical basis for the reduced reflectivity and the corresponding increased light absorption. The measured reflectivity, current-voltage characteristics, and performance under simulated space radiation conditions will be presented and compared with present conventional and COMSAT Violet Cells. (Author)

A75-24246 Latest developments of the circular solar array. H. W. Scheel (H. W. Scheel KG, Berlin, West Germany). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 501-508. 6 refs.

The Faltwickel process of stowing a large, thin solar array sheet onto the outer surface of a cylindric hub in the sheet's center is described. Some advantages of this process are stiffness, high power-to-weight ratio, low stowage volume, and nearly universal applicability. The design of a satellite built inside the hub of the array, resulting in the central antenna satellite, and modification of the design for telescoping circular solar arrays are discussed, and mockups of the deployment structure are outlined. The space-worthiness of these arrays remains to be tested. F.G.M.

A75-24248 Design and qualification of the CTS solar cell blanket. P. Paulsen, W. Woodcock (Telefunken AG, Hamburg, West Germany), and P. Sachs (ESRO, European Space Research and Technology Centre, Noordwijk, Netherlands). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 529-543.

The Canadian Communications Technology Satellite (CTS) will be equipped with the first lightweight flexible foldable solar array to be flown in a geostationary orbit. The major purpose of the satellite will be to test this array as well as other advanced subsystems. The design characteristics of the array that will generate an initial power output greater than 1 kW are discussed. An extensive test program conducted to qualify the chosen design is described. The results demonstrate that the advanced technologies employed in the blanket design are capable of surviving launch, deployment, and orbital environmental loads. V.P.

A75-24251 Power generation for the X4 spacecraft - A step in the development of a high power/mass ratio, hybrid solar array for applications spacecraft. B. Collins (Hawker Siddeley Dynamics, Ltd., Stevenage, Herts., England). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 581-591.

A75-24252 Development of a flexible, fold-out solar array. J. Fremy and D. Lorans (Société Anonyme des Télécommunications, Paris, France). In: Photovoltaic power generation; Proceed-

ings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 593-611. 7 refs. Research sponsored by the International Telecommunications Satellite Organization; Centre National d'Etudes Spatiales Contract No. 71-279.

The electrical component of a one-wing full-scale model of a 2 kW solar array has been developed. The design selected is a flexible solar blanket, folded in the launch configuration and deployed by a multilink pantograph. Environmental tests on the model, along with development tests on component modules, are presented, with emphasis on deep thermal cycles. Outstanding features of the new array are: gain in power-to-weight ratio and reduction of overall volume in stowed phase; interchangeability of the solar subarrays; and versatility for EOL power needs between 800 W and 4 kW per wing. The modular concept in the design provides, moreover, ease in manufacturing, handling, testing and factory reworking; field maintainability; and cost reduction by standardization of subassemblies up to the fold level. S.J.M.

A75-24254 * Solar one - The Delaware solar house and results obtained during the first year of operation. K. W. Böer (Delaware, University, Newark, Del.). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 627-638. 14 refs. NSF-Navy-NASA-supported research.

The design of a system which uses CdS/Cu2S solar cells to convert solar energy into electricity and heat, and which uses a heat pump for auxiliary heating and air conditioning is discussed. Salt hydrates are used for heat storage, while air serves as the heat transfer medium. The operational parameters and economic aspects of the system are examined, and preliminary test results are analyzed. V.P.

A75-24255 The use of solar cells in the lighthouse service. E. R. Richards (Trinity House Lighthouse Service, London, England). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 639-649.

For a number of years, Trinity House has been testing solar cells with a view to using them as a means of powering small navigation lights. An experimental solar cell power supply was installed at a station on the River Thames in 1968. Although some problems have been encountered with this installation, the results have been encouraging, and further installations are planned. Some of the problems encountered, and the financial aspects of the use of solar cells, are examined in this paper. (Author)

A75-24256 Some aspects of a solar battery system and its use for irrigation in remote sun-rich regions. S. Deb, M. K. Mukherjee (Jadavpur University, Calcutta, India), and H. Saha (Jadavpur University, Calcutta; Kalyani University, Kalyani, West Bengal, India). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 651-662. 9 refs.

A75-24257 Solar generators for terrestrial applications (Générateurs solaires pour applications terrestres). B. Dalibot (Radiotechnique-Compélec, Paris, France). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 665-673. In French.

Solar electricity generation can be attractive for use in areas which are isolated or require a reliable and constant supply of electricity. The paper concerns various past and present application of solar generation, with emphasis on experience gained with BPX 47 modules, which consist of 64 silicon photocells 40 mm in diameter, have a conversion efficiency of about 10 per cent, and deliver 8 W of power at 12 or 24 V under an illumination of 100 mW per sq cm. The number of modules needed for a specific application can be calculated as a function of the power consumption and the annual insolation at the site. Solar generators have been used to supply electricity to a copper refinery in Chile since 1960, a 50-W navigational radio beacon near Bordeaux since 1968, and a 12-W microwave repeater since 1971. Other applications will include light beacons for marine and air navigation and educational television in remote areas. A.T.S.

A75-24258 * Terrestrial applications of FEP-encapsulated solar cell modules. A. F. Forestieri and A. F. Ratajczak (NASA, Lewis Research Center, Cleveland, Ohio). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 675-697.

The NASA-Lewis Research Center program of transferring the FEP-encapsulated solar cell technology developed for the space program to terrestrial applications is presented. The electrical power system design and the array mechanical design are described, and power systems being tested are discussed. The latter are located at NOAA-RAMOS weather stations at Sterling, Va., and Mammoth Mountain, Calif.; on the roof of the Lewis Research Center; on a NOAA-Coast Guard buoy in the Gulf of Mexico; in a U.S. Forest Service mountaintop voice repeater station in the Inyo National Forest, Calif., and in a backpack charger for portable transmitter/receivers being used in the same place. Preliminary results of testing are still incomplete, but show that rime ice can cause cracks in modular cells without damaging the FEP though, which keeps the grid lines intact, and that electrically active elements of the module must be completely sealed from salt water to prevent FEP delamination. F.G.M.

A75-24259 Process development for low cost integrated solar arrays. M. Wolf (Pennsylvania, University, Philadelphia, Pa.). In: Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974. Cologne, West Germany, Deutsche Gesellschaft für Luft- und Raumfahrt, 1974, p. 699-715. 10 refs. NSF Grant No. GI-29729.

The problems of developing less costly methods of solar array material handling and processing, and scaling up the volume handled by 6 orders of magnitude are presented. The fabrication of integrated arrays, containing a large number of electrically series connected cells within a common sheet of silicon, is suggested to reduce to a minimum the relatively high cost of making external connections. The geometry of the integrated array is described, and fabrication processes that will reduce the number of individual pieces handled and replace batch processing with a continuous flow process are outlined. The use of polycrystalline silicon in sheet form is offered as a way of reducing material costs by an order of magnitude. F.G.M.

A75-24376 Corrosion problems in energy conversion and generation; Proceedings of the Symposium, New York, N.Y., October 15-17, 1974. Symposium sponsored by the Electrochemical Society. Edited by C. S. Tedmon, Jr. (GE Research and Development Center, Schenectady, N.Y.). Princeton, N.J., Electrochemical Society, Inc., 1974. 480 p. $12.

Papers are presented studying the effects of corrosion in a variety of energy conversion and generation systems, including electrochemical energy conversion, gas turbine technology, high-temperature gas reactors, liquid metal cooled reactors, and light-water cooled reactors. Some of the topics covered include materials corrosion in molten salt-lithium/sulfur cells, corrosion and compatibility of materials in inorganic oxyhalides, the sulfidation properties of cobalt-iron alloys at 700 C, chemical stability and degradation of MHD electrodes, the solubility of oxygen in geothermal brines, iodine induced cracking of Zircalloy fuel cladding, and caustic cracking in hot aqueous and superheated steam. P.T.H.

A75-24377 **Corrosion and related problems in high-temperature cells.** E. J. Cairns and R. A. Murie (GM Research Laboratories, Warren, Mich.). In: Corrosion problems in energy conversion and generation; Proceedings of the Symposium, New York, N.Y., October 15-17, 1974. Princeton, N.J., Electrochemical Society, Inc., 1974, p. 3-19. 30 refs.

General corrosion and materials problems in batteries and fuel cells will be reviewed. Emphasis will be placed upon materials for high-temperature (300-700 C) rechargeable cells. In the alkali metal/chalcogen cells, stainless steels, niobium-1% zirconium, molybdenum and tungsten have been used as electronic conductors and containment materials, however, the positive electrode current collector remains a problem. These positive electrodes require carbon current collectors. Recent studies of aluminum nitride as an insulator will be reported and discussed. (Author)

A75-24384 **Corrosion studies of materials for auxiliary equipment in MHD power plants.** R. E. Gannon, F. A. Hals (Avco Everett Research Laboratory, Inc., Everett, Mass.), and H. H. Reynolds (Lowell Technological Institute, Lowell, Mass.). In: Corrosion problems in energy conversion and generation; Proceedings of the Symposium, New York, N.Y., October 15-17, 1974. Princeton, N.J., Electrochemical Society, Inc., 1974, p. 212-224. 12 refs.

Under specific operational modes, the high temperature air preheater of an open cycle MHD power system will function in a molten alkali salt environment. In such an environment, liquid phase corrosion of the high temperature refractory matrix could limit the operational life of the preheater. An experimental investigation of the behavior of candidate refractories in contact with molten potassium sulfate was therefore initiated. The results indicate that the primary modes for the degradation of commercial refractory materials can be traced to the infiltration of the pores of the ceramic structure by the molten salt. The salt then appears to attack the grain boundaries of the refractory causing an expansion of the structure. Certain exceptions to this general behavior were noted and are discussed in some detail. (Author)

A75-24676 **The Mitre solar energy demonstration system.** J. S. Burton and W. L. Wheaton (Mitre Corp., McLean, Va.). In: Earth Environment and Resources Conference, Philadelphia, Pa., September 10-12, 1974, Digest of Technical Papers. New York, Lewis Winner, 1974, p. 104, 105.

The objectives of this program are to design, test, and operate a 1 kilowatt (peak) photovoltaic electrical power system incorporating dynamic control. This system will operate on a load demand priority basis and will employ energy storage subsystems so as to satisfy energy demand during non-illuminated conditions. Results derived from this study are expected to provide insight into the design and development of larger photovoltaic and hybrid power systems. (Author)

A75-24750 **Energy systems - Modeling and policy analysis.** M. L. Baughman (MIT, Cambridge, Mass.). In: Modeling and simulation. Volume 5 - Proceedings of the Fifth Annual Pittsburgh Conference, Pittsburgh, Pa., April 24-26, 1974. Part 2. Pittsburgh, Pa., Instrument Society of America, 1974, p. 603-609. 9 refs. NSF Grant No. GI-39150.

A preliminary assessment of Project Independence is presented, and the role of energy systems analysis and modeling is related to the planning functions of government and industry in the area of energy resources. The MIT Energy System Modeling program is described, and three simulations of the effects of alternative oil prices on the goal of zero oil imports are discussed. It is shown that even with very optimistic supply scenarios, reducing the energy system to zero imports by 1980 may be quite difficult. F.G.M.

A75-24751 **An econometric analysis of fuel selection for power generation.** C. Neill (American Gas Association, Arlington, Va.), D. R. Limaye, and J. R. Sharko (Mathematica, Inc., Princeton, N.J.). In: Modeling and simulation. Volume 5 - Proceedings of the Fifth Annual Pittsburgh Conference, Pittsburgh, Pa., April 24-26, 1974. Part 2. Pittsburgh, Pa., Instrument Society of America, 1974, p. 683-686.

An econometric analysis of the effects of fuel prices and fuel-burning capabilities of power plants on fuel selection is presented. A mathematical model using a logistic curve to calculate the market share of each of three variable fuels (coal, oil, and gas) is constructed, and the analytical approach and calibration results are described. It is shown that if all three fuels are priced equally, each will capture one third of their variable capabilities. The calculations and inputs required for application of this model to a concrete situation are outlined. F.G.M.

A75-24786 # **Application of thermodynamic and material- and energy-balance calculations to gasification processes.** M. Ishida, R. C. Bailie, and T. Shirai. *Tokyo Institute of Technology, Bulletin*, no. 122, 1974. p. 1-12. 15 refs.

The relation among gas composition, heating value, and heat requirement for steam-oxygen and steam-hydrogen gasification processes are discussed. The results are shown in figures from which the required quantity of oxygen (or hydrogen) as well as the product gas compositions can be estimated. These figures can also be applied for evaluation of the performance in an adiabatic reactor. (Author)

A75-24957 * # **Effect of attitude constraints on solar-electric geocentric transfers.** L. L. Sackett and T. N. Edelbaum (Charles Stark Draper Laboratory, Inc., Cambridge, Mass.). *American Institute of Aeronautics and Astronautics, Electric Propulsion Conference, 11th, New Orleans, La., Mar. 19-21, 1975, Paper 75-350.* 12 p. 10 refs. Contract No. NAS3-18886.

The present work assesses the increase in flight time and fuel consumption due to introducing attitude constraints on both the thrust vector and the plane of the solar cell arrays on geocentrically orbiting spacecraft. A modified version of the SECKSPOT computer program calculates nearly time-optimal trajectories for the constrained case of zero pitch and roll. Unconstrained cases are generated with the SECKSPOT code. It is concluded that with a pitch constraint but without a roll constraint, power would not be a function of thrust direction, and so the time-optimal thruster direction would be along the projection of the primer vector in the plane normal to the radius vector. The roll constraint would cause power to become a function of thrust angle and sun angle. For certain sun angles the locus of the ratio of power to maximum power is concave and thus there may be jumps in the control angle. Comparisons are made for a SERT-C type mission between constrained and unconstrained cases in an inverse square gravity field. S.J.M.

A75-25005 # **Review of central power magnetohydrodynamics.** J. B. Dicks (Tennessee, University, Tullahoma, Tenn.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 11th, Washington, D.C., Feb. 24-26, 1975, Paper 75-264.* 6 p. 18 refs.

Central power magnetohydrodynamics has grown to the point where it can be applied producing in the first generation of electrical plants 50 to 55 percent thermal efficiency and in later versions of these plants efficiencies up to 75 percent, in contrast with overall efficiencies of 40 percent or less, available in present coal-fired central power plants, considerably less than that in nuclear plants. Magnetohydrodynamic power generation can do all of this, at the same time providing low levels of pollution in the power plant effluent. Current status and future plans in the United States will be reviewed as well as the technical status in the Soviet Union. (Author)

A75-25013 * # **Mode shift strategies in intercity transportation and their effect on energy consumption.** S. Sokolsky (Aerospace Corp., El Segundo, Calif.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 11th, Washington, D.C., Feb. 24-26, 1975, Paper 75-315.* 16 p. 26 refs. Contract No. NAS2-6473.

Policies are examined which, if implemented, could lead to significant energy savings in intercity travel in the northeast corridor arena, without restricting the traveler's freedom of mode choice. The

effects on arena energy consumption of introducing new, more energy-efficient aircraft are investigated; and several strategies unrelated to the implementation of new aircraft are introduced to yield reductions in overall intercity energy use. In both parts of this analysis, resulting changes in patronage (modal share) and energy use are demonstrated, leading to new insights into the effectiveness of different potential policies for achieving energy conservation. Some observations on induced demand trends that could be associated with certain strategies and the resultant potential effect on energy conservation are provided. S.J.M.

A75-25086 **Epitaxial silicon solar cell.** V. L. Dalal, H. Kressel, and P. H. Robinson (RCA Laboratories, Princeton, N.J.). *Journal of Applied Physics*, vol. 46, Mar. 1975, p. 1283-1285. 11 refs.

A new design for silicon solar cells employing epitaxial deposition is presented. It is shown that the use of epitaxial solar cells may result in higher efficiencies for converting solar energy into electricity. Preliminary experiments are reported which show the feasibility of making near-ideal junctions with high quantum yields. (Author)

A75-25678 **Use of flexible reflective surfaces for solar energy concentration.** W. I. Jacobi (Sheldahl Co., Northfield, Minn.). *(American Vacuum Society, National Symposium, 21st, Anaheim, Calif., Oct. 8-11, 1974.) Journal of Vacuum Science and Technology*, vol. 12, Jan.-Feb. 1975, p. 169-173. 15 refs.

A flexible metalized film, stretched drum-head fashion, can form a mirror that can be oriented to direct sunlight to a central receiver. The use of taut membrane is being explored as part of a study of the feasibility of a large-scale solar thermal power plant. The evaluation of any reflector requires measurement of the spectral response, specularity, and over-all flatness. Integrating the spectral response to the energy distribution of sunlight gives the total reflected energy. Of equal importance is the specularity or divergence of the reflected beam. The combination of these factors will determine a candidate reflector's suitability. A device for measuring the bi-directional reflectance-distribution function is described and data are presented. A discussion of membrane-reflector development and data from life tests are presented. (Author)

A75-25679 **Thin film coatings in solar-thermal power systems.** R. E. Peterson and J. W. Ramsey (Honeywell Systems and Research Center, Minneapolis, Minn.). *(American Vacuum Society, National Symposium, 21st, Anaheim, Calif., Oct. 8-11, 1974.) Journal of Vacuum Science and Technology*, vol. 12, Jan.-Feb. 1975, p. 174-181. 26 refs.

The applications and requirements for thin film coatings in solar-thermal power systems are reviewed. The substantial impact of selective absorber coatings and antireflection coatings on both flat plate and concentrating type solar collectors is covered. The results of durability life tests on a high-temperature stable, vacuum-evaporated absorber coating consisting of layers of Al2O3-Mo-Al2O3 are reported. This coating was unaffected by 500 h at 930 C. Other tests included thermal cycling, thermal shock, ultraviolet irradiation, and solar wind simulation. An electroplated solar absorber coating for low-temperature applications has been developed which has a solar absorption of 0.96 and an infrared emittance of 0.07 at 100 C. A chemically etched antireflection coating for glass has been investigated. Solar transmission of 0.97 is possible with this low-cost technique. (Author)

A75-25827 **The Electric Power Research Institute's role in applying superconductivity to future utility systems.** M. Rabinowitz (Electric Power Research Institute, Palo Alto, Calif.). *(Applied Superconductivity Conference, Argonne and Batavia, Ill., Sept. 30-Oct. 2, 1974.) IEEE Transactions on Magnetics*, vol. MAG-11, Mar. 1975, p. 105-108.

The advantages and role of superconductive power transmission lines in future utility systems are outlined. Superconductors will provide lower power loss at higher power density over larger distances. These characteristics are important in view of ecological considerations, increasing power use, and probable remoteness of future sources such as solar or nuclear power plants. The need for an integrated approach to the problem, preferably coordinating the efforts of several companies and institutes, is emphasized. S.J.M.

A75-25831 **A superconducting microwave engine.** G. J. Dick (RAI, South Laguna; California Institute of Technology, Pasadena, Calif.). *(Applied Superconductivity Conference, Argonne and Batavia, Ill., Sept. 30-Oct. 2, 1974.) IEEE Transactions on Magnetics*, vol. MAG-11, Mar. 1975, p. 441, 442. NSF Grant No. GP-37166; Contract No. N00014-70-C-0133.

In this paper a new technique of electromechanical energy conversion is proposed. This technique would make use of the high Q's attainable in superconducting resonators to achieve direct mechanical to microwave energy conversion with a net efficiency greater than 90%, a value which is far higher than that obtained by conventional techniques. In addition, if surface magnetic and electric field levels are limited by the critical fields obtained in fixed resonators, power densities would be achieved which are large enough to make such a machine a practical means both for generating microwave energy and for reconverting the microwave again to mechanical energy for power transmission purposes. (Author)

A75-25832 **Will superconducting magnetic energy storage be used on electric utility systems.** W. V. Hassenzahl (California, University, Los Alamos, N. Mex.). *(Applied Superconductivity Conference, Argonne and Batavia, Ill., Sept. 30-Oct. 2, 1974.) IEEE Transactions on Magnetics*, vol. MAG-11, Mar. 1975, p. 482-488. 18 refs. AEC-sponsored research.

As the cost of fossil fuel has increased and the load factors on electric utilities have decreased, the need for efficient, reliable energy storage systems has increased. Although pumped hydro storage is now used extensively on those utility systems having the appropriate resources nearby, it is only 65% efficient. Superconducting magnetic energy storage which promises to be more than 90% efficient and easily sited may become a competitive energy storage technology. A comparison of the various energy storage systems is presented in terms of performance on electric power systems, and cost. Emphasis is given to the various technologies involved in the development of large superconducting magnets. A brief review of the Los Alamos Scientific Laboratory program on superconducting magnetic energy storage is included. (Author)

A75-25987 **Floating vs flying - A propulsion energy comparison.** F. Marbury (Ketron, Inc., Arlington, Va.). In: Interagency Workshop on Lighter than Air Vehicles, Monterey, Calif., September 9-13, 1974, Proceedings. Cambridge, Mass., MIT Flight Transportation Laboratory, 1975, p. 187-197. 5 refs.

Floating craft are compared to those that fly. Drag/weight for floaters is shown to be proportional to v2/L, while for flyers it is independent of size and speed. The transportation market will therefore assign airships to lower speeds than airplanes, and will favor large airship sizes. Drag of an airship is shown to be only 11 percent of submarine drag at equal displacement and speed, raising the possibility that airships can compete with some types of ships. (Author)

A75-25995 **Lighter than air - A look at the past, a look at the possibilities.** W. F. Shea (California State, Dept. of Transportation, Sacramento, Calif.). In: Interagency Workshop on Lighter than Air Vehicles, Monterey, Calif., September 9-13, 1974, Proceedings. Cambridge, Mass., MIT Flight Transportation Laboratory, 1975, p. 285-295. 31 refs.

The use of lighter-than-air airships as a feasible economic method of flight is reviewed from the first hot-air balloon flight in 1783. Some famous airships are described, including the Hindenburg and the U.S. ZMC-2 and K-class nonrigid blimps. The problems associated with the high power output and large storage areas needed

for airships are described, and some arguments for and against nuclear powered airships and predicted cruising speeds and load capacities are presented. Potential peacetime uses of airships for hauling very large cargo loads and their vulnerability in military operations and inclement weather are discussed. F.G.M.

A75-26067 RTG electrical power for spacecraft. P. J. Dick (Teledyne Isotopes, Energy Systems Div., Timonium, Md.). In: EASCON '74; Electronics and Aerospace Systems Convention, Washington, D.C., October 7-9, 1974, Record.
New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 322-327. 10 refs.

Radioisotope Thermoelectric Generator (RTG) technology growth has reached the threshold where kilowatt levels of electric power for spacecraft are now practical for consideration. Through research and development sponsored by the U.S. Atomic Energy Commission, efficiencies can now be doubled by application of new selenide thermoelectric materials. System specific powers will increase correspondingly to 4 and 5 watts(e) per pound. These dramatic performance improvements, coupled with projections to halve production costs of the long lived Pu-238 radioisotope heat source material promise to bring RTG space electric power to the range of $4,000 per watt(e) in the late 1970s. (Author)

A75-26068 Solar cell modules for lightweight solar arrays. D. J. Curtin and W. J. Billerbeck (COMSAT Laboratories, Clarksburg, Md.). In: EASCON '74; Electronics and Aerospace Systems Convention, Washington, D.C., October 7-9, 1974, Record.
New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 328-3281. 29 refs. Research sponsored by the International Telecommunications Satellite Organization.

This paper discusses the requirements for solar cell modules to be compatible with lightweight solar arrays in 7- to 10-year missions in geosynchronous orbit. It characterizes recent developments in advanced cells, interconnects, interconnect bonding technology, adhesives, and substrates and analyzes stresses and fatigue life of welded silver bonds for interconnects cycled down to -196 C. In addition, it describes several advantages of a new lightweight solar cell module employing wrap-around contact solar cells, silver-plated INVAR interconnectors, and an open substrate, and presents the results of extended thermal cycle tests on this type of module. (Author)

A75-26332 # Empirical method of designing the current-voltage characteristics for the discharge mode of a thermionic converter (Empiricheskii metod rascheta vol'tampernykh kharakteristik razriadnogo rezhima TEP). A. A. Konoplev, V. D. Iuditskii, and L. I. Pushina. *Zhurnal Tekhnicheskoi Fiziki,* vol. 45, Feb. 1975, p. 314-319. 14 refs. In Russian.

The approximate method proposed is based on the representation of the current-voltage characteristics with allowance for the drop in the plasma gap and on the use of generalized experimental data. The empirical relations derived provide an effective means of information compression. V.P.

A75-26448 A generalization of the Carnot theorem - The theorem of useful power (Une généralisation du théorème de Carnot - Le théorème de la puissance utile). S. Fabrega. *Entropie,* vol. 10, no. 59, 1974, p. 4-10. In French.

A theorem of thermodynamics is introduced which permits direct expression of the mechanical power provided by a machine, without taking explicit account of heat exchanges with its exterior. Certain difficulties are avoided by ignoring the classical notion of thermodynamic heat sources. On the other hand, the internal sources of dissipation of work into heat, which constitute the true energy loss, are put locally into each point of the machine. The Carnot efficiency concept is included in the theorem, but in a much more general form, applicable to the sometimes complex situations encountered in practice: transitory effects, heterogeneous systems, open cycles, discontinuity layers, physicochemical changes of state, and diverse energy exchanges (electrical, radiational, etc.). S.J.M.

A75-26544 Theory of heat extraction from fractured hot dry rock. A. C. Gringarten (Service Géologique National, Bureau de Recherches Géologiques et Minières, Orléans, France), P. A. Witherspoon (California, University, Berkeley, Calif.), and Y. Ohnishi (Kyoto University, Kyoto, Japan). *Journal of Geophysical Research,* vol. 80, Mar. 10, 1975, p. 1120-1124. 14 refs. Research supported by the University of California.

A theory of heat extraction from fractured hot dry rock is presented, based on an infinite series of parallel vertical fractures of uniform aperture. Fractures are uniformly spaced and drain heat from blocks of homogeneous and isotropic impermeable rock. Cold water enters at the bottom of each fracture, and solutions are given in terms of dimensionless parameters from which the exiting water temperatures at the top of the fractures can be determined. An example of the application of the theory demonstrates how a multiply fractured system provides a more efficient mechanism for heat extraction than a single fracture in hot dry rock. (Author)

A75-26712 # Temperature sensor for photoelectric energy converters (Datchik temperatury fotoelektricheskikh preobrazovatelei energii). L. L. Silin and A. Kh. Cherkasskii (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Istochnikov Toka, Kishinev, Moldavian SSR). *Geliotekhnika,* no. 6, 1974, p. 13-15. 5 refs. In Russian.

The resistive temperature sensors usually used on photoelectric cells are not transparent to visible light and, therefore, cannot be used on the illuminated side of the cells. A description is given of a thermoresistive sensor developed to minimize the masking effect. Such sensors have performed reliably for two years of continuous use. A.T.S.

A75-26713 # Dynamic method for calculating the series resistance of a semiconductor photoelectric converter (Dinamicheskii metod rascheta posledovatel'nogo soprotivleniia poluprovodnikovogo fotopreobrazovatelia). A. S. Lisin (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Istochnikov Toka, Kishinev, Moldavian SSR). *Geliotekhnika,* no. 6, 1974, p. 16-23. In Russian.

A dynamic method is proposed for calculating the series resistance of a semiconductor photoelectric cell. The method allows one to express the series resistance in terms of the dynamic resistance of the p-n junction and the rear contact. The analysis is made for the most widespread type of photocell, with a continuous rear contact and a front contact in the form of a band around the perimeter of the doped layer. The dependences of the series resistance on the dynamic resistance are graphed for various values of the spreading resistance of the doped layer; the dynamic resistance of the rear region, including the base and the rear contact; and the dimensions of the photocell. It is shown that the series resistance can increase by more than a factor of 3 in going from no-load to short-circuit conditions. A.T.S.

A75-26714 # Testing of a photoelectric generator in a mountainous region of the Azerbaidzhan SSR (Ispytanie fotoelektricheskogo generatora v gornom raione Azerbaidzhanskoi SSR). N. V. Pul'manov, M. Ia. Bakirov, N. P. Aliev, and V. N. Potapov (Akademiia Nauk Azerbaidzhanskoi SSR, Fizicheskii Institut, Baku, Azerbaidzhan SSR). *Geliotekhnika,* no. 6, 1974, p. 27-30. 5 refs. In Russian.

Results are presented from a one-year test of photoelectric generator under natural conditions in a mountainous region of the Azerbaidzhan SSR. The experiment was conducted to determine the feasibility of using such generators as autonomous power sources for cathodic protection or support towers for high-voltage electric-transmission lines in remote areas. The current-voltage load characteristics and the daily and seasonal variation in the power output of the device are discussed. A.T.S.

A75-26718 # Method for calculating solar radiation for semicylindrical collectors (Metod rascheta solnechnoi radiatsii dlia polutsilindricheskikh priemnikov). Iu. N. Iakubov, K. B. Baibutaev, and A. Kh. Khozhiev (Bukharskii Pedagogicheskii Institut, Bukhara,

Uzbek SSR). *Geliotekhnika*, no. 6, 1974, p. 52-57. 7 refs. In Russian.

Analytical equations are derived for determining the incident and reentering radiation for the transparent surface of a semi-cylindrical solar-radiation collector (such as a greenhouse). The proposed calculation method is as accurate as previous methods, but is more general and reduces the volume of computations. Specific numerical examples are given as illustrations. A.T.S.

A75-27518 Interferometric tuning of a 15-atm CO2 laser. F. O'Neill and W. T. Whitney (U.S. Navy, Naval Research Laboratory, Washington, D.C.). *Applied Physics Letters*, vol. 26, Apr. 15, 1975, p. 454-456. 12 refs.

Efficient controlled frequency narrowing and tuning of a high-power 15-atm electron-beam-controlled CO2 laser has been achieved using a Fabry-Pérot etalon as a dispersive element in the laser resonator. Tuning has been accomplished over the free spectral range of the etalon giving a laser linewidth of less than 0.2 per cm for an output pulse energy of 100 mJ in a spot about 1 sq mm. The laser pulse length is 40 nsec for a peak power 5 MW. (Author)

A75-27519 * High-efficiency graded band-gap Al/x/Ga/1-x/As-GaAs solar cell. J. A. Hutchby (NASA, Langley Research Center, Hampton, Va.). *Applied Physics Letters*, vol. 26, Apr. 15, 1975, p. 457-459. 14 refs.

A detailed theoretical analysis of an n-on-p graded band-gap Al(x)Ga(1-x)As-GaAs solar cell yields a maximum air mass zero power conversion efficiency of 17% compared to 9% for a similar GaAs cell. The analysis includes surface and bulk minority carrier recombination, junction recombination current, spectrally varying surface reflection, and series resistance loss. The maximum efficiency is determined for a surface recombination velocity of 10,000 cm/sec and hole and electron diffusion lengths of 2.1 and 7.6 microns, respectively. The improved efficiency is primarily due to a built-in electric field, caused by the band-gap gradation, accelerating photo-generated holes toward the p-n junction. This field reduces the surface and bulk recombination of the holes, and thereby enhances their collection. (Author)

A75-27520 GaAs concentrator solar cell. L. W. James and R. L. Moon (Varian Associates, Palo Alto, Calif.). *Applied Physics Letters*, vol. 26, Apr. 15, 1975, p. 467-470. 6 refs.

For terrestrial applications, the figure of merit for photovoltaic solar energy conversion devices is watts output per dollar of cost. AlGaAs/GaAs heterojunction cells have a very favorable watts per dollar figure of merit when used at high values of sunlight concentration. An experimental 1/2-in.-diam cell was operated in air mass 1.4 sunlight with an output power density of 4.52 W/sq cm at an effective concentration of 312 suns with a power conversion efficiency of 17.5%. The same cell was operated at 200 C with an output power density of 3.45 W/sq cm at a 14% efficiency. The efficiency of the cell was 23% with a fill factor of 0.85 at a lower concentration ratio which is obtainable using simple concentrator schemes. (Author)

A75-27531 * # Solar collector performance evaluated outdoors at NASA-Lewis Research Center. R. W. Vernon (NASA, Lewis Research Center, Cleveland, Ohio). *National Science Foundation, Workshop on Solar Collectors for Heating and Cooling of Buildings, New York, N.Y., Nov. 21-23, 1974, Paper.* 6 p. 5 refs.

The study of solar reflector performance reported is related to a project in which solar collectors are to be provided for the solar heating and cooling system of an office building at NASA's Langley Research Center. The solar collector makes use of a liquid consisting of 50% ethylene glycol and 50% water. A conventional air-liquid heat exchanger is employed. Collector performance and solar insolation data are recorded along with air temperature, wind speed and direction, and relative humidity. G.R.

A75-27533 * # Status of the NASA-Lewis flat-plate collector tests with a solar simulator. F. F. Simon (NASA, Lewis Research Center, Cleveland, Ohio). *National Science Foundation, Workshop on Solar Collectors for Heating and Cooling of Buildings, New York, N.Y., Nov. 21-23, 1974, Paper.* 19 p.

Simulator test results of 15 collector types are reported. Collectors are given performance ratings according to their use for pool heating, hot water, absorption A/C or heating and solar Rankine machines. Collectors found to be good performers in the above categories, except for pool heating, were a black nickel coated, 2 glass collector, and a black paint 2 glass collector containing a mylar honeycomb. For pool heating, a black paint, one glass collector was found to be the best performer. Collector performance parameters of 5 collector types were determined to aid in explaining the factors that govern performance. The two factors that had the greatest effect on collector performance were the collector heat loss and the coating absorptivity. (Author)

A75-27716 Solar cells - Present state and perspectives on terrestrial applications (Les photopiles solaires - Etat actuel et perspectives d'applications terrestres). W. Palz (Centre National d'Etudes Spatiales, Paris, France). *L'Onde Electrique*, vol. 55, Mar. 1975, p. 153-160. 11 refs. In French.

Historical aspects, availability and advantages, recent technical developments, economic aspects, and future perspectives concerning the use of solar energy. Its prominence in the space program and consequences of space program budgets on lack of cost reduction are reviewed. The present work advocates transduction of the energy into electricity. It is argued that existing Si and CdS solar cells could provide the basis for the development of solar electric power plants of competitive cost and efficiency. The need for a coordinated research effort in the near future is emphasized. S.J.M.

A75-27717 The future of silicon solar cells for terrestrial use (L'avenir des cellules solaires au silicium à usage terrestre). H. Durand (Laboratoires d'Electronique et de Physique Appliquée, Limeil-Brévannes, Val-de-Marne, France). *L'Onde Electrique*, vol. 55, Mar. 1975, p. 161-166. In French.

The economic implications of recent R&D programs in various countries regarding silicon photovoltaic conversion are presented. The following parameters are discussed: material (cheaper Si, ribbon pulling, polycrystalline deposits), cells (influence of the material's physical properties, front- and rear-face processing), panels (reliability, photon concentrators), and systems (problems involving usage, importance of energy storage). It is concluded that before the end of this century, solar electric energy will become viable in sunny countries and in small- to medium-scale generator applications. S.J.M.

A75-27718 Thermoelectric generators (Les générateurs thermoélectriques). R. Stoll (Thomson-CSF, Division Faisceaux Hertziens, Levallois-Perret, Hauts-de-Seine, France). *L'Onde Electrique*, vol. 55, Mar. 1975, p. 167-176. In French.

Thermoelectric generators using direct conversion of the heat generated by a gas burner into electricity by means of semiconductor thermocouples are described. They are currently being used to power electronic equipment in remote locations. In addition to high reliability and reduced maintenance, they now represent the most economic autonomous power source in the 10 to 500 W range. S.J.M.

A75-27777 # On the future of jet propulsion in subsonic transport aviation. M. Roy. *Periodica Polytechnica, Transportation Engineering*, vol. 2, no. 1, 1974, p. 49-59.

Parametric development potential studies on the thermodynamic cycle of transport aviation turbofan engines show that substantial weight and consumption savings can be obtained, without increasing turbine inlet temperatures, from the expected improvements in compressor turbine efficiencies. It is shown that improvements may be obtained by increasing the dilution to roughly mu = 12, while ejector-induced tertiary flow over special wing-flap combinations may provide short takeoff and landing distances and significant noise reduction. V.P.

A75-27778 **Energy Delta: Supply vs. demand; Proceedings of the Energy Symposium, San Francisco, Calif., February 25-27, 1974.** Symposium sponsored by AAAS, AAS, ASA, IEEE, and ORSA. Edited by G. W. Morgenthaler and A. N. Silver (Martin Marietta Aerospace, Rockville, Md.). Tarzana, Calif., American Astronautical Society (Science and Technology. Volume 35), 1975. 605 p. $30.

The papers deal with national energy policy alternatives and structuring of viable energy strategies; reducing the energy demand by more efficient means of transportation, more efficient industrial processes, and changes in personal life styles; increasing the energy supply by developing new energy sources and expanding old ones; and the economics of energy issues. Among the major topics discussed are the energy research and development alternatives for future supply; energy saving developments in metal processing; solar heating and cooling of buildings; and the energy game and the role of uncertainty.

S.D.

A75-27779 **Energy supply and demand challenges and some possible solutions.** M. R. Thomasson (Shell Oil Co., Houston, Tex.). In: Energy Delta: Supply vs. demand; Proceedings of the Energy Symposium, San Francisco, Calif., February 25-27, 1974. Tarzana, Calif., American Astronautical Society, 1975, p. 1-30.

The United States energy supply and demand forecasts for the period 1975-1990 are reviewed, along with an analysis of the world supply and demand over this period in terms of prices and supply on the international scene. Shell's forecast of U.S. domestic energy supply for this period is found to fall markedly below the demand forecasted for the same period. With major commitment to energy efficiency and conservation combined with a nationwide drive to make energy self-sufficient, the U.S. is predicted to become by 1990 essentially independent of energy imports. S.D.

A75-27780 ***Time factors in slowing down the rate of growth of demand for primary energy in the United States.*** L. Lees and M. P. Lo (California Institute of Technology, Pasadena, Calif.). In: Energy Delta: Supply vs. demand; Proceedings of the Energy Symposium, San Francisco, Calif., February 25-27, 1974. Tarzana, Calif., American Astronautical Society, 1975, p. 41-63. 5 refs. NSF Grant No. 29726.

A study is conducted to identify the time scales and magnitudes of slowing down the rate of growth of energy consumption by improving efficiency, reducing wasteful practices, and shifting to less energy-intensive activities. Two important energy-consuming sectors of the economy are chosen as illustrative examples: transportation (25%), and space heating, air conditioning and water heating in the residential sector (22%). The results obtained are then examined for their impact on the required rate of energy imports and the required rate of domestic energy supply over the next 25 years. S.D.

A75-27781 **Coal gasification - A review of status and technology.** J. G. Conner (Battelle Memorial Institute, Columbus, Ohio). In: Energy Delta: Supply vs. demand; Proceedings of the Energy Symposium, San Francisco, Calif., February 25-27, 1974. Tarzana, Calif., American Astronautical Society, 1975, p. 263-272. 9 refs.

Techniques for coal gasification as a means for increasing the supply of clean energy derived from coal are reviewed. Applications for coal gasification are discussed as well as those economic, technical, and environmental considerations that can be expected to influence the decisions to employ gasification. High-, intermediate-, and low-Btu gasification processes are reviewed as to status and potential, and problem areas are identified. The production of low-Btu gas for industrial use is considered along with the large-scale operations for high-Btu-gas production. Basic technological needs associated with gasification are identified, and conclusions are drawn as to likely trends in U.S. development work on coal gasification.

(Author)

A75-27782 **The outlook for fusion energy sources Remaining technological hurdles.** R. F. Post (California, University, Livermore, Calif.). In: Energy Delta: Supply vs. demand; Proceedings of the Energy Symposium, San Francisco, Calif., February 25-27, 1974. Tarzana, Calif., American Astronautical Society, 1975, p. 301-324. AEC-sponsored research.

The current status of fusion research is reviewed to define the scientific-technical issues that still stand in the way of achieving fusion power. The two basic approaches to fusion - magnetic confinement and laser pellet fusion - are outlined, and concepts of fusion reactor design are discussed. S.D.

A75-27783 * **Solar heating and cooling of buildings.** R. D. Bourke and E. S. Davis (California Institute of Technology, Jet Propulsion Laboratory, Systems Analysis Section, Pasadena, Calif.). In: Energy Delta: Supply vs. demand; Proceedings of the Energy Symposium, San Francisco, Calif., February 25-27, 1974. Tarzana, Calif., American Astronautical Society, 1975, p. 327-357. 5 refs.

Solar energy has been used for space heating and water heating for many years. A less common application, although technically feasible, is solar cooling. This paper describes the techniques employed in the heating and cooling of buildings, and in water heating. The potential for solar energy to displace conventional energy sources is discussed. Water heating for new apartments appears to have some features which could make it a place to begin the resurgence of solar energy applications in the United States. A project to investigate apartment solar water heating, currently in the pilot plant construction phase, is described. (Author)

A75-27784 **Roles for solar thermal conversion systems in our energy economy.** D. F. Spencer (National Science Foundation, Advanced Energy Research and Technology Div., Washington, D.C.) and A. B. Greenberg (Aerospace Corp., Los Angeles, Calif.). In: Energy Delta: Supply vs. demand; Proceedings of the Energy Symposium, San Francisco, Calif., February 25-27, 1974. Tarzana, Calif., American Astronautical Society, 1975, p. 359-388.

The NSF solar thermal conversion program, which is at a conceptual analysis and exploratory research level, is outlined with respect to mission, system, subsystem, and components and materials. Major conclusions are that solar thermal conversion electrical powerplants are most competitive with fossil fuels powerplants for intermediate or peaking power applications, and that central receiver solar thermal systems appear to offer the greatest potential for competitive economic performance for electrical generation applications. S.D.

A75-27785 **The Solar Community - Energy for residential heating, cooling, and electrical power.** W. H. McCulloch, D. O. Lee, and W. P. Schimmel, Jr. (Sandia Laboratories, Albuquerque, N. Mex.). In: Energy Delta: Supply vs. demand; Proceedings of the Energy Symposium, San Francisco, Calif., February 25-27, 1974. Tarzana, Calif., American Astronautical Society, 1975, p. 389-410. AEC-supported research.

The paper reviews research and development work conducted within the Solar Total Energy Community Project in which the sun is used as the source for most of the community's energy needs. It is shown that the Solar Community is technologically feasible and that the projected costs warrant the further investigation of solar energy as an alternative residential energy source. Recent findings and improvements are discussed, along with the current status of the continuing analytical and experimental studies. S.D.

A75-27786 **Solar/hydroelectric combined power systems.** F. A. Blake (Martin Marietta Aerospace, Denver, Colo.). In: Energy Delta: Supply vs. demand; Proceedings of the Energy Symposium, San Francisco, Calif., February 25-27, 1974. Tarzana, Calif., American Astronautical Society, 1975, p. 411-430. 9 refs. NSF Grant No. GI-41305.

A description is given of the terrestrial solar energy conversion power system which consists of equipment that, when installed in an

existing stored-energy power system, augments overall power generation without increasing energy consumption. The solar/hydroelectric power system concept is discussed, and its major merits are noted. Benchmark historical data are given which show that all the elements required for the near-term development of a solar energy conversion system are readily available, although the economics of such systems are presently not advantageous with reference to oil, fossil fuel, and nuclear plants. S.D.

A75-27787 Current worldwide utilization and ultimate potential of geothermal energy systems. L. J. P. Muffler (U.S. Geological Survey, Menlo Park, Calif.). In: Energy Delta: Supply vs. demand; Proceedings of the Energy Symposium, San Francisco, Calif., February 25-27, 1974. Tarzana, Calif., American Astronautical Society, 1975, p. 433-442. 21 refs.

The current status of geothermal energy utilization for electricity generation is discussed along with the potential capabilities of existing geothermal energy systems. Present geothermal electrical capacity throughout the world is roughly 1075 MW, which is only 0.1% of the world's generating capacity from all modes. Although under present technology and economics most of this energy is either too diffuse or too deeply buried to be considered as a resource, the amount of heat available in the upper part of the earth's crust is large enough to afford great possibilities. Factors favoring the increased use of geothermal energy for electricity generation are examined. S.D.

A75-27788 New technology challenges in exploration, exploitation and environmental impact of geothermal systems. G. V. Keller (Colorado School of Mines, Golden, Colo.). In: Energy Delta: Supply vs. demand; Proceedings of the Energy Symposium, San Francisco, Calif., February 25-27, 1974.
Tarzana, Calif., American Astronautical Society, 1975, p. 443-453.

An analysis of various types of geothermal system shows that the best site for geothermal energy is where modern volcanism or tectonism exists. Since a geothermal prospect undergoes drilling and production tests in the boreholes, a technological solution is proposed which requires use of starch-base muds that can be broken chemically. Problems concerning downhole measurement tools, design of steam or hot-water wells, and environmental hazards are examined. The most pressing technological challenges are considered to be those associated with the identification of the nature of geothermal heat concentrations. S.D.

A75-27789 Salt domes, pit craters, and dry steam fields - Heat pipe applications. J. Green (McDonnell Douglas Corp., Huntington Beach, Calif.). In: Energy Delta: Supply vs. demand; Proceedings of the Energy Symposium, San Francisco, Calif., February 25-27, 1974. Tarzana, Calif., American Astronautical Society, 1975, p. 455-487. 77 refs.

Heat pipes operating vertically with the heat source at the lower end have, in theory, high efficiencies over pipe lengths exceeding 100 meters. Three geological applications are possible: (1) heat pipe-nuclear reactor couples in salt domes, (2) heat pipes penetrating the crust of lava lakes, and (3) heat pipes tapping high enthalpy steam fields. Environmental aspects of these pollution-free energy sources are as follows: salt domes are seismically safe, can sustain positive or negative pressures, and exist at shallow depths in energy-need centers in the Gulf Coast and the American Arctic. Radioactive fluids cannot enter the hydrological or meteorological cycles should an accident occur within a salt dome. Lava lakes provide extreme temperature gradients for high heat pipe efficiencies and are likewise in an energy-need center - Hawaii. Heat pipes would extend the life of the geothermal field while keeping the corrosive subsurface fluids apart from surface heat-exchange turbomachinery. (Author)

A75-27790 Ocean thermal power and windpower systems - Natural solar energy conversion for near-term impact on world energy markets. W. E. Heronemus and J. G. McGowan (Massachusetts, University, Amherst, Mass.). In: Energy Delta: Supply vs. demand; Proceedings of the Energy Symposium, San Francisco, Calif., February 25-27, 1974. Tarzana, Calif., American Astronautical Society, 1975, p. 491-506. 10 refs.

The potential of two energy conversion systems which use the natural solar collection of the earth and its atmosphere over land and sea as their power input is discussed. The first concept, for large scale power generation, is based on a Rankine cycle heat engine driven by the thermal difference which exists between the warm tropical surface waters of the ocean and the great mass of cold water below. Windpower, the second concept, is discussed in the context of small to large scale systems comprising a number of methods for extracting a portion of the kinetic energy of the earth's atmosphere. Suggested configurations for energy distribution systems utilizing these natural energy resources complete with energy storage and transmission systems are given. (Author)

A75-27791 Hydrogen - A carrier of energy. D. P. Gregory (Institute of Gas Technology, Chicago, Ill.). In: Energy Delta: Supply vs. demand; Proceedings of the Energy Symposium, San Francisco, Calif., February 25-27, 1974.
Tarzana, Calif., American Astronautical Society, 1975, p. 507-518. 16 refs.

Production, transmission, storage, utilization, and safety of hydrogen as a nonfossil energy source are discussed. Hydrogen can be produced from wholly domestic energy sources without importation, thereby acting as a common fuel to bridge the gap between the fossil-fuel age and the nuclear or solar age. Hydrogen is shown to be a nonpolluting gas which is easily transported in underground pipelines, can be stored by relatively inexpensive techniques, and can be used to meet most of the present applications of oil and natural gas. S.D.

A75-27792 Prospects of photosynthetic energy production. B. Kok (Martin Marietta Laboratories, Baltimore, Md.). In: Energy Delta: Supply vs. demand; Proceedings of the Energy Symposium, San Francisco, Calif., February 25-27, 1974.
Tarzana, Calif., American Astronautical Society, 1975, p. 519-526.

The relevant aspects of photosynthesis are reviewed, with particular reference to the mechanism and efficiency of plant photosynthesis. Photosynthesis as a source of energy is examined, and prospects for expanded exploitation of natural solar conversion systems are evaluated. It is shown that photolysis of water can be considered as a prospective source of energy to be developed in the future. S.D.

A75-27826 Geothermal energy (L'énergie géothermique). J. Goguel. *Sciences et Techniques,* Mar. 15, 1975, p. 7-12. In French.

The direct use of underground heat sources for the production of heat energy is investigated. Several currently functional facilities are described. The geological conditions and mechanics necessary for such sources to exist and be economically viable, as well as the techniques formulated to exploit the sources, are explained. S.J.M.

A75-27827 Fundamental research on the selection of new electrochemical generators of medium power (Recherches fondamentales pour la sélection de nouveaux générateurs électrochimiques de moyenne puissance). M. Bonnemay (CNRS, Laboratoire d'Electrolyse, Bellevue, Hauts-de-Seine; Conservatoire National des Arts et Métiers, Paris, France), G. Bronoël, and J. Sarradin (CNRS, Paris, France). *Sciences et Techniques,* Mar. 15, 1975, p. 13-21. 38 refs. In French.

The operational characteristics, advantages, and disadvantages of various new battery designs are examined. General motivations for research in this area, short-term predictions concerning the lead storage cell, long-term forecasts regarding the choice of preferred drawplate constructions, the oxygen electrode, and the use of a hydrogen electrode are considered. In the long-term category, high-energy massive storage batteries, combustible power packs, and reversible or mechanically rechargeable piles are discussed. S.J.M.

A75-27960 A high-speed superconducting generator. R. B. Blaugher, T. J. Fagan, J. H. Parker, Jr., J. Wells (Westinghouse

Research Laboratories, Pittsburgh, Pa.), and J. L. McCabria (Westinghouse Electric Corp., Aerospace Electrical Div., Lima, Ohio). In: International Cryogenic Engineering Conference, 5th, Kyoto, Japan, May 7-10, 1974, Proceedings. Guildford, Surrey, England, IPC Science and Technology Press, Ltd., 1974, p. 143-148. 6 refs. Contract No. F33615-71-C-1591.

This paper reviews the overall cryogenic and mechanical design and final test results of the prototype 12,000 rev/min 4-pole superconducting rotor developed for the USAF. We will discuss some of the important mechanical details relating to superconducting coil construction, rotor fabrication, welding, and overall rotor assembly. We will then present the cryogenic cooling scheme, thermal load, He transfer system and overall instrumentation. Finally, the actual running tests will then be reviewed, which include: warm and cold spin-up to 12,000 rev/min, overspeed tests, and successful field excitation (at 12,000 rev/min) to an equivalent 5 MVA power rating. (Author)

A75-27961 **Superconductive d.c. generator.** M. Yamamoto and M. Yamaguchi (Tokyo Shibaura Electric Co., Ltd., Yokohama, Japan). In: International Cryogenic Engineering Conference, 5th, Kyoto, Japan, May 7-10, 1974, Proceedings. Guildford, Surrey, England, IPC Science and Technology Press, Ltd., 1974, p. 154-156. Research supported by the Japanese Society for the Promotion of Machine Industry.

This paper describes a superconductive homopolar generator that has been developed; it is rated at 3000 kW, 20 kA and 150 V at 1000 rev/min and 4.5 T, produced by a superconductive coil of 1.6 m bore. Feasible outputs, given present manufacturing techniques seem to be 50-150 MW with a terminal voltage of 500-750 V. In the future, it should be possible to achieve an output of 500 MW, 1000 V and 500 kA. (Author)

A75-27962 **Main problems met in the study of cryogenic generators.** G. Ruelle (Société Générale de Constructions Electriques et Mécaniques ALSTHOM, Belfort, France). In: International Cryogenic Engineering Conference, 5th, Kyoto, Japan, May 7-10, 1974, Proceedings. Guildford, Surrey, England, IPC Science and Technology Press, Ltd., 1974, p. 160-163.

The main problems arising from cryogenic generator development especially concern the rotor: the problem of the electromagnetic and mechanical behavior of the shield required for protecting the superconductor against the induction changes faced with any possible disturbances; the problem of the superconductor and cooling helium system behavior faced with the particular conditions of a cryogenic generator; the problem of structural materials; technological problems arising from helium admission in the rotor. It is obvious that chances of development could be largely increased if a certain number of parallel researches succeeded in the following fields: development of superconductors having a higher critical temperature; development of structural materials, metallic and nonmetallic; dropping of refrigerator costs and reliability increasing. (Author)

A75-27967 **Superconducting synchronous machine.** S. Akiyama, H. Fujino, A. Ishihara, and K. Ueda (Fuji Electric Co., Ltd., Yokosuka, Kanagawa, Japan). In: International Cryogenic Engineering Conference, 5th, Kyoto, Japan, May 7-10, 1974, Proceedings. Guildford, Surrey, England, IPC Science and Technology Press, Ltd., 1974, p. 308-311.

A synchronous generator with stationary superconducting field coils was made and tested in order to investigate the electrical features of such a machine. The machine has four-pole field windings outside a rotating armature with horizontal axis. The induced voltage and the short-circuit current increase linearly with the field current and are not saturated. Various reactances were measured with the short-circuit test, the Dalton-Cameron method and the dc decay method. The synchronous reactance is very small as compared with conventional machines. This means that superconducting machines are superior in steady-state stability. In the sudden short-circuit tests, visible variations of the field current and the dc component of the armature current were not observed. Synchronous operation of the machine was performed with connection to the commercial distribution network, and a sharp V-curve and other characteristics have been obtained. (Author)

A75-27973 **Cryogenics safety in a hydrogen fuel society.** R. Reider, F. J. Edeskuty, and K. D. Williamson, Jr. (California, University, Los Alamos, N. Mex.). In: International Cryogenic Engineering Conference, 5th, Kyoto, Japan, May 7-10, 1974, Proceedings. Guildford, Surrey, England, IPC Science and Technology Press, Ltd., 1974, p. 562-565. 9 refs.

Various aspects of the safety problem involved with the use of liquid hydrogen as a fuel source are considered. The properties of structural materials required for this technology, the hazards posed directly by H2, transportation fuel fires, and some recommended standards are discussed. The work emphasizes the viability of cryogenic hydrogen as an eventual replacement of petrochemical sources. S.J.M.

A75-28093 **SIMSHAC - A simulation program for solar heating and cooling of buildings.** C. B. Winn, G. R. Johnson, and T. E. Corder (Colorado State University, Fort Collins, Colo.). *Simulation*, vol. 23, Dec. 1974, p. 165-170. 7 refs.

A dynamic simulation model for use in analyzing the performance of specific designs of solar-heated-and-cooled buildings has been developed. To use the design program, one has merely to specify the components and the manner in which they are connected and all initial conditions. Program SIMSHAC then writes the program for the specific system to be analyzed. Each subsystem is described by a set of time-dependent differential equations or, possibly, algebraic equations. System state variables include temperature, mass flow rate, and enthalpy. The model can handle three types of incident solar radiation data models. These are (1) deterministic (e.g., an algebraic-equation sun model), (2) random simulation (e.g., a model based upon cloud-cover statistics), and (3) actual tabulated input information based upon collected solar data for a specific site. The model has been used for the analysis of five different types of buildings in five locations within the United States. (Author)

A75-28437 **Solar energy in earth processes.** V. E. McKelvey (U.S. Geological Survey, Washington, D.C.). *Technology Review*, vol. 77, Mar.-Apr. 1975, p. 34-37.

The role played by solar radiation in geothermal energy storage, in photosynthetic oxygen production as energy storage, in ocean heating, in erosion, and in salinity (or the lack of it) of the waters as energy storage is examined. Man's use of the earth's energy is argued to be trivial in relation to the total power available. S.J.M.

A75-28438 **The geology and geophysics of geothermal energy.** J. B. Combs (Texas, University, Dallas, Tex.). *Technology Review*, vol. 77, Mar.-Apr. 1975, p. 46-49.

Means of prospecting for geothermal resources are examined. In particular, such geophysical methods as electrical conductivity measurement are emphasized. Geothermal reservoirs tend to follow the contours of the continental plates. Some of the problems inherent in this type of energy source are indicated, and the application potential of the method is considered. S.J.M.

A75-28439 **Lasers investigated for space propulsion.** M. L. Yaffee. *Aviation Week and Space Technology*, vol. 102, Apr. 21, 1975, p. 47, 48, 53, 54.

A program has been launched to establish the feasibility and potential of high-power lasers for space vehicle propulsion and power generation. Laser energy would be transmitted from a ground or space laser-generating station to a weight-critical spacecraft, where it could be converted into propulsive thrust or electrical power. Location of the generating station, technology problem areas, laser transmission profiles, and receiver fabrication are considered. S.J.M.

A75-28450 **Characteristics of a rocking wave power device.** D. T. Swift-Hook, B. M. Count, I. Glendenning (Central Electricity Generating Board, Marchwood Engineering Laboratories, Southampton, England), and S. Salter (Edinburgh, University, Edinburgh, Scotland). *Nature*, vol. 254, Apr. 10, 1975, p. 504-506.

The results are presented of an investigation concerning the bandwidth of wave periods covered by a device considered by Salter (1974) for extracting a large proportion of the total wave power from water waves. It was found that good power conversion efficiencies (more than 50%) can be obtained over the range of wave periods (a 2:1 bandwidth) corresponding to that found in the ocean waves. G.R.

A75-28508 # **The solution of information-deficiency problems of electroenergy technology (Zur Lösung von Informationsmangel-Problemen der Elektroenergietechnik).** E. Muschick. *Zeitschrift für elektrische Informations- und Energietechnik*, vol. 4, no. 6, 1974, p. 412-419. 10 refs. In German.

Uncertainties concerning aspects of energy demand are of particular importance in the technological field considered. Decisions regarding the construction or the amplification of networks and power plants have to be made on a long-term basis. Uncertainties occur also in connection with the generation of power. Approaches are discussed for making the required decisions on the basis of the given situation which includes known and uncertain factors. Attention is given to a utilization function and the calculation of the optimal strategy. An analysis of the utilization functions on the basis of field theory is discussed and an example involving a decision made according to the simple minimax principle is presented. G.R.

A75-28590 # **Cooling by solar heat.** A. Weinstein (Westinghouse Electric Corp., Baltimore, Md.) and C. S. Chen (U.S. Energy Research and Development Administration, Washington, D.C.). *American Institute of Aeronautics and Astronautics and American Astronautical Society, Solar Energy for Earth Conference, Los Angeles, Calif., Apr. 21-24, 1975, AIAA Paper 75-609.* 8 p. 6 refs.

A large-scale solar system for the heating and cooling of the George A. Towns elementary school in Atlanta, Georgia has been designed and is under construction. The system, utilizing all commercially available components, features a 100-ton absorption cooling machine, 10,000 square feet of solar collectors and 13,000 square feet of reflective surfaces to augment the insolation collected, and a closed loop collector drain-down system with added corrosion protection. It is scheduled to begin operation in April to May of 1975 and is expected to provide for more than 60 percent of the cooling and heating requirement for the school. Material and labor costs for the system are still high, especially as a result of very sharp increases in conventional component prices. (Author)

A75-28591 # **Solar energy and energy conservation in a state-assisted housing for the elderly project.** T. E. Skarupa (Department of Community Affairs, Hartford, Conn.). *American Institute of Aeronautics and Astronautics and American Astronautical Society, Solar Energy for Earth Conference, Los Angeles, Calif., Apr. 21-24, 1975, AIAA Paper 75-611.* 3 p.

A75-28593 # **Systems aspects of ocean thermal energy conversion.** R. H. Douglass, Jr. and P. Bakstad (TRW Systems Group, Redondo Beach, Calif.). *American Institute of Aeronautics and Astronautics and American Astronautical Society, Solar Energy for Earth Conference, Los Angeles, Calif., Apr. 21-24, 1975, AIAA Paper 75-615.* 5 p. 9 refs.

Solar energy conversion using an ocean-driven heat engine (OTEC) occupies a special place on the systems engineering horizon. In addition to the concept's proven technical feasibility, conditions in the field of OTEC research are such that systems innovations can be readily and profitably implemented. A team led by TRW Systems Group has synthesized a baseline design for an OTEC plant of 100 MWe output, with initial cost of $2100/KW, a cost which could be reduced considerably through the application of new technology and proposed refinements in baseline subsystems. It is estimated that a per-kilowatt cost of $1100 for a functioning OTEC plant could be realized before 1990 if a vigorous research and development program is carried out. (Author)

A75-28594 # **Site limitations on Solar Sea Power Plants.** C. Zener (Carnegie-Mellon University, Pittsburgh, Pa.). *American Institute of Aeronautics and Astronautics and American Astronautical Society, Solar Energy for Earth Conference, Los Angeles, Calif., Apr. 21-24, 1975, AIAA Paper 75-618.* 5 p. NSF Grant No. GI-39114.

Successful operation of a Solar Sea Power Plant (SSPP) requires that the warm water intake draw water only from the top mixed layer of the ocean. This requirement gives the maximum allowable flux intake as a function of the thickness of the mixed layer, the drift velocity of the surface ocean current, the latitude of the plant, and the radius of the intake pipe. For the typical values of a thickness of 300 ft, a velocity of 0.1 ft/sec, a latitude of 20 degrees, and a cylindrical radius of 50 ft, the critical maximum intake flux is about 40 million gpm, corresponding to a SSPP of about 400 MW net capacity. (Author)

A75-28595 # **100 MWe solar power plant design configuration and performance.** F. A. Blake (Martin Marietta Aerospace, Denver, Colo.). *American Institute of Aeronautics and Astronautics and American Astronautical Society, Solar Energy for Earth Conference, Los Angeles, Calif., Apr. 21-24, 1975, AIAA Paper 75-623.* 9 p. 6 refs. NSF Grant No. AER-74-07570.

A75-28596 # **A central receiver solar power plant in a hybrid mode of operation.** R. A. Stickley (Sheldahl, Inc., Northfield, Minn.) and R. J. Zoschak (Foster Wheeler Corp., Livingston, N.J.). *American Institute of Aeronautics and Astronautics and American Astronautical Society, Solar Energy for Earth Conference, Los Angeles, Calif., Apr. 21-24, 1975, AIAA Paper 75-624.* 7 p.

One concept for utilizing solar energy for the generation of electrical power envisions an extensive field of steerable heliostats concentrating solar energy upon a tower-mounted central receiver where feedwater is converted to superheated steam for driving a conventional turbine generator system. A problem basic to this concept is development of methods for extending the power generating process through periods when solar energy is not directly available. This paper explores the feasibility of a solar energy system operating in a hybrid, energy displacement mode with a conventional fossil-fueled power generating station. The selection of thermal input processes and plant steam conditions are discussed, together with receiver design and control considerations and justified investment in plant solar components. (Author)

A75-28597 * # **Solar electric and thermal conversion system in close proximity to the consumer.** K. W. Böer (Delaware, University, Newark, Del.). *American Institute of Aeronautics and Astronautics and American Astronautical Society, Solar Energy for Earth Conference, Los Angeles, Calif., Apr. 21-24, 1975, AIAA Paper 75-628.* 7 p. 14 refs. NSF-Navy-NASA-supported research.

Solar cells may be used to convert sunlight directly into electrical energy and into lowgrade heat to be used for large-scale terrestrial solar-energy conversion. Both forms of energy can be utilized if such cells are deployed in close proximity to the consumer (rooftop). Cadmium-sulfide/copper-sulfide (CdS/Cu2S) solar cells are an example of cells which may be produced inexpensively enough to become economically attractive. Cell parameters relevant for combined solar conversion are presented. Critical issues, such as production yield, life expectancy, and stability of performance, are discussed. Systems-design parameters related to operating temperatures are analyzed. First results obtained on Solar One, the experimental house of the University of Delaware, are given. Economic aspects are discussed. Different modes of operation are discussed in respect to the power utility and consumer incentives. (Author)

A75-28598 # **Urban waste energy resources.** D. L. Wise, R. G. Kispert, and S. E. Sadek (Dynatech R/D Co., Cambridge, Mass.).

American Institute of Aeronautics and Astronautics and American Astronautical Society, Solar Energy for Earth Conference, Los Angeles, Calif., Apr. 21-24, 1975, AIAA Paper 75-632. 26 p. 6 refs. Research supported by the Consolidated Natural Gas Service Co.; NSF Grant No. C-827.

The present paper summarizes the results of research into the feasibility of producing methane economically from municipal solid waste by anaerobic digestion. The analysis was performed for a plant designed to process 1000 tons of solid waste per day. The waste was assumed to consist of 50% organic matter, 8% metals, 9% glass, 3% plastics, 5% other organic matter, and 25% moisture. Four main operations are performed by the facility: feed preparation; digestion; gas treatment and handling; and effluent handling and disposal. A computer model was used to evaluate the economics of the process. The optimization criterion used was the minimization of the 20-year average gross cost of producing the fuel gas. It was found that methane can be produced at a baseline cost of $2.09 per thousand cubic feet. The sensitivity of the production cost to variations in performance and cost parameters and the effect of public ownership of the facility were also analyzed. A.T.S.

A75-28599 # **The oceanic biomass energy plantation.** H. A. Wilcox (U.S. Navy, Naval Undersea Center, San Diego, Calif.). *American Institute of Aeronautics and Astronautics and American Astronautical Society, Solar Energy for Earth Conference, Los Angeles, Calif., Apr. 21-24, 1975, AIAA Paper 75-635.* 8 p. 46 refs. NSF-sponsored research.

The Ocean Energy Farm Project is designed to explore and develop the technical and economic ability to raise large quantities of vegetation on artificial substrates (meshes made of plastic lines) in the surface waters of the tropical and temperate oceans. The first crop species under development is the giant California kelp, Macrocystis pyrifera. The project is a three-phase, 11- to 15-year effort to result in a 100,000-acre farm system in the Atlantic or Pacific by the 1985-to-1990 time period. This system is projected to produce foods, fuels, fertilizers, plastics, and other products for man's consumption at a rate sufficient to supply all the requirements for two to three persons per acre of cultivated ocean at today's world average consumption levels. The productivity of the system is based on bringing the nutrients of the deep waters by means of wave-powered upwelling devices into contact with the solar energy of the surface waters. The project used a 7-acre experimental farm off the northern tip of San Clemente Island, California. (Author)

A75-28600 # **The satellite solar power station - An option for energy production on earth.** P. E. Glaser (Arthur D. Little, Inc., Cambridge, Mass.). *American Institute of Aeronautics and Astronautics and American Astronautical Society, Solar Energy for Earth Conference, Los Angeles, Calif., Apr. 21-24, 1975, AIAA Paper 75-637.* 9 p. 5 refs.

The option for using satellite solar power stations for large-scale power generation on earth, collecting and converting solar energy into microwave energy, transmitting it to the earth's surface, and transforming it into electricity, is reviewed. The current state of technology and the necessary developments for accomplishing these functions are discussed, and the results of recent microwave transmission and rectification demonstration tests are mentioned. The requirements for earth-to-orbit transportation are presented. Considerations are given to cost projections, resource use and economic comparisons. Environmental issues, including impact of waste heat release, space vehicle exhaust, noise pollution and location of antenna sites are listed. Biological effects and radio frequency interference are explored. The time frame for accomplishing the operational system is outlined. (Author)

A75-28601 * # **Overcoming two significant hurdles to space power generation - Transportation and assembly.** R. Kline and C. A. Nathan (Grumman Aerospace Corp., Bethpage, N.Y.). *American Institute of Aeronautics and Astronautics and American Astronautical Society, Solar Energy for Earth Conference, Los Angeles, Calif., Apr. 21-24, 1975, AIAA Paper 75-641.* 11 p. 6 refs. NASA-sponsored research.

The design of large, space-based power generation satellites is strongly influenced by the transportation modes available and the assembly methods adopted. Flight plans for assembly are explored using the Space Shuttle as the transport vehicle. Future heavy-lift launch systems are postulated, and their impact on assembly cost of operational Solar Satellite Power Stations (SSPS) presented. Sensitivity to various levels of ground detail parts prefabrication are compared to corresponding levels of orbital fabrication. Assumptions concerning the degree of human skills are outlined, and related to the method of assembly. Cost comparisons and recommendations for continued studies are developed. (Author)

A75-28602 # **The adaptation of free space power transmission technology to the SSPS concept.** W. C. Brown and O. E. Maynard (Raytheon Co., Waltham, Mass.). *American Institute of Aeronautics and Astronautics and American Astronautical Society, Solar Energy for Earth Conference, Los Angeles, Calif., Apr. 21-24, 1975, AIAA Paper 75-642.* 12 p. 20 refs.

Laboratory experiments on the point-to-point transmission of energy by highly collimated microwave beams have achieved over-all efficiencies of up to 48%. The elements involved in a free-space microwave transmission system are discussed. The elements include the microwave link, devices to convert dc to microwave power, and devices to collect microwave power and reconvert it to dc. Studies have been made of a baseline system in which a geosynchronous Satellite Solar Power Station (SWPS) would generate electrical power and transmit it to earth via 10-cm microwaves. The SSPS would have a 1.0-km transmitting antenna using adaptive-phased-array technology for beam focusing and pointing. The ground receiving site would utilize a rectenna structure, in which the rectifying elements are distributed uniformly over the 6.8-km receiving aperture. Three possible side effects of the system, biological effects, radio-frequency interference and weather modification, are discussed. A.T.S.

A75-28603 # **Gulf stream based ocean thermal power plants.** J. G. McGowan and W. E. Heronemus (Massachusetts, University, Amherst, Mass.). *American Institute of Aeronautics and Astronautics and American Astronautical Society, Solar Energy for Earth Conference, Los Angeles, Calif., Apr. 21-24, 1975, AIAA Paper 75-643.* 10 p. 14 refs. NSF-supported research.

The results of an ongoing analytical study for the design of major components and a total system for Gulf Stream based ocean thermal power plants, up to 400 mWe net, are presented. Critical subsystems and components (such as heat exhangers, cold water inlet pipe, and containment hulls) are identified and the technical basis of their design and selection is discussed. Details of the latest total power system configuration (the Mark II design) are given and key problem areas for future implementation of the concept are summarized. (Author)

A75-28604 # **Unsteady aerodynamics of variable pitch vertical axis windmill.** E. C. James (Tetra Tech, Inc., Pasadena, Calif.). *American Institute of Aeronautics and Astronautics and American Astronautical Society, Solar Energy for Earth Conference, Los Angeles, Calif., Apr. 21-24, 1975, AIAA Paper 75-649.* 7 p.

A linearized theory is developed to treat the unsteady aerodynamics of a vertical axis windmill. The wind speed is uniform and steady. The circular orbit of the blades represents a large amplitude flight path motion. Along this trajectory the blades are free to execute small amplitude pitching. The results include blade force, moment, power required to sustain a specified windmill speed, and the rate of energy loss due to shedding of vorticity. Relative to the wind speed, the high and low speed cases of windmill operation are investigated. (Author)

A75-28650 # **Part load specific fuel consumption of gas turbines.** J. Jerie (Ceske Vysoke Uceni Technicke, Prague, Czechoslovakia). *ASME, Transactions, Series A - Journal of Engineering for Power,* vol. 97, Apr. 1975, p. 303, 304.

An analysis is made of the effect of various thermodynamic and design conditions on the feasibility of improving the part load specific fuel consumption (PLSFC) of gas turbines. It is shown that appropriate control of compressor and turbine characteristics is important in practically all developments of gas turbines aimed at improving the PLSFC. A.T.S.

A75-28893 # **Design study of the energy characteristics of thermionic electric power generating components and assemblies (Raschetnoe issledovanie energeticheskikh kharakteristik termoemissionnykh elektrogeneriruiushchikh elementov i sborok).** Iu. A. Broval'skii, V. V. Lebedeva, I. I. Raikov, N. M. Rozhkova, and V. V. Siniavskii. *Teplofizika Vysokikh Temperatur*, vol. 13, Jan.-Feb. 1975, p. 171-175. In Russian.

A computer algorithm is proposed for analyzing the current-voltage characteristics of power generating ducts with a mean current density from 5 to 15 A per sq cm. The algorithm includes several subroutines which may be used alone or in a unified program. Allowance is made for the initial current-voltage characteristics of the thermionic converter (TC) obtained theoretically or experimentally. It is found that for effective assemblies, the mean power density in a component is approximately 1/3 less than the TC power for the same temperatures of the emitter. Power is reduced due to the fact that the emitter is nonisothermal and as a result of joule losses at the electrodes and in the commutation system. The choice of an optimal geometry for the emitter in the asembly can reduce the total losses in the assembly to 50%. S.D.

A75-28962 **Thermal power plants (Thermische Kraftanlagen).** H.-J. Thomas (München, Technische Universität, Munich, West Germany). Berlin, Springer-Verlag, 1975. 392 p. 279 refs. In German. $23.80.

Basic concepts and relations concerning thermal power plants are examined, taking into account the Carnot cycle, principles of heat transfer, operational processes in thermal engines, questions regarding the transferability of test results, and material problems in thermal power plants. Thermal cycles in steam-engine and gas-turbine processes are discussed along with the design, operation, and control of conventional installations for the generation of steam. Nuclear reactors are considered and a description is provided of thermal turbomachines. Attention is also given to development problems, trends, and information useful for the planning and the economical employment of power plants. G.R.

A75-29115 # **Ocean thermal energy conversion system evaluation.** L. C. Trimble and B. Messinger (Lockheed Missiles and Space Co., Inc., Sunnyvale, Calif.). *American Institute of Aeronautics and Astronautics and American Astronautical Society, Solar Energy for Earth Conference, Los Angeles, Calif., Apr. 21-24, 1975, AIAA Paper 75-616.* 20 p. 10 refs.

The baseline design of an OTEC (ocean thermal energy conversion) system is outlined, and methodology by which improvements can be made in heat exchangers and associated pumps so that OTEC will compete with other energy sources is indicated. Some historical background precedes the presentation. It is concluded that the area of greatest improvement need is the development of higher heat transfer performance associated with the sea-water side of the heat exchanger. S.J.M.

A75-29116 # **Tropical ocean thermal power plants and potential products.** G. L. Dugger, H. L. Olsen, W. B. Shippen, E. J. Francis, and W. H. Avery (Johns Hopkins University, Silver Spring, Md.). *American Institute of Aeronautics and Astronautics and American Astronautical Society, Solar Energy for Earth Conference, Los Angeles, Calif., Apr. 21-24, 1975, AIAA Paper 75-617.* 16 p. 33 refs. Contract No. N00017-72-C-4401.

A conceptual design and performance estimates for ocean thermal energy conversion power plants floating in the tropical oceans are presented. Near the equator a temperature difference of 39 F between warm surface water and water at 2,000-3,000 ft depth generally is available to operate a closed Rankine cycle system. With ammonia as the working fluid inside the tubes, two-phase-flow heat exchangers using 6-in.-ID x 0.06-in.-wall aluminum tubing would require about 100,000 sq ft of surface area per MWe net power output. Plant capital cost is estimated to be $210-360 per kWe. Several potential products for shipment to shore, including liquid H2, NH3, and aluminum are discussed; the liquid ammonia, with an estimated cost near $70 per ton delivered to shore, may prove most attractive in view of world needs for fertilizers. (Author)

A75-29117 # **Solar thermal conversion mission analysis.** E. Blond and P. B. Bos (Aerospace Corp., El Segundo, Calif.). *American Institute of Aeronautics and Astronautics and American Astronomical Society, Solar Energy for Earth Conference, Los Angeles, Calif., Apr. 21-24, 1975, AIAA Paper 75-619.* 11 p.

Alternative solar thermal conversion system concepts operating in realistic operating environments have been evaluated. These systems are to provide electrical power in the Southwestern United States during the 1980-2000 time period. Based upon the comparative technical and economic assessments of these alternative solar concepts, the central receiver system operating in an intermediate or load-following mode has tentatively been identified as the preferred concept. This central receiver power plant appears to be economically competitive with conventional power plants in the 1990 time period. A preliminary market capture potential has also been estimated for this preferred concept. (Author)

A75-29118 # **Derivation of a total satellite energy system.** G. R. Woodcock and D. L. Gregory (Boeing Aerospace Co., Seattle, Wash.). *American Institute of Aeronautics and Astronautics and American Astronautical Society, Solar Energy for Earth Conference, Los Angeles, Calif., Apr. 21-24, 1975, AIAA Paper 75-640.* 17 p. 17 refs.

A total satellite solar energy system will include not only the geosynchronous orbit generating and transmission elements, but also high and low orbit transportation systems and launch, production and orbital assembly facilities. The amortization of the development and procurement of these systems is included in an analysis of the overall economics. Trends of increasing performance of solar cell and thermal engine generation were extrapolated to yield levels appropriate to relatively near term (1990) initial operational capability. These levels were used in the determination of generation system characteristics including weight. Vehicle size was found to be a prime factor in the derivation of a low cost transportation system for low orbit operations; a gross lift off weight of over twenty million pounds is indicated. The geosynchronous transportation system selected employs resistojets exhausting hydrogen. (Author)

A75-29137 * **The nature of the sunspot phenomenon. III - Energy consumption and energy transport. IV - The intrinsic instability of the magnetic configuration.** E. N. Parker (Chicago, University, Chicago, Ill.). *Solar Physics*, vol. 40, Feb. 1975, p. 275-289, 291-301. 34 refs. Grant No. NGL-14-001-001.

The basic relation is described between conversion of thermal energy into convective fluid motion and convective transport of thermal energy, and the equilibrium configuration of a sunspot's magnetic field is shown to be unstable to the hydromagnetic exchange instability. It is determined that heat transport necessarily accompanies convective driving of fluid motion and that the formation of cool sunspots requires convection extending coherently over several scale heights, a distance of at least 500 km. Several theoretical possibilities for sunspot stabilization are reviewed, and it is suggested that a suitable redistribution of cooling in the umbra may be the stabilization mechanism. It is believed that if cooling extends to a great depth in an elongated portion of a sunspot, the magnetic pressure on the boundary will be reduced, tending to reduce the elongation. F.G.M.

STAR ENTRIES

N75-15658# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ENGINE DEVELOPMENT PROGRAM FOR THE APL REMOTELY PILOTED VEHICLE
T. R. Small Jul. 1974 35 p
(Contract N00017-72-C-4401)
(AD-787507; APL-TG-1249) Avail: NTIS CSCL 01/3

Performance of a custom-built (Sakert-Riggs) two-cylinder glow plug engine for use in the APL Remotely Piloted Vehicle was tested. Output power was less than expected, and plans to modify the engine to increase its power were foiled because of the early discovery of a structural weakness that showed up in every unit tested. An alternate engine was then developed, based on a low-cost proven design (McCulloch) that had been in quantity production for a number of years. This engine showed higher peak power and weighs more, but requires less than one-fourth the fuel at cruise power, primarily because it uses spark plug ignition with gasoline rather than glow plug ignition with methanol. Late in the test program, another brand (Kolbo) custom-built two-cylinder glow plug engine was introduced. *Limited testing showed it to be a satisfactory, lightweight, but* fuel-hungry engine. Author (GRA)

N75-15668# Pope, Evans, and Robbins, Inc., Alexandria, Va.
DEVELOPMENT OF COAL FIRED FLUIDIZED-BED BOILERS Monthly Progress Reports, Nov. 1968 - Aug. 1969
Oct. 1974 234 p
(Contract DI-14-01-0001-478)
(PB-235899/2; MPR-45-54) Avail: NTIS HC $7.50 CSCL 07A

The report is the second set of a series of progress reports on research concerning coal-fired fluidized bed combustion for steam generation. Air pollution aspects are discussed including limestone injection control efforts and exhaust emissions. Also coal feeding and classification are discussed as well as general performance and design. GRA

N75-15669# Pope, Evans, and Robbins, Inc., Alexandria, Va.
DEVELOPMENT OF COAL FIRED FLUIDIZED-BED BOILERS Monthly Progress Reports, Oct. 1967 - Oct. 1968
Oct. 1974 221 p
(Contract DI-14-01-0001-478)
(PB-235898/4; MPR-32-44) Avail: NTIS HC $7.25 CSCL 07A

The progress reports describe research on a coalburning fluidized bed boiler. Aspects including air pollution control and exhaust emission, fly ash combustion and carbon loss, coal feeding and classification, and efficiency and design are discussed. GRA

N75-15742# Fairchild Space and Electronics Co., Germantown, Md.
SENSE 2: SPACE APPLICATIONS OF NUCLEAR POWER. VOLUME 1: COMMERCIAL COMMUNICATIONS SATELLITE
B. Raab May 1974 179 p
(Contract AT(49-15)-3063)
(AEC-SNS-3063-3-Vol-1) Avail: NTIS HC $7.00

The use of nuclear radioisotope power systems for commercial communications satellites and various military space missions, launched on present-day booster vehicles are studied. An evaluation is provided of competitiveness of radioisotope power systems as compared with solar power systems to provide power system designers with information on the important operating characteristics of the systems. Cm-244 and Pu-238 are considered as the radioisotope fuel. The organic Rankine system, Brayton system, and thermoelectric generators were considered as energy conversion systems. NSA

N75-15768# Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
A PROCESS FOR CLEANING AND REMOVAL OF SULFUR COMPOUNDS FROM LOW Btu GASES Interim Report, Oct. 1972 - Aug. 1974
R. H. Moore, C. H. Allen, G. F. Schiefelbein, and R. F. Maness Aug. 1974 93 p refs
(Contract DI-14-32-0001-1519)
(PB-236522/9; BNW-211B01284; OCR-100-Int-1) Avail: NTIS HC $4.75 CSCL 07A

Production of low Btu fuel gas for use in gas turbines imposes stringent requirements on a gas cleaning process to prevent corrosion and erosion of turbine blades. The gas must be cleaned at high temperatures to achieve maximum efficiency. A venturi scrubber is described which utilizes a molten salt as the working fluid to clean the gas. The venture utilizes kinetic energy in the gas to disperse the molten salt in the gas phase. Laboratory studies demonstrated process feasibility and a pilot plant was constructed to accept 50-100 SCFM of fuel gas from a fixed *bed gasifier. Gasifier and pilot plant gas scrubbing equipment* are in shakedown operation. GRA

N75-15769# National Research Development Corp., London (England).
PRESSURISED FLUIDIZED BED COMBUSTION Monthly Progress Report, Aug. 1972 - Sep. 1973
Wayne A. McCurdy Oct. 1974 230 p
(Contract DI-14-32-0001-1511)
(PB-236498/2) Avail: NTIS HC $7.50 CSCL 21B

The effect of operating at bed temperatures of up to 1750 F are investigated. Factors considered are: (1) freedom from deposits and erosion of a static cascade of turbine blades; (2) sulfur and NOx emissions; and (3) the sintering behavior of the material in the bed. The commercial incentives to operate at higher bed temperatures and turbine inlet temperatures are to further increase the efficiency of power generation and the simplication of operation over a wide load range. The results of the investigations and related translation to commercial operating conditions have reinforced the claims as to the bendfits that will accrue from using pressurized fluidized combustion. GRA

N75-15772# National Research Development Corp., London (England).
PRESSURIZED FLUIDIZED BED COMBUSTION Interim Report, Aug. 1972 - Sep. 1973
Jul. 1974 198 p
(Contract DI-14-32-001-1511)
(PB-235591/5; OCR-85-INT-1) Avail: NTIS MF $2.25; SOD HC $2.20 CSCL 21B

Research on pressurized fluidized bed combustion for clean electric power generation from coal is reported. The capabilities are assessed of pressurized fluidized combustion while minimizing atmospheric pollution, avoiding excessive maintenance problems and reducing capital and operating costs of electric power

generating systems. In particular, the study examines the effect on fouling of turbine blades, emission of alkalis and oxides of sulfur and nitrogen, and the bed behavior when operating at 1650 to 1750 F. GRA

N75-15781# California Univ., Berkeley. Lawrence Berkeley Lab. Inorganic Materials Research Div.
CRYOGENIC PROPERTIES OF Fe-Mn AND Fe-Mn-Cr ALLOYS
M. J. Schanfein, M. J. Yokota, V. F. Zackay, E. R. Parker, and J. W. Morris, Jr. May 1974 28 p refs Presented at Symp. on Properties of Mater. for Liquid Nat. Gas Tankage, Boston, 21 May 1974
(Contract W-7405-eng-48)
(LBL-2764; Conf-740549-1) Avail: NTIS HC $3.75

A wide range of microstructures were obtained in Fe-Mn alloys by varying the manganese and chromium contents. When a bcc (alpha) structure was produced, increasing amounts of manganese were found to be detrimental to low temperature toughness. At manganese levels greater than 12% where appreciable amounts of epsilon and gamma phases formed the ductile-brittle transition temperature dropped rapidly. In terms of the (epsilon + gamma) phases present, the ductile-brittle transition temperature decreased at a rate of 1.3 C/vol % (epsilon + gamma). Increasing the (epsilon + gamma) content to achieve good low temperature toughness, however, also caused a decrease in the yield strength. Increases in the yield strength were achieved without appreciable increase in the ductile-brittle transition temperature by greater manganese additions and by chromium additions. Author (NSA)

N75-15818# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Mechanical Engineering.
HYDROGEN AS A FUEL Semiannual Technical Report, 1 Jan. - 30 Jun. 1974
R. F. McAlevy, III, R. B. Cole, J. W. Hollenberg, L. Kurylko, and R. S. Magee 31 Aug. 1974 238 p refs
(Contract N00014-67-A-0202-0046; ARPA Order 2615)
(AD-787484; ME-RT-74011) Avail: NTIS CSCL 21/4

An engineering study of the technical problems expected with the large-scale introduction of hydrogen (H2) as a fuel has been initiated. Information was gathered and evaluated regarding H2 generation, transportation and utilization as an engine fuel. H2 generation by coal gasification, electrolysis and thermochemical processes using nuclear heat sources was investigated. Although embrittlement by H2 might weaken the pipeline itself, the principal problem expected in this mode of transmission appears to lie with existing compressors. A novel regenerative, compressor is discussed in this regard. Fundamental relationships between fuel properties and reciprocating engine performance parameters are established and form a rational basis for evaluating H2 (vs. gasoline) as a fuel. An extensive review of published results revealed that H2 was capable of highly efficient, low polluting operation of such engines when fuel-lean mixtures were used. (Modified author abstract) GRA

N75-16071# Bureau of Mines, Anchorage, Alaska. Field Operation Center.
NATURAL GAS FIELDS, COOK INLET BASIN, ALASKA Open File Report
Donald P. Blasko Apr. 1974 34 p refs
(PB-235767/1; BM-OFR-35-74) Avail: NTIS HC $3.75 CSCL 21D

Locations of gas fields within the Cook Inlet area, extent of development of individual fields, estimated recoverable reserves and production, and an analysis of the natural gas from each field are given. GRA

N75-16072# Texas Univ., Austin.
BASIC RESEARCH NEEDS FOR TERTIARY OIL RECOVERY: PROCEEDINGS OF A NATIONAL SCIENCE FOUNDATION WORKSHOP
R. S. Schechter and W. H. Wade 1974 61 p refs Presented at the Natl. Sci. Found. Workshop, Austin, Tex., 26-27 Jun. 1974 Sponsored in part by NAS-NRC
(Grant NSF GP-44165)
(PB-236726/6) Avail: NTIS HC $4.25 CSCL 08I

Proceedings of a workshop on basic research needs for tertiary oil recovery are presented. Topic areas cover: Low interfacial tensions and residual-oil; behavior or polymer in porous media; structure of micellar solutions; adsorption of surfactants on reservoir rock; surfactant floods; distribution of wettability and oil recovery; measurement of oil in place; and thermal recovery. GRA

N75-16074# Maryland Univ., College Park. Dept. of Mechanical Engineering.
SOLAR HEATING AND COOLING FOR BUILDINGS WORKSHOP. PART 2: PANEL SESSIONS, MARCH 23
Redfield Allen Apr. 1974 66 p Workshop held at Washington, D. C., 21-23 Mar. 1973
(Grant NSF GI-32488)
(NSF/RA/N-74-014) Avail: NTIS HC $4.25

Panel discussions of the broader aspects of solar heating and cooling, which provided for programmed interaction among researchers, and architectural, manufacturing, marketing, professional-society, governmental, and user sectors are presented. The following major topics were discussed: (1) solar building technology, including solar heating and cooling systems, energy conservation, and hot water heating; (2) NSF solar heating and cooling for buildings program, including NSF policy in industry and technology assessment; (3) industrial activities; and (4) related building activities, such as, planning, land development, architecture, and utilities. J.M.S.

N75-16076# Committee on Interior and Insular Affairs (U. S. Senate).
AN ASSESSMENT AND ANALYSIS OF THE ENERGY EMERGENCY
Benjamin Cooper Washington GPO 1973 22 p refs Staff analysis prepared for Comm. on Interior and Insular Affairs pursuant to S. Res. 45, 93d Congr., 1st Sess., 4 Dec. 1973
(GPO-25-382) Avail: Comm. on Interior and Insular Affairs

The background and conditions which led to the energy supply shortages (late 1973) are analyzed along with the urgent need for action to minimize the impact of these shortages. Strict motor gasoline rationing is suggested for increased energy savings. F.O.S.

N75-16077# Committee on Interior and Insular Affairs (U. S. Senate).
MARKET PERFORMANCE AND COMPETITION IN THE PETROLEUM INDUSTRY, PART 1
Washington GPO 1974 473 p refs Hearings pursuant to S. Res. 45 before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 28-29 Nov. 1973
(GPO-28-503) Avail: Comm. on Interior and Insular Affairs

The structure and operations of the oil and gas industries were examined to determine if they operate in a competitive manner, in the best interests of the country. The shipment during the energy crisis of home heating oil from the Houston-Lake Charles area refineries to the North Eastern States and the Upper Plains States is discussed along with the diesel fuel shortage of Metro in the District of Columbia. The development of the Alaskan resources, crude oil production, refining industry, and marketing are also discussed. F.O.S.

N75-16079*# Honeywell, Inc., Minneapolis, Minn.
DYNAMIC CONVERSION OF SOLAR GENERATED HEAT TO ELECTRICITY
J. C. Powell, E. Fourakis, J. M. Hammer, G. A. Smith, J. C. Grosskreutz, E. McBride et al Aug. 1974 288 p refs Prepared in cooperation with Black and Veatch Consulting Engr.
(Contract NAS3-18014)

(NASA-CR-134724; Rept-2852-41429) Avail: NTIS HC $8.75 CSCL 10A

The effort undertaken during this program led to the selection of the water-superheated steam (850 psig/900 F) crescent central receiver as the preferred concept from among 11 candidate systems across the technological spectrum of the dynamic conversion of solar generated heat to electricity. The solar power plant designs were investigated in the range of plant capacities from 100 to 1000 Mw(e). The investigations considered the impacts of plant size, collector design, feed-water temperature ratio, heat rejection equipment, ground cover, and location on solar power technical and economic feasibility. For the distributed receiver systems, the optimization studies showed that plant capacities less than 100 Mw(e) may be best. Although the size of central receiver concepts was not parametrically investigated, all indications are that the optimal plant capacity for central receiver systems will be in the range from 50 to 200 Mw(e). Solar thermal power plant site selection criteria and methodology were also established and used to evaluate potentially suitable sites. The result of this effort was to identify a site south of Inyokern, California, as typically suitable for a solar thermal power plant. The criteria used in the selection process included insolation and climatological characteristics, topography, and seismic history as well as water availability.

Author

N75-16081# Committee on Public Works (U. S. Senate).
FUEL AVAILABILITY AND ALLOCATION IN THE UNITED STATES
Washington GPO 1974 176 p Hearing before Subcomm. on Energy of Comm. on Public Works, 93d Congr., 2d Sess., 4 Feb. 1974
(GPO-31-711) Avail: Subcomm. on Energy

Allocation and distribution of gasoline in the U.S. is discussed in terms of possible inequities in the allocation program. It is concluded that the burden of the energy crisis is to be equally shared.

J.M.S.

N75-16082# Federal Power Commission, Washington, D.C.
TOTAL ENERGY SUPPLY AND DEMAND, VOLUME 1, CHAPTER 6
[1974] 105 p refs
Avail: NTIS HC $5.25

The future availability of natural gas supply in the U.S. is assessed and compared to the future supplies of other energy sources and to total energy availability as projected to the year 1990. Major factors considered are: (1) the relationship of gas to the energy system and to major components of the system, including other fuels; and (2) the relationship of energy demand and growth to economic growth. The assessment is conducted within a framework of world energy supply and demand due to increased U.S. dependence on foreign sources of energy. Projections are based on the assumption that the declining availability of domestic natural gas will be made up from domestic and foreign supplies of other energy sources, as well as imported gas and liquefied natural gas. Thus, a rate of total energy growth that will meet the essential needs of the economy and sustain an average rate of economic growth of four percent annually is maintained.

J.M.S.

N75-16083# Committee on Science and Astronautics (U. S. House).
ENERGY FROM US AND CANADIAN TAR SANDS: TECHNICAL, ENVIRONMENTAL, ECONOMIC, LEGISLATIVE, AND POLICY ASPECTS
Washington GPO Dec. 1974 97 p refs Rept. presented to Subcomm. on Energy of Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., 7 Oct. 1974 Prepared by the Library of Congr., Sci. Policy Res. Div. and the Foreign Affairs Div.
(GPO-43-005) Avail: Subcomm. on Energy

A Congressional hearing was conducted to examine the technical, environmental, economic, legislative, and policy aspects of obtaining petroleum energy from the tar sands of the United States and Canada. Testimony was submitted on the following subjects: (1) the nature, location, and extent of major tar sands, (2) U.S. policy and legislative aspects of U.S. development, (3) the Canadian tar sands industry, and (4) Canadian oil policies and their implications for exports to the U.S. Maps of the known sources of tar sands are included.

P.N.F.

N75-16084*# Pratt and Whitney Aircraft, South Windsor, Conn. Engineering Facility.
DEVELOPMENT OF ADVANCED FUEL CELL SYSTEM, PHASE 2 Final Report, 30 Jun. 1972 - 30 Sep. 1973
L. M. Handley, A. P. Meyer, and W. F. Bell 30 Sep. 1973 170 p
(Contract NAS3-15339)
(NASA-CR-134721; PWA-4984) Avail: NTIS HC $6.25 CSCL 10A

A multiple task research and development program was performed to improve the weight, life, and performance characteristics of hydrogen-oxygen alkaline fuel cells for advanced power systems. Development and characterization of a very stable gold alloy catalyst was continued from Phase I of the program. A polymer material for fabrication of cell structural components was identified and its long term compatibility with the fuel cell environment was demonstrated in cell tests. Full scale partial cell stacks, with advanced design closed cycle evaporative coolers, were tested. The characteristics demonstrated in these tests verified the feasibility of developing the engineering model system concept into an advanced lightweight long life powerplant.

Author

N75-16085*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div. Electrical Power Systems.
TEST REPORT SEPS SOLAR ARRAY ROOT SECTION MODEL
6 Dec. 1974 50 p
(Contract NAS8-30315)
(NASA-CR-120606; LMSC-D384268) Avail: NTIS HC $3.75 CSCL 10A

The fabrication and test of a solar array functional root section model to verify preliminary array design concepts is presented. The root section model is full scale width and contains a model array blanket. The blanket contains 1/8 live electrical modules and the remainder contains solar cell mass simulators. A storable Astromast is used for array blanket extension and retraction. The model component and system assembly hardware, tests, and test results are described.

Author

N75-16087# Oslo Lysverker (Norway).
OSLO'S FUTURE POWER SUPPLY
Jan. 1974 95 p In NORWEGIAN
(NP-20121) Avail: AEC Depository Libraries HC $7.75

In a general introduction the potential sources of energy and related environmental aspects are summarized. Hydroelectric, fossil fuelled, and nuclear power, and combined power-district heating are discussed. The energy supply situation in Oslo is described along with energy consumption in Norway. Economic factors such as investments, financing, and prices are discussed. A proposal for a program for the future development of the city's energy supply is presented. A detailed survey of energy sources and power plants, and Oslo Lysverker's price tariff is included.

NSA

N75-16088# Handelsministeriet, Copenhagen (Denmark).
COORDINATED EXTENSION OF POWER PLANTS IN THE 1980'S. A STATEMENT SUBMITTED TO THE MINISTRY OF COMMERCE, SHIPPING, AND INDUSTRY BY THE ENERGY COMMITTEE OF THE POWER PLANTS
Mar. 1974 33 p In DANISH

(NP-20023) Avail: NTIS Avail: AEC Depository Libraries' HC $4.75

A statement from Denmark on the extension of power plants is presented and concludes that the capital involved will be of the same size for nuclear and conventional power plants. On the background of rising prices for fossil fuel the future energy pattern and energy development including their distribution upon energy raw materials must be set out. Nuclear energy is a suitable means of lessening Denmark's dependence upon oil and coal. The necessary capital should be acquired through self-financing, and foreign loans should be considered if necessary. If the activities of the power plants are tightened for financial reasons, reductions in electricity consumption must be considered in the not too distant future. Author (NSA)

N75-16089# Los Alamos Scientific Lab., N.Mex.
GEOTHERMAL ENERGY: A NEW APPLICATION OF ROCK MECHANICS
J. C. Roegiers and D. W. Brown 1974 15 p refs Presented at the 3rd Intern. Congr. on Rock Mech., Denver, 1 Sep. 1974 Sponsored by AEC
(LA-UR-74-821; Conf-740909-2) Avail: NTIS HC $3.25

The extraction of thermal energy from the numerous regions of the earth's crust containing hot-but essentially dry-rock at moderate depths, may offer a solution to the developing world energy crisis. A deep exploratory hole has already been drilled into basement crystalline rock in north-central New Mexico, and tested at various horizons. These experiments have demonstrated that a large vertical fracture system can be created in granitic rocks using conventional hydraulic fracturing techniques. Of more importance relative to the Los Alamos convective energy extraction concept, an open pressurized fracture system has been maintained in these crystalline rocks for many hours with only negligible fluid leak off. Further, an analysis of seismic signals resulting from the hydraulic fracturing process indicates that a method may be available to determine both the orientation and vertical extent of the resulting fracture. Author (NSA)

N75-16090# California Univ., Livermore. Lawrence Livermore Lab.
AEC IN SITU OIL SHALE PROGRAM
J. S. Kahn 3 Jun. 1974 16 p refs
(Contract W-7405-eng-48)
(UCID-16520) Avail: NTIS HC $3.25

In order to make use of the vast oil shale deposits of the Western U.S., the AEC recommends an accelerated program to develop the technical base essential to the commercialization of a modified in situ technology. A void volume is created by mining a portion of the oil shale deposit and rubblizing the rock above the volume. The rubble zone is then retorted underground. Technical and economic analysis of these field programs would determine the commercial feasibility of the process. If feasibility is determined, the field program would be scaled up to larger volumes. The following technical issues have been identified as critical to commercial feasibility: (1) determination of minimum porosity; (2) determination of rubblization procedures to achieve minimum porosity; (3) determination of process variables affecting maximum retort rates, highest conversion efficiency and optimum product quality; (4) control of process parameters; (5) identification and resolution of mine safety issues; (6) identification of key environmental issues; (7) analysis of the operation of the total retorting system; and (8) the demonstration of the process on a commercial scale and technology transfer. Author (NSA)

N75-16091# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
BENEFICIAL USES OF WASTE HEAT
O. Ilari, A. Antonelli, and G. Boeri Mar. 1974 52 p refs Presented at the Study Group on the Release of Thermal Effluents of Nuclear Power and its Environmental Impact, Vienna, 23-27 Oct. 1972
(RT/PROT-(74)10; Conf-7210122-1) Avail: AEC Depository Libraries HC $5.50

The problem of the utilization of waste heat from electric power stations as an alternative method of the direct disposal to the environment is examined. The problem of thermal pollution is particularly relevant in consideration of the foreseeable increase of nuclear power production in the near future; this concern may find a partial solution by means of suitable technologies (cooling towers or ponds); or by the utilization of waste heat for beneficial uses; in this way waste heat is no longer considered as an environmental factor of pollution, but as energy still usable, even though degraded. In the review of the efforts made in some countries with a more developed nuclear industry, different practical cases of applications or plants, for the utilization of waste heat: sewage processing, domestic heating are discussed. Author (NSA)

N75-16092# Oak Ridge National Lab., Tenn.
NSF-RANN ENERGY ABSTRACTS A Monthly Abstract Journal of Energy Research
M. P. Guthrie, ed. May 1974 46 p
(Contract W-7405-eng-26)
(ORNL-EIS-74-52-Vol-2-5) Avail: NTIS HC $3.75

Bibliographic citations with abstracts are presented for 105 publications concerning energy and energy sources including supply, demand, research, policy, consumption, forecasting, management, and environmental problems. The publications cited are technical journal articles, popular or semi-technical magazine articles, topical reports, symposium papers and proceedings, monographs, and books. NSA

N75-16093# Combustion Power Co., Inc., Menlo Park, Calif.
ENERGY CONVERSION FROM COAL UTILIZING CPU-400 TECHNOLOGY Monthly Progress Report, Jul. - Aug. 1973
Oct. 1973 102 p refs
(Contract DI-14-32-0001-1536)
(PB-235817/4) Avail: NTIS HC $5.25 CSCL 10A

Progress on modification of the CPU-400 (coal combustion unit) pilot plant is discussed. The plant, constructed to convert heat energy of solid waste to electrical energy through use of a gas turbine/generator, is being modified to accept coal as the energy source. Installation of coal processing and feed systems are covered, along with experiments demonstrating the viability of the direct coal-fired gas turbine approach using CPU-400 technology. Author (GRA)

N75-16094# Voorhees (Alan M.) and Associates, Inc., McLean, Va.
GUIDELINES TO REDUCE ENERGY CONSUMPTION THROUGH TRANSPORTATION ACTIONS
May 1974 128 p refs Sponsored by Urban Mass Transportation Admin.
(PB-235983/4; UMTA-IT-06-0092-74-2) Avail: NTIS HC $5.75 CSCL 21D

This document is intended to serve as an aid to local transportation planners, traffic engineers, and administrators in the incorporation of energy conservation considerations into the transportation planning process, especially in reference to short-range transportation planning. Various types of low cost, short-term transportation actions are summarized and their potential for reducing energy consumption is estimated. Summary tables are presented which array the actions in terms of relevant institutional and legal considerations, and socioeconomic and environmental effects. Interrelationships between the energy consumption reduction potential of groups of actions are discussed and a process for formulation of coherent packages of such actions is presented. Guidelines are presentd for evaluating and formulating these action packages for large (1,000,000 and over population), medium (250,000 to 1,000,000), and small (50,000 to 250,000) urban areas. GRA

N75-16095# Maryland Univ., College Park. Dept. of Mechanical Engineering.
PROCEEDINGS OF THE SOLAR HEATING AND COOLING FOR BUILDINGS WORKSHOP. PART 2: PANEL SESSIONS, MARCH 23
Redfield Allen Apr. 1974 67 p Workshop held at Washington, D. C., 21 - 23 Mar. 1973
(Grant NSF GI-32488)
(PB-235483/5; NSF/RA/N-74-014; NSF/RANN/SE/GI-32488/PR/73) Avail: NTIS HC $4.25 CSCL 13A

The meeting was called in recognition of the pressing need for exchange of information among researchers in this rapidly expanding field. Papers were presented under the following subject headings: solar building technology; NSF solar heating and cooling for buildings program; industrial activities; related building activities. GRA

N75-16096# Indiana Univ., Bloomington.
PROCEEDINGS OF THE WORKSHOP ON BIO-SOLAR CONVERSION
Martin Gibbs, Alexander Hollaender, Bessel Kok, Lester O. Krampitz, and Anthony SanPietro 1974 93 p refs Workshop held at Bethesda, Md., 5-6 Sep. 1973
(Grant NSF GI-40253)
(PB-236142/6; NSF/RA/N-74-041) Avail: NTIS HC $4.75 CSCL 10B

Proceedings of a workshop to consider feasibility of using photosynthesis (or a modified form thereof) to generate hydrogen as a source of energy are presented. Topic areas covered include: photo-hydrogen metabolism in algae; problems and suggestions dealing with solar energy; reactions of molecular hydrogen in macro-algae; photosynthesis (general); homogeneous hydrogenase from chromatium; genetic reengineering of photosynthetic microorganisms to obtain efficient hydrogen-producing photosystems; solar energy fixation with algal-bacterial systems; economic constraints on solar photosynthetic energy conversion; nature of the desired reduced product in bio-solar energy processes; genetic feasibility of biological energy conversion; and a proposal to search for mutant strains carrying oxygen resistant hydrogenase. GRA

N75-16097*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
WORKSHOP PROCEEDINGS: PHOTOVOLTAIC CONVERSION OF SOLAR ENERGY FOR TERRESTRIAL APPLICATIONS. VOLUME 1: WORKING GROUP AND PANEL REPORTS
Oct. 1973 112 p Conf. held at Cherry Hill, N. J., 23-25 Oct. 1973 2 Vol.
(Contract NAS7-100; Grant NSF AG-485)
(NASA-CR-138209; PB-234860/5; NSF/RA/N-74-013-1) Avail: NTIS HC $5.25 CSCL 10B

The workshop on photovoltaic conversion of solar energy for terrestrial applications was called in recognition of the pressing need for the exchange of information among researchers in this field and to promote a dialogue between researchers and representatives of manufacturing, marketing, government and utilities. The proceedings of this photovoltaic workshop cover working group summaries and discussions and technical presentations. GRA

N75-16098*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
WORKSHOP PROCEEDINGS: PHOTOVOLTAIC CONVERSION OF SOLAR ENERGY FOR TERRESTRIAL APPLICATIONS. VOLUME 2: INVITED PAPERS
Oct. 1973 294 p refs Conf. held at Cherry Hill, N. J., 23-25 Oct. 1973 Sponsored in part by NASA 2 Vol.
(Grant NSF AG-485)
(NASA-CR-138193; PB-234861/3; NSF/RA/N-74-013-2) Avail: NTIS HC $8.75 CSCL 10B

Technical presentations and discussions of a workshop on terrestrial applications of solar energy are presented. Topic areas cover systems and diagnostics, cadmium sulfide/copper sulfide thin film cells, single crystal and polycrystalline silicon, and other materials and devices. GRA

N75-16099# Peat, Marwick, Mitchell and Co., Washington, D.C.
INDUSTRIAL ENERGY STUDIES OF GROUND FREIGHT TRANSPORTATION, VOLUME 1 Final Report
R. H. Leilich, J. C. Prokopy, and D. Ruina Jul. 1974 237 p refs
(Contract DI-14-01-001-1670)
(PB-236016/2; FEA/EI-1670) Avail: NTIS HC $7.50 CSCL 10A

Detailed energy use data for truck and railroad freight transportation in selected SIC categories is developed. Industry characteristics of energy use, sources of supply, and conservation and substitution measures, for railroad, line haul; railroads, switching and terminal establishments; REA express; local trucking, with and without storage, and terminal and joint terminal maintenance facilities for motor freight transportation; and trucking are covered. GRA

N75-16100# Peat, Marwick, Mitchell and Co., Washington, D.C.
INDUSTRIAL ENERGY STUDIES OF GROUND FREIGHT TRANSPORTATION. VOLUME 2: APPENDICES Final Report
R. H. Leilich, J. C. Prokopy, and D. Ruina Jul. 1974 55 p refs
(Contract DI-14-01-001-1670)
(PB-236017/0; FEA/EI-1670-A) Avail: NTIS HC $4.25 CSCL 10A

Energy use characteristics are developed by SIC code for each major kind of fuel and type of process. Emphasis is placed on energy consumption in ground freight transportation, specifically railroads, and for-hire and privately operated motor carriers of freight. The best of earlier research is supplemented by additional research to develop data. Substitutability and conservation alternatives of numerous fuels and their potential energy impacts are identified. Author

N75-16101# General Electric Co., Philadelphia, Pa. Space Div.
SOLAR HEATING AND COOLING OF BUILDINGS. PHASE O: FEASIBILITY AND PLANNING STUDY. VOLUME 1: Final Report
May 1974 28 p Sponsored by NSF
(PB-235431/4; DOC-74SD4219-Vol-1; NSF/RA/N-74-021A) Avail: NTIS HC $3.75 HC also available from NTIS $45.00/set of 5 reports as PB-235430-SET $9.00/set of 3 executive summaries as PB-235420 CSCL 13A

Work performed in the first step (Phase O) of a program to assess the feasibility and merits of the use of solar energy for heating and cooling buildings and providing hot water is summarized. In Phase O the technical, economic, societal, legal, and environmental factors of solar energy use were studied; problems and potential solutions were identified; and proof-of-concept experiments were planned. GRA

N75-16102# General Electric Co., Philadelphia, Pa. Space Div.
SOLAR HEATING AND COOLING OF BUILDINGS. PHASE O: FEASIBILITY AND PLANNING STUDY. VOLUME 2: TECHNICAL REPORT
May 1974 474 p Sponsored by NSF
(PB-235432/2; DOC-74SD4219-Vol-2; NSF/RA/N-74-021B) Avail: NTIS HC $11.50 HC also available from NTIS $45.00/set of 5 reports as PB-235430-SET CSCL 13A

The results of a study to assess the feasibility and practical merits of the use of solar energy to heat and cool buildings and provide hot water are reported. Included are descriptions of program methodology, development of requirements, systems definition, assessment of capture potential, social and environmental study, preliminary cost study, recommendations for proof of concept experiments, and development of plans for utilization. GRA

N75-16103# TRW Systems Group, Redondo Beach, Calif.
SOLAR HEATING AND COOLING OF BUILDINGS, PHASE O. VOLUME 3: APPENDICES
31 May 1974 365 p refs
(Contract NSF C-853)
(PB-235424/9; TRW-21568-003; NSF/RA/N-74-022C) Avail: NTIS HC $10.00 HC also available from NTIS $20.00/set of 3 reports as PB-235421-SET CSCL 13A

N75-16104# Illinois Univ., Urbana.
ENERGY USE IN THE COMMERCIAL AND INDUSTRIAL SECTORS OF THE US ECONOMY, 1963
Clark W. Bullard, III and Robert A. Herendeen 21 Nov. 1973 266 p refs
(Grant NSF GI-35179X)
(PB-235487/6; UIUC-CAC-DN-73-105; NSF/RA/N-74-057) Avail: NTIS HC $8.50 CSCL 10A

Detailed analyses are presented of energy use in the 368 commercial and industrial sectors of the U.S. economy in 1963, and of intersector dependence in energy terms. Besides direct use, full attention is paid to the flow of non-energy goods and the energy thereby implied. The approach, which is based on energy input-output analysis, is described. GRA

N75-16105# Data Resources, Inc., Lexington, Mass.
A STUDY OF THE DEMAND FOR GASOLINE Final Report
Jul. 1974 157 p refs Sponsored in part by EPA
(Contract EQC-322)
(PB-235254/0) Avail: NTIS HC $6.25 CSCL 21D

Calculations of the response of the demand for gasoline to alternative levels of prices and incomes for the next 2 years are given, including specific evaluations of the direct and indirect effects of increases in the gasoline tax. The calculations are based on an econometric model of the demand for gasoline developed for Environmental Protection Agency and Council on Environmental Quality by Data Resources, Inc. and projections made using this model in conjunction with the DRI macro econometeric model of the U.S. economy. GRA

N75-16106# Boston Univ., Mass. Dept. of Chemistry.
PHOTOCHEMICAL CONVERSION OF SOLAR ENERGY Quarterly Progress Report, 1 Jan. - 31 Mar. 1974
Norman N. Lichtin 30 Apr. 1974 22 p refs
(Grant NSF GI-38103)
(PB-235503/0; NSF/RANN/SE/GI-38103/PR/74/1) Avail: NTIS HC $3.25 CSCL 07E

Thin layer wholly illuminate photogalvanic cells were constructed using NESA and platinum electrodes. The electrolyte consisted of iron-thionine solution absorbed on a polyelectrolyte membrane. Evaluation of the performance of cells using aqueous-organic mixtures as solvents was pursued. A number of kinetic parameters were evaluated employing solution in solvents composed of various proportions of water and dimethylacetamide. Using the technique of pulsed laser photolysis-kinetic spectrometry, it was found that in aqueous solution semithionine appears to be gendrated in part by reaction of discreet molecules of triplet thionine with Fe(II) and in part by electron transfer within excited complexes of thionine and Fe(II). GRA

N75-16107# TRW Systems Group, Redondo Beach, Calif.
SOLAR HEATING AND COOLING OF BUILDINGS, PHASE O. VOLUME 1: EXECUTIVE SUMMARY
31 May 1974 87 p
(Contract NSF C-853)
(PB-235422/3; TRW-25168.001; NSF/RA/N-74-022A) Avail: NTIS HC $4.75 HC also available from NTIS $20.00/set of 3 reports as PB-235421-SET HC also available from NTIS $9.00/set of 3 executive summaries as PB-235420 CSCL 13A

The results of a study to establish the technical and economic feasibility of using solar energy for heating and cooling buildings are summarized. Included in the report are: study objectives; significant study results; study methodology; capture potential assessment; social, environmental, and economic impact; proof-of-concept experiments; development plans for phases 1 and 2; utilization planning; and conclusions and recommendations. The report concludes that solar energy will reduce projected fossil fuel consumption in the year 2000 by a very small amount if conventional designs with their high costs are used. GRA

N75-16108# General Electric Co., Philadelphia, Pa. Space Div.
SOLAR HEATING AND COOLING OF BUILDINGS. PHASE O. FEASIBILITY AND PLANNING STUDY. VOLUME 3, BOOK 2, APPENDIX C, TASK 3: ASSESSMENT OF CAPTURE POTENTIAL. APPENDIX D, TASK 4: SOCIAL AND ENVIRONMENTAL STUDY Final Report
May 1973 257 p refs
(Contract NSF C-855)
(PB-235434/8; Doc-74SD4219-Vol-3-Bk-2-App-C; NSF/RA/N-74-021D-Vol-3-Bk-2) Avail: NTIS HC $6.50 HC also available from NTIS $45.00/set of 5 reports as PB-235430-SET CSCL 10A

Appendix C, Assessment of Capture Potential, contains data on the number of buildings, new construction, energy demand, fractions of buildings heated and cooled, and three scenarios for building loads and savings. Appendix D, Social and Environmental Study, presents supplemental material to clarify the information in the Technical Report (Volume 2). Included in this section are discussions of demographic and economic, social, and energy scenarios, impact analysis, and problems and solutions to commercial diffusion. Portions of this document are not fully legible. GRA

N75-16109# Stanford Research Inst., Menlo Park, Calif.
POLLUTION-FREE ELECTROCHEMICAL POWER GENERATION FROM LOW GRADE COAL Final Report
D. F. McMillen, R. D. Weaver, and M. Anbar Jan. 1974 88 p refs
(Grant NSF GI-34027)
(PB-236162/4; NSF/RA/N-74-028) Avail: NTIS HC $4.75 CSCL 10B

Results from a study exploring the feasibility of a combined chemical-electrochemical system for generating electrical power under nonpolluting conditions. The process uses coal or coal products to reduce lead oxide to lead in a molten carbonate medium. The lead contained in the molten carbonate is then used in a metal-air electrochemical cell to generate electrical power. It was demonstrated that: (1) the lead-air electrochemical system in molten carbonate is a feasible system for power generation, (2) feasibility of the concept will not be limited by the rate of PbO reduction and (3) the system is capable of producing electrical power from coal at 3.4 mil/kWh on the basis of a fuel cost of $10 per ton (i.e., with an overall efficiency of 42%). GRA

N75-16110# West Virginia Univ., Morgantown. Engineering Experiment Station.
THE DESIGN AND DEVELOPMENT OF AN INTERACTIVE ENERGY MODEL
Patrick A. Bond and Jack Byrd, Jr. 1974 160 p refs
(Grant NSF GI-32724)
(PB-236144/2; NSF/RA/N-74-094) Avail: NTIS HC $6.25 CSCL 10A

Design and development of an interactive energy simulation model are discussed. The interactive simulation model differs from most energy models in that it considers the actions of the various decisionmakers involved in energy planning. The simulation

model proposes various contingencies to each of the decisionmakers and asks them to make decisions according to their priorities. After each decisionmaker decides upon his course of action, the simulation model forecasts the future results of these decisions. GRA

N75-16111# International Research and Technology Corp., Washington, D.C.
INDUSTRIAL ENERGY STUDY OF THE INDUSTRIAL CHEMICALS GROUP Final Report
James C. Saxton, Marc P. Kramer, David L. Robertson, Michael A. Fortune, and Nickolaus E. Leggett 30 Aug. 1974 160 p refs
(Contract DI-14-01-0001-1654)
(PB-236322/4; IRT-342-R) Avail: NTIS HC $6.25 CSCL 10A

Results for energy use in each of the six SIC industries within the industrial chemicals group are given. Report covers the alkalies and chlorine industry; industrial gases industry; inorganic pigments industry; industrial inorganic chemicals industry; cyclic crudes, and cyclic intermediates, dyes, and organic pigments industry; and industrial organic chemicals industry. GRA

N75-16113# Foster Associates, Inc., Washington, D.C.
PROSPECTIVE REGIONAL MARKETS FOR COAL CONVERSION PLANT PRODUCTS PROJECTED TO 1980 AND 1985. VOLUME 1: MARKET ANALYSIS Final Report, Feb. 1973 - Sep. 1974
Nov. 1974 202 p
(Contract DI-14-32-0001-1509)
(PB-236631/8; OCR-102-Vol-1) Avail: NTIS HC $7.25 CSCL 21D

Potential regional markets for liquid hydrocarbons and high- and low-Btu gas converted from coal are discussed. The report covers transportation economics; demand for gas in 1980 and 1985; seasonal variation in gas demand; natural gas storage; projected gas supply and price; government curtailment policies and incremental pricing; gas supply by region; the electric utility market need for low-Btu gas; and analysis of markets for distillate oil, residual oil, low-Btu gas, and new types of electric generation. GRA

N75-16114# *Sheldahl Co., Northfield, Minn. Advanced Products* Div.
SOLAR POWER ARRAY FOR THE CONCENTRATION OF ENERGY (SPACE) Semiannual Progress Report, 1 Jan. - 30 Jun. 1974
R. A. Stickley 31 Jul. 1974 281 p Prepared in cooperation with Northern States Power Co., Minneapolis, Foster Wheeler Corp., Livingston, N. J., and Minnesota Univ., Minneapolis
(Grant NSF GI-41019)
(PB-236247/3; NSF/RANN/SE/GI-41019/PR/7412; NSF/RA/N-74-090) Avail: NTIS HC $8.75 CSCL 10B

Technical performance and economics of a heliostat field-central receiver solar energy conversion system operating in a hybrid, energy displacement mode with a conventional fossil fueled electrical power generating system are discussed. Metallized thin film reflective materials are analyzed and tested to determine the feasibility of their use as taut membrane heliostat reflectors. Methods are discussed for predicting the theoretical limits of performance of ideal heliostat arrays; a turntable heliostat concept using multiple edge-mounted reflectors; heliostat command and control requirements; selection of metallized thin film candidates and initiation of environmental exposure tests; parametric design and performance predictions for a concentrator subsystem; energy conversion processes used in conventional fossil fueled power generating systems. GRA

N75-16115# Delaware Univ., Newark. Inst. of Energy Conversion.
DIRECT SOLAR ENERGY CONVERSION FOR LARGE SCALE TERRESTRIAL USE Interim Report, 1 Jan. - 30 Jun. 1974
5 Jul. 1974 97 p refs
(Grant NSF GI-34872)
(PB-236193/9; NSF/RA/N-74-083) Avail: NTIS HC $4.75 CSCL 10B

Good process control is reported for all steps in the production of Cu2S/CdS solar cells. This has resulted in highly reproducible cell performance permitting controlled study of the influence of individual parameters such as etching, barriering, etc. Accelerated life testing continues to substantiate previous estimates of useable life at approximately 50C in excess of 15 years. Cell regeneration experiments are giving positive results. Auger spectroscopy and energy scanning X-ray diffraction results show that high cell performance is related to a high Cu'S ratio in the copper sulfide layer and a critical thickness range. GRA

N75-16116# Helio Associates, Inc., Tucson, Ariz.
AIR-STABLE SELECTIVE SURFACES FOR SOLAR ENERGY COLLECTORS Semiannual Progress Report 1 Apr. - 30 Jun. 1974
A. B. Meinel Jul. 1974 138 p refs
(Grant NSF GI-41895)
(PB-236196/2; NSF/RANN/SE/GI-41895/PR/74/12; NSF/RA/N-74-095) Avail: NTIS HC $5.75 CSCL 10B

The primary effort of this program is to evaluate the possibilities for test of selective surface samples for continued exposure to air and its associated water vapor, carbon dioxide and aerosols to temperature cycles from room temperature up to 150C. A secondary portion of the program is to evaluate collector performance with selective surfaces, in particular, the sensitivity analysis of selective surfaces used on the absorber and on the cover windows. GRA

N75-16117# American Cyanamid Co., Stamford, Conn. Chemical Research Div.
RESEARCH ON CADMIUM STANNATE SELECTIVE OPTICAL FILMS FOR SOLAR ENERGY APPLICATIONS Semiannual Progress Report, 1 Jan. - 30 Jun. 1974
G. Haacke Jul. 1974 31 p ref
(Grant NSF GI-39539)
(PB-236208/5; NSF/RANN/SE/GI-39539/PR/74/2; NSF/RA/N-74-053) Avail: NTIS HC $3.75 CSCL 10B

Detailed characterization of sputter coated cadmium stannate films were carried out. Current deposition technology was found to yield coatings which consist of Cd2SnO4 as major phase and smaller concentrations of CdSnO3 and CdO. The presence of CdO appears to impede the electrical conductivity. Infrared reflectance measurements on cadmium stannate films showed for some samples reflectives as high as 90%, these contained impurities. Highest reflectivities were observed in films doped with either tantalum or indium. Indium and tantalum doped films of different thickness have been prepared to determine optimum coating thickness required for application in solar thermal collectors. Development of backwall CsS/Cu2S solar cells on silica/Cs2SnO4 substrates yielded encouraging results. Cadmium stannate resistance can be made small if appropriate electrical contact geometry is used. GRA

N75-16118# *Colorado State Univ., Fort Collins. Solar Energy* Applications Lab.
SOLAR THERMAL ELECTRIC POWER SYSTEMS Quarterly Progress Report, 1 Apr. - 30 Jun. 1974
Jul. 1974 28 p refs Prepared jointly with Westinghouse Electric Corp.
(Grant NSF GI-37815)
(PB-236368/7; QPR-2; NSF/RANN/SE/GI-37815/PR/74/2; NSF/RA/N-74-082) Avail: NTIS HC $3.75 CSCL 10B

Parametric performance and cost models were developed for many concentrating collector, heat transport, and heat storage subsystems. A dynamic programming method of optimization was used to select optimal solar thermal power systems, and a dynamic simulation computer program was developed to calculate the power station output using hourly solar and weather data. Power systems from 3 to 300 MW capacity that can be used in electrical networks were considered. GRA

N75-16119# Arizona Univ., Tucson. Optical Sciences Center.
CHEMICAL VAPOR DEPOSITION RESEARCH FOR FABRICATION OF SOLAR ENERGY CONVERTORS Semiannual Progress Report, 1 Jan. - 30 Jun. 1974
B. O. Seraphin 15 Aug. 1974 78 p refs
(Grant NSF GI-36731)
(PB-236189/7; SAPR-1;
NSF/RANN/SE/GI-36731IX/PR/74/2; NSF/RA/N-74-077)
Avail: NTIS HC $4.75 CSCL 10B

This project supports research on a new approach to a selective solar energy convertor that can be used to transform solar radiation into high temperature heat. The selective solar energy convertor is basically a two-layered construction in which the top layer is a semiconductor material, such as silicon, having high absorption for solar radiation and high transparency for blackbody radiation from the heated unit. The bottom layer is a metal film having high reflectance. A chromium oxide layer on top of the stainless steel substrate reduces the effects of a mismatch of thermal expansion and inhibits interaction between substrate and multilayer stack. The successful transfer of the previously developed technology to stainless steel substrates is described. Several hundred temperature cycles of the stack up to 500C did not induce detrimental effects. Changes in the optical characteristic of the stacks at 500C do not lead to a degradation of the optical performance. GRA

N75-16120# Arizona State Univ., Tempe. Engineering Research Center.
TERRESTRIAL PHOTOVOLTAIC POWER SYSTEMS WITH SUNLIGHT CONCENTRATION Semiannual Progress Report, 15 Jan. - 30 Jun. 1974
C. E. Backus Jul. 1974 137 p refs Prepared in cooperation with Spectrolab, Sylmar, Calif.
(Grant NSF GI-41894)
(PB-236180/6; SAPR-1; ERC-R-74010;
NSF/RANN/SE/GI-41894/PR/74/2; NSF/RA/N-74-076)
Avail: NTIS HC $6.25 CSCL 10B

Basic parametric relationships inherent in a solar system that concentrates sunlight onto solar cells are investigated. These relationships can then be used to determine the optimum combinations of components that minimize the cost per watt of these systems. Existing analytical models were used to study solar cell response to high intensites and the characteristics of several optical concentrators operating over a time period of a year. Methods were developed to predict the direct incident radiation. Land-space utilization was shown to be related to the number of hours of tracking, and hence the watt-hours of power that can be guaranteed. GRA

N75-16121# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PHOTOVOLTAIC CONVERSION OF SOLAR ENERGY FOR TERRESTRIAL APPLICATIONS. VOLUME 1: WORKING GROUP AND PANEL REPORTS
1974 107 p Conf. held at Cherry Hill, N. J., 23-25 Oct. 1973
(Grant NSF AG-485)
(PB-236163/2; NSF/RA/N-74-013A-Vol-1) Avail: NTIS HC $5.25 CSCL 10B

The Workshop was called in recognition of the pressing need for exchange of information concerning solar energy for terrestrial applications and to promote a dialogue between researchers and representatives of manufacturing, marketing, government, and utilities. The meeting was also intended to aid NSF in planning resources and in developing reasonable goals and milestones for the photovoltaic program with the constraints of expected funding. The introductory remarks by NSF, the working group summaries and discussions, and the panel discussion are included. GRA

N75-16122# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PHOTOVOLTAIC CONVERSION OF SOLAR ENERGY FOR TERRESTRIAL APPLICATIONS. VOLUME 2: INVITED PAPERS
1974 288 p Presented at the Workshop, Cherry Hill, N. J., 23-25 Oct. 1973
(Grant NSF AG-485)
(PB-236164/0; NSF/RA/N-74-013B-Vol-2) Avail: NTIS HC $8.75 CSCL 10B

Technical presentations and discussions of the photovoltaic workshop are covered. Topic areas include single-crystal silicon, polycrystalline silicon, systems and diagnostics, CdS/Cu2S thin film cells, and other materials and devices. GRA

N75-16123# British Steel Corp., Sheffield (England). Information Services.
COAL PETROGRAPHY AND PETROLOGY. A BIBLIOGRAPHY 1964 - 1973
R. L. Davies Aug. 1974 22 p refs
(PB-236351/3; SM/BIB/859) Avail: NTIS HC $3.25 CSCL 08G

A bibliography of 161 briefly annotated references to the published technical journal literature on coal petrology and petrography is presented. GRA

N75-16124# Geological Survey, Denver, Colo.
AVERAGE OIL YEILD TABLES FOR OIL SHALE SEQUENCES IN CORES FROM THE UINTA BASIN, UTAH, THAT AVERAGE 15, 20, 25, 30, 35, AND 40 GALLONS PER TON Final Report
Janet K. Pitman and William B. Cashion 1974 345 p
(PB-236068/3; USGS-GD-74-035) Avail: NTIS HC $9.50 CSCL 08G

The Oil-Shale Data Analysis Program developed by the U.S. Geological Survey was designed primarily for the computation of resource estimates from Fischer assay data. The program was used to generate tables of oil-shale intervals that maintain specified average oil yields for oil-shale cores in the Uinta Basin, Utah. Data are arranged by township, range, and section. GRA

N75-16125# Gilbert Associates, Inc., Reading, Pa.
LOW BtU GASIFICATION HIGH TEMPERATURE-LOW TEMPERATURE H2S REMOVAL COMPARISON EFFECT ON OVERALL THERMAL EFFICIENCY IN A COMBINED CYCLE POWER PLANT Interim Report, Apr. - Sep. 1973
R. A. Ashworth and G. W. Switzer Jan. 1974 65 p refs
(Contract DI-14-32-0001-1236)
(PB-235780/4; OCR-79-INT-1) Avail: NTIS MF $2.25; SOD HC $1.85 CSCL 07A

The effect of high temperature and low temperature coal gas desulfurization on power plant thermal efficiency is compared. A combined power cycle, gas turbine and steam turbine, was assumed for the coal gasification/power generation process. Material balances, flow sheets with temperature, pressure, energy output, and overall heat balance closure are considered. GRA

N75-16151# Argonne National Lab., Ill.
REDUCTION OF ATMOSPHERIC POLLUTION BY THE APPLICATION OF FLUIDIZED-BED COMBUSTION Monthly Progress Report
A. A. Jonke Oct. 1974 245 p refs
(Contract DI-14-32-0001-1543)
(PB-235840/6; ANL/ES-CEN-F062; MPR-62) Avail: NTIS HC $7.50 CSCL 07A

An experimental program is being carried out to develop advanced technology in pressurized, fluidized-bed combustion of coal and to investigate the effects of operating variables on combustion efficiency, sulfur retention efficiency, and NOx and trace-element levels in the flue gas. Methods for the regeneration of the sulfated additive are being studied so that the additive can be reused in the combustor. Most of the recent experimental work has been devoted to studying various aspects of the different regeneration schemes. However, concurrently with the regeneration studies, the testing and operation of the combustor have continued. Author (GRA)

N75-16152# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.

COMPILATION OF AIR POLLUTANT EMISSION FACTORS, SECOND EDITION, SUPPLEMENT NO. 3

Thomas Lahre and William Vatavuk May 1974 55 p refs (PB-235736/6; AP-42-Suppl-3) Avail: NTIS HC $4.25 CSCL 13B

The report is a supplement for Compilation of Air Pollutant Emission Factors, AP-42. The scope of this second edition has been broadened to reflect expanding knowledge of emissions. The topics covered are natural gas combustion, liquefied petroleum gas consumption, wood/bark waste combustion in boilers, sewage sludge incineration, lead smelting, secondary lead smelting, chemical wood pulping, pulpboard, plywood veneer, and layout operations. GRA

N75-16337# National Environmental Research Center, Las Vegas, Nev.

RADIOLOGICAL SURVEILLANCE PROGRAM FOR THE PROJECT GASBUGGY PRODUCTION TEST, 15 MAY - 6 NOVEMBER 1973 Final Report

Aug. 1974 63 p refs

(Contract AT(26-1)-539)

(NERC-LV-539-30) Avail: NTIS HC $4.25

The test well, located about 88 km (55 mi) east of Farmington, New Mexico, had been shut-in for about 42 months since an earlier production test. Data furnished by the El Paso Natural Gas Company indicate that a total of about 49 Ci of H-3 and about 4.7 Ci of Kr-85 was released into the atmosphere during the flaring of about 3.03 million cubic meters (107 MMCF) of natural gas. Aerial and ground surveillance teams collected environmental samples prior to, during, and after the production test. Samples of air were analyzed for Kr-85, and samples of atmospheric moisture, vegetation, soil, precipitation, and surface water were analyzed for H-3. Based upon wind patterns and aircraft trackings, samples were collected where the maximum concentrations of these nuclides would be expected to be found. Contaminated water removed from the gas was stored and injected into the flare at higher than normal rates during most of the surveillance operations. Author (NSA)

N75-16362# California Univ., Livermore. Lawrence Livermore Lab.

NEW APPROACHES TO CTR: GENERAL RELATIVISTIC POWER PLANTS

Lowell Wood, Thomas Weaver, and John Nuckolls 4 Mar. 1974 17 p refs Presented at Conf. on Electrostatic and Electromagnetic Confinement of Plasmas and the Phenomenology of Relativistic Electron Beams, New York, 4-6 Mar. 1974 Sponsored by AEC (UCRL-75443; Conf-740316-6) Avail: NTIS HC $3.25

Power generation involving gravitational initiation and confinement of fusion detonation events is discussed. The prospects for reproducing on vastly smaller scales the explosions of stars themselves for powering human civilization are discussed. It is recognized that gravitational CTR may appear to be enormously more difficult in a technological sense than the challenging program of inertial fusion via laser-energized implosion. Some possible means by which these difficulties may be overcome are also discussed. Author (NSA)

N75-16368# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ENERGY CHARACTERISTICS OF COAXIAL PLASMA SOURCE

A. G. Belikov and V. P. Goncharenko 3 Oct. 1974 10 p refs Transl. into ENGLISH from the book "Plazmennye Uskoriteli" (USSR), 1973 p 200-203

(FTD Proj. T74-04-03)

(AD-787419; FTD-HT-23-1076-74) Avail: NTIS CSCL 20/9

An electrode device was used for experiments on the energy conversion coefficient of plasma generation. The energy of the plasma cluster is shown to grow linearly with the outside supply of stored energy, within the studied range of variation. The distribution of energy carried by the cluster was measured, and results are presented in tables and graphs. N.E.R.

N75-16410# Committee on Public Works (U. S. Senate).

TRANSPORTATION AND THE NEW ENERGY POLICIES: TRUCK SIZES AND WEIGHTS, PART 2

Washington GPO 1974 676 p refs Hearings before Subcomm. on Transportation of Comm. on Public Works, 93d Congr., 2d Sess., 20-21 Feb. and 26 Mar. 1974

(GPO-29-802) Avail: Subcomm. on Transportation

The effect of increasing allowable sizes and weights of motor vehicles using our highways is examined. Factors considered are: (1) reduction of energy consumption; (2) impact on highways and bridges; (3) deterioration in highway safety; (4) rising maintenance and construction costs of highways; (5) lower operating costs to truckers; (6) lower transportation costs to shippers; and (7) decrease in price of goods to consumers. J.M.S.

N75-16557*# Lockheed Aircraft Corp., Burbank, Calif.

EVALUATION OF ADVANCED LIFT CONCEPTS AND POTENTIAL FUEL CONSERVATION FOR SHORT-HAUL AIRCRAFT

H. S. Sweet, J. H. Renshaw, and M. K. Bowden Washington NASA Feb. 1975 93 p refs

(Contract NAS2-6995)

(NASA-CR-2502) Avail: NTIS HC $4.75 CSCL 01C

The effect of different field lengths, cruise requirements, noise level, and engine cycle characteristics on minimizing fuel consumption and minimizing operating cost at high fuel prices were evaluated for some advanced short-haul aircraft. The conceptual aircraft were designed for 148 passengers using the upper surface-internally blown jet flap, the augmentor wing, and the mechanical flap lift systems. Advanced conceptual STOL engines were evaluated as well as a near-term turbofan and turboprop engine. Emphasis was given to designs meeting noise levels equivalent to 95-100 EPNdB at 152 m (500 ft) sideline. Author

N75-16572# Royal Aircraft Establishment, Farnborough (England).

A GENERALISED ANALYSIS OF THE PERFORMANCE OF A VARIETY OF DRIVE SYSTEMS FOR HIGH REYNOLDS NUMBER, TRANSONIC WIND TUNNELS

P. G. Pugh and J. Y. G. Evans Feb. 1974 101 p refs

(RAE-TR-73134; BR39686) Avail: NTIS HC $5.25

Several drive systems for transonic wind tunnels used in aircraft model testing are discussed in terms of man and energy efficiency. These criteria are strongly related to capital cost, running cost, and measurement reliability. The Evans clean flow tunnel, when operated at low charge tube Mach numbers, attains high mass and energy efficiencies for 10 sec run times. The Ludwieg tube drive system has an inherently poor energy efficiency which can be improved by addition of a recovery tube at the expense of mass efficiency. The injector driven wind tunnel attains higher mass efficiency than any other, but at the expense of low energy efficiency which implies high running costs. ESRO

N75-16637*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

STUDY OF THE COSTS AND BENEFITS OF COMPOSITE MATERIALS IN ADVANCED TURBOFAN ENGINES Final Report, 27 Jun. - 27 Dec. 1973

C. A. Steinhagen, C. L. Stotler, and R. E. Neitzel Oct. 1974 194 p refs

(Contract NAS3-17775)

(NASA-CR-134696; R74AEG418) Avail: NTIS HC $7.00 CSCL 11D

Composite component designs were developed for a number of applicable engine parts and functions. The cost and weight of each detail component was determined and its effect on the

total engine cost to the aircraft manufacturer was ascertained. The economic benefits of engine or nacelle composite or eutectic turbine alloy substitutions was then calculated. Two time periods of engine certification were considered for this investigation, namely 1979 and 1985. Two methods of applying composites to these engines were employed. The first method just considered replacing an existing metal part with a composite part with no other change to the engine. The other method involved major engine redesign so that more efficient composite designs could be employed. Utilization of polymeric composites wherever payoffs were available indicated that a total improvement in Direct Operating Cost (DOC) of 2.82 to 4.64 percent, depending on the engine considered, could be attained. In addition, the percent fuel saving ranged from 1.91 to 3.53 percent. The advantages of using advanced materials in the turbine are more difficult to quantify but could go as high as an improvement in DOC of 2.33 percent and a fuel savings of 2.62 percent. Typically, based on a fleet of one hundred aircraft, a percent savings in DOC represents a savings of four million dollars per year and a percent of fuel savings equals 23,000 cu m (7,000,000 gallons) per year. Author

N75-16651# Allied Chemical Corp., Idaho Falls, Idaho. Idaho Chemical Programs Operations Office.
POSSIBILITIES FOR LITHIUM BOROHYDRIDE RECYCLE
E. E. Filby Jun. 1974 27 p refs
(Contract AT(10-1)-1375)
(ICP-1054) Avail: NTIS HC $3.75

The use of lithium borohydride as a portable source of hydrogen fuel gas is considered. Would it be possible to chemically recycle the lithium borate byproduct of the hydrogen generation reaction, and if so, how? An outline of pertinent boron chemistry shows numerous possible intermediate reaction sequences, and two apparently reasonable recycle routes. One of these uses methyl borate as an intermediate and is closest to a true cycle in that it consumes only hydrogen and produces only water in regenerating the borohydride. The other sequence, using a diborane intermediate, is heavily favored thermodynamically. It consumes hydrogen, carbon, and oxygen and produces water and carbon dioxide. Author (NSA)

N75-16712 British Library Lending Div., Boston Spa (England).
STATE OF THE ART AND PROSPECTS FOR ELECTRIC VEHICLES
K.-J. Oehms 29 Oct. 1973 19 p Transl. into ENGLISH from Elektrizitaetswirtschaft (West Ger.), v. 70, no. 17, 16 Aug. 1971 p 511-517
(BLL-OA-Trans-1250-(6196.3)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The electrical components for electric vehicles for use in city centres, viz. dc motors, thyristor controllers, lead-acid accumulators and battery changing techniques have been investigated in experimental vehicles. Their investigation can soon be concluded, and the series construction of vehicles which meet the appropriate marketing requirements commenced. Electric vehicles will help to solve particularly severe environmental problems. Thus, only a few years are needed for their large scale introduction into traffic, and then the statement that a true breakthrough in electric vehicles has already begun, is confirmed. Author

N75-16773# Sandia Labs., Albuquerque, N.Mex. Plowshare and Transducer Technology Div.
SENSIBLE HEAT STORAGE IN LIQUIDS
T. D. Brumleve Jul. 1974 41 p refs
(Contract AT(29-1)-789)
(SLL-73-0263) Avail: NTIS HC $3.75

Initial investigations are presented covering several aspects of thermal energy storage as sensible heat in liquids. Heat loss to the environment from insulated tanks and underground mined cavities is characterized as a function of size, temperature difference, and time. Storage and interchange of hot and cool liquids within a single storage volume is discussed along with the advantages of preventing mixing. A technique for minimizing mixing through the use of a thermocline at the interface between hot and cool liquids is presented together with the mechanisms which degrade energy availability. Author (NSA)

N75-16774# Los Alamos Scientific Lab., N.Mex.
CONCEPTUAL DESIGN OF A HEAT PIPE METHANATOR
W. A. Ranken Apr. 1974 11 p refs
(Contract W-7405-eng-36)
(LA-5596) Avail: NTIS HC $3.25

A conceptual design of a unit for converting synthesis gas from coal to methane is described. Gravity-return heat pipes are used in a simple configuration that provides for removing the reaction heat from the methanation-promoting catalyst, transmitting a portion of this heat to an incoming-gas preheat section, and delivering the remainder to a steam generation unit. Problems peculiar to the use of heat pipes for this purpose are considered, and methods for solving or circumventing these problems are discussed. Author (NSA)

N75-16967 British Library Lending Div., Boston Spa (England).
LEAD ACCUMULATOR BATTERIES IN TELECOMMUNICATIONS
R. Colin Jun. 1974 39 p Transl. into ENGLISH from Commutation et Electronique (France), no. 37, Apr. 1972 p 25-44
(BLL-Trans-2943-(9022.81)) Avail: British Library Lending Div., Engl.: 4 BLL photocopy coupons

The principles of the theory and the techniques of electric accumulators are described along with this application in the field of telecommunications. Author

N75-16968 British Library Lending Div., Boston Spa (England).
ENERGY FROM THE EARTH'S DEPTHS
A. Blokhnin [1974] 4 p Transl. into ENGLISH from the Russian
(BLL-M-23516-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Underground pumped-storage schemes are discussed as a possible auxiliary energy supply for peak-load consumption. The working principles are summarized, with some of the technical and engineering considerations in its construction. N.E.R.

N75-16969 British Library Lending Div., Boston Spa (England).
DRY OIL
[1974] 3 p Transl. into ENGLISH from the Russian
(BLL-M-23508-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

A new oil dewatering technique is reported that introduces the chemical demulsification agent directly into the well as well as into the pipeline for the highest effectiveness. This combined scheme of oil preparation produces an excellent oil at great economic savings. G.G.

N75-16970# Electricity Council, London (England).
AIR CONDITIONING OF OFFICE BUILDINGS WITH ALL-ELECTRIC SUPPLY. PART 1: TECHNICAL CONCEPTION
M. Kuhn and H. Vicktor 1974 18 p Transl. into ENGLISH from Heizung-Lueftung-Haustech. (Duesseldorf), v. 25, no. 4, Apr. 1974 p 109-112
(OA-Trans-938-Pt-1) Avail: NTIS HC $3.25

A energy concept is developed, which is initially based on the model of an office building with all-electric supply. The principles and the technical conception are discussed, along with economic considerations relating to all-electric air conditioning. Cost comparisons are made with other energy sources, and the heating and cooling load is calculated. Author

N75-16972*# National Aeronautics and Space Administration. Pasadena Office, Calif.
LOW TO HIGH TEMPERATURE ENERGY CONVERSION SYSTEM Patent Application
Charles G. Miller, inventor (to NASA) (JPL) Filed 27 Dec. 1974 24 p

(Contract NAS7-100)
(NASA-Case-NPO-13510-1; US-Patent-Appl-SN-536786) Avail: NTIS HC $3.25 CSCL 10A

A low to high temperature energy conversion system is described which includes a decomposition chamber in which ammonia (NH3) is decomposed into hydrogen and nitrogen by absorbing heat of decomposition from a low temperature (300 C) energy source. The separated hydrogen and nitrogen are then supplied to a recombination chamber where they recombine to produce ammonia. The recombination process is associated with a significant increase in temperature, used to increase the temperature of a fluid to temperatures on the order of 550 C. NASA

N75-16973# Committee on Commerce (U. S. Senate).
DEVELOPMENT OF OIL AND GAS ON THE CONTINENTAL SHELF
George A. Doumani and Norma W. Dyas Washington GPO 1974 16 p refs Rept. presented to Comm. on Commerce pursuant to S. Res. 222, 93d Congr., 2d Sess., 18 Apr. 1974 Prepared by the Library of Congr., Sci. Policy Res. Div.
(GPO-31-891) Avail: *Comm. on Commerce*

The possibilities and risks involved in offshore drilling for oil and gas are summarized, with legal and jurisdictional problems and environmental and land use issues included. Relevant legislation is outlined. N.E.R.

N75-16975# Comptroller General of the United States, Washington, D.C.
PROGRESS AND PROBLEMS IN DEVELOPING NUCLEAR AND OTHER EXPERIMENTAL TECHNIQUES FOR RECOVERING NATURAL GAS IN THE ROCKY MOUNTAIN AREA
2 Apr. 1974 86 p
(B-164105) Avail: NTIS HC $4.75

Economic, technical, and environmental aspects of methods for recovering natural gas in the Rocky Mountains are discussed. The three techniques covered include nuclear stimulation, massive hydraulic fracturing, and chemical explosive techniques. Factors which would have an impact on the cost of development with these methods are evaluated, and potential problems are defined. N.E.R.

N75-16977# Advisory Group for Aerospace Research and Development, Paris (France).
THE 1974 AGARD ANNUAL MEETING: THE ENERGY PROBLEM: IMPACTS ON MILITARY RESEARCH AND DEVELOPMENT
Dec. 1974 84 p refs In ENGLISH and partly in FRENCH Meeting held at Paris, 26 Sep. 1974
Avail: NTIS HC $4.75

The proceedings of a conference on the impact of the energy problem on military research and development projects are presented. Some of the subjects discussed are as follows: (1) energy problems in a global context, (2) energy related research and development in the U.S. Air Force, (3) alternate fuels for aviation purposes, (4) the impact of future fuels on military aircraft engines, and (5) energy resources and utilization.

N75-16978 Ministry of Defence, Paris (France).
ENERGY PROBLEMS IN A GLOBAL CONTEXT
Jacques-emile Dubois *In* AGARD The 1974 AGARD Ann. Meeting Dec. 1974 p 6-20 refs In ENGLISH and FRENCH

An analysis of the world-wide problems created by the consumption of non-renewable sources of energy is presented. The energy system of an industrial society is described by a diagram. A correlation between the energy consumption per individual of a given country and the gross national product of the company is developed. A chart of prospective sources of energy to meet future requirements is provided. Methods for obtaining additional energy by methods which do not consume fossil fuels are explained. The characteristics of an energy system based on the use of hydrogen as the primary energy sources are defined. Author

N75-16979 Air Force Dept., Washington, D.C.
ENERGY-RELATED RESEARCH AND DEVELOPMENT IN THE UNITED STATES AIR FORCE
Michael I. Yarymovych *In* AGARD The 1974 AGARD Ann. Meeting Dec. 1974 p 21-30

The requirements for petroleum based energy sources by the Department of Defense of the United States are analyzed. In addition to the requirements of the military forces, the logistic requirements are also examined. The impact of the energy crisis on military research and development programs to develop new energy sources for military use is examined. Methods of reducing fuel consumption by aircraft design and structural modification are proposed. The effectiveness of a campaign to reduce energy requirements and expenditures is documented. Author

N75-16980 Pinkel (I. Irving), Fairview Park, Ohio.
ALTERNATIVE FUELS FOR AVIATION
I. Irving Pinkel *In* AGARD The 1974 AGARD Ann. Meeting Dec. 1974 p 31-36
CSCL 21D

The status of energy programs to provide hydrocarbon fuels from new sources is examined. Experience in the United States with non-hydrocarbon fuels for turbine powered aircraft is analyzed. The various alternate sources of hydrocarbon fuels are defined. The use of metals and metal slurries as turbine fuels is proposed. The advantages and disadvantages of liquid hydrogen as an aircraft fuel are discussed. A specific example of an aircraft operating on liquid hydrogen is described. Author

N75-16981 National Aerospace Lab., Amsterdam (Netherlands).
IMPACT OF FUTURE FUELS ON MILITARY AERO-ENGINES
F. Jaarsma *In* AGARD The 1974 AGARD Ann. Meeting Dec. 1974 p 37-46 refs

The expected impact of the fossil fuel shortage on the design and operation of aircraft engines is discussed. Alternate fuels such as cryogenic fluids and synthetic fuels are proposed. Various aspects related to combustion of cryogenic and synthetic fuels are analyzed to examine the effects on seals, pumps, contamination, and engine operating procedures. Author

N75-16982 Technische Hochschule, Darmstadt (West Germany). Inst. fuer Flugtechnik.
IMPACT ON AERODYNAMIC DESIGN
X. Hafer *In* AGARD The 1974 AGARD Ann. Meeting Dec. 1974 p 47-55 refs

The impact of fossil fuel consumption and anticipated shortages on aircraft design for improved efficiency is examined. Aerodynamic possibilities for improved efficiency are as follows: (1) aerodynamic configuration optimization, (2) boundary layer suction, (3) the oblique wing, and (4) supercritical airfoils. Aerodynamic improvements using active controls are as follows: (1) relaxed static stability, (2) maneuver load control, (3) active flutter control, and (4) gust alleviation and fatigue damage control. Changes in aircraft aerodynamics design resulting from the use of hydrogen fuel are analyzed. Author

N75-16983 National Gas Turbine Establishment, Pyestock (England).
ENERGY RESOURCES AND UTILIZATION
M. C. Neale *In* AGARD The 1974 AGARD Ann. Meeting Dec. 1974 p 56-66 refs

An analysis of the world situation with respect to fossil fuels is presented. The impact of the fuel shortage on military aviation in European countries is examined. The availability and utilization of fuels other than petroleum are discussed. Charts are developed to show the following conditions: (1) world crude oil production and proven reserves, (2) world energy production and consumption, (3) total energy consumption per capita for the major nations, (4) outlets for refinery products, and (5) estimated coal reserves. Author

N75-16984# Argonne National Lab., Ill. Chemical Engineering Div.
HIGH ENERGY BATTERY PROGRAM AT ARGONNE NATIONAL LABORATORY
P. A. Nelson and D. S. Webster Apr. 1974 24 p refs
(Contract W-31-109-eng-38)
(ANL-8064) Avail: NTIS HC $3.25

Electrically rechargeable lithium/sulfur batteries are being developed for use as energy-storage devices for electric utility networks and as power sources for electric automobiles. The objectives of the program, to be completed by 1980, are to install a 1-MW battery in a demonstration facility at an electric utility substation and to install in a test vehicle, a car battery that was built by a commercial subcontractor. Recent work has indicated that high temperature cells having negative electrodes of a lithium-aluminum alloy, a molten salt electrolyte of LiCl-KCl (mp, 352 C), and positive electrodes of iron sulfide show promise of meeting the requirements of batteries both for off-peak energy storage and for electric automobiles. In a test of a full-scale Li-Al/LiCl-KCl/FeS2 cell, a maximum specific energy of 121 W-hr/kg was attained and, in 41 cycles over a period of 1390 hr, the specific energy was 65-100 W-hr/kg. Studies of small scale cells with FeS electrodes indicate that FeS is also a promising electrode material. Author (NSA)

N75-16985# Aerojet Nuclear Co., Idaho Falls, Idaho.
IDAHO GEOTHERMAL R AND D PROJECT REPORT FOR PERIOD 16 DECEMBER 1973 - 15 MARCH 1974
J. F. Kunze and L. G. Miller 18 Mar. 1974 41 p
(Contract AT(10-1)-1375)
(ANCR-1155) Avail: NTIS HC $3.75

The Idaho Geothermal R and D Project was initially charted by the Division of Applied Technology in December 1973. This report covers the first three months of activity. A brief summary is given in section 2, with more detailed discussions in subsequent sections. Author (NSA)

N75-16986# Sandia Labs., Albuquerque, N.Mex.
DESIGN ANALYSIS OF ASYMMETRIC SOLAR RECEIVERS
W. H. McCulloch and G. W. Treadwell Aug. 1974 23 p refs
(Contract AT(29-1)-789)
(SAND-74-0124) Avail: NTIS HC $3.25

One of the primary distinctions among parabolic cylinder solar collectors is the focal length of the reflector. For a given collector width, this focal length is directly related to the rim angle. This study considers in detail the effects of varying the receiver design with focal length. As the rim angle is decreased, an increasing portion of the receiver and its envelope receives little or no reflected solar flux, and this portion may be designed to minimize thermal losses. The result is a design which is not symmetric about the receiver axis. The purpose of this analysis is to examine the performance of such an asymmetric receiver design and to determine the optimum rim angle. The results of the study show that, for the receiver configuration and operational conditions described, the optimum receiver has a 90 deg rim angle. The impact of varying a number of design parameters is also evaluated. Author (NSA)

N75-16988# Sandia Labs., Albuquerque, N.Mex.
DEVELOPMENT AND PERFORMANCE OF A MINIATURE, HIGH-VOLTAGE THERMAL BATTERY
R. P. Clark and E. V. Forsman 1974 6 p refs Presented at 9th Intersociety Energy Conversion Eng. Conf., San Francisco, 26 Aug. 1974 Sponsored by AEC
(SLA-74-5363; Conf-740805-5) Avail: NTIS HC $3.25

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

N75-16989# Sandia Labs., Albuquerque, N.Mex.
REVIEW OF THERMAL BATTERY TECHNOLOGY
B. H. VanDomelen and R. D. Wehrle 1974 6 p refs Presented at the 9th Intersociety Energy Conversion Eng. Conf., San Francisco, 26 Aug. 1974 Sponsored by AEC
(SLA-74-5381; Conf-740805-4) Avail: NTIS HC $3.25

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

N75-16990# Argonne National Lab., Ill.
DEVELOPMENT OF HIGH SPECIFIC ENERGY BATTERIES FOR ELECTRIC VEHICLES Progress Report, Aug. 1973 - Jan. 1974
P. A. Nelson, E. C. Gay, R. K. Steunenberg, J. E. Battles, W. W. Schertz, D. R. Vissers, K. M. Myles, D. S. Webster, and L. Burris Jun. 1974 39 p refs
(Contract W-31-109-eng-38)
(ANL-8058) Avail: NTIS HC $3.75

The development of a high specific energy lithium/sulfur battery having the performance characteristics required for powering pollution free automobiles is considered. The cells have negative electrodes of molten lithium and positive electrodes of iron sulfide separated by a molten lithium halide-containing electrolyte. The operating temperature of the cells is about 400 C. Cells with negative electrodes of liquid lithium and positive electrodes of FeS2-Li2S mixtures in graphite housings achieved short time peak power densities as high as 1.4 W/sq cm, and sustained power densities up to 0.6 W/sq cm for approximately 50 sec. Capacity densities as high as 0.38 A-hr/sq cm were achieved upon charging at a current density of 0.025 A/sq cm and discharging at 0.1 A/sq cm. Several cells were operated for more than 500 hr and 100 cycles with only moderate declines in capacity density over the cell lifetime. Author (NSA)

N75-16991# Sandia Labs., Albuquerque, N.Mex. Exploratory Batteries Div.
PELLET TYPE THERMAL BATTERY
D. M. Bush Jul. 1974 21 p
(Contract AT(29-1)-789)
(SAND-74-0007) Avail: NTIS HC $3.25

A prototype thermal battery was developed which incorporates a pelletized heat source as well as pelletized depolarizer and electrolyte materials. The system used was Ca/LiCl-KCl/CaCrO4. Fabrication, assembly, and test results are discussed.
Author (NSA)

N75-16992# Sandia Labs., Albuquerque, N.Mex.
INTEGRATION OF PHOTOVOLTAIC AND SOLAR THERMAL ENERGY CONVERSION SYSTEMS
F. L. Vook and D. G. Schuler Jul. 1974 19 p refs
(Contract AT(29-1)-789)
(SAND-74-0093) Avail: NTIS HC $3.25

For optimal solar energy utilization to reduce fossil consumption for residential energy needs, it is proposed to integrate photovoltaic and solar-thermal energy conversion systems to provide household electricity, hot water, space heating, and air conditioning. Author (NSA)

N75-16993# Atomic Energy Commission, Washington, D.C. Div. of Headquarters Services.

SOLAR ENERGY PROGRAM PLAN FOR HEATING AND COOLING BUILDINGS

R. P. McGee, J. E. Rannels, and C. I. York Feb. 1974 41 p refs

(WASH-1337-5-Draft) Avail: NTIS HC $3.75

A program is presented to accelerate the development and marketing of solar heating and cooling systems for buildings, using existing technology, with a goal of achieving commercial production on a national scale within five years. Author (NSA)

N75-16994# Sandia Labs., Albuquerque, N.Mex.

SIXTY MINUTE THERMAL BATTERY: A FEASIBILITY STUDY

D. M. Bush and A. R. Baldwin 1974 28 p refs Presented at the 9th Intern. Power Sources Symp., Brighton, United Kingdom, 17 Sep. 1974 Sponsored by AEC

(SLA-73-5888; Conf-740908-1) Avail: NTIS HC $3.75

An experimental unit, designated the XP60, is being used to study the feasibility of a 60-minute thermal battery. It has a pellet-type configuration, including iron-potassium perchlorate heat pellets. The electrochemical system is Ca/LiCl-KCl, $CaCrO_4$/Fe. There are twelve cells, 8.25 cm in diameter, assembled on a mandrel. Cell stack temperatures were determined by placing thermocouples in individual cells and recording the temperature during battery discharge. Thermal and electrical data are presented for specific batteries, several of which had activated lives exceeding 60 minutes. Author (NSA)

N75-16995# New South Wales Univ., Kensington (Australia). School of Nuclear Engineering.

COMPARISON OF THE ENVIRONMENTAL ASPECTS OF NUCLEAR AND FOSSIL FUELED POWER STATIONS

Z. J. Holy 1973 9 p refs Presented at the Ann. Eng. Conf., New South Wales, Australia, 20 May 1974

(Conf-740555-1) Avail: AEC Depository Libraries HC $4.00

The major problems facing our society today are the growing demands for energy and the pollution associated with its generation. The major environmental hazards associated with both fossil fueled and nuclear power stations are discussed. The environmental and biological effects of air pollution, thermal pollution, radioactive effluents from power stations and fuel reprocessing plants, and radioactive waste disposal are dealt with, and the safety of nuclear power stations discussed. Methods are outlined for the comparison of hazards associated with fossil fired and nuclear plants, and one of these is used in the analysis. Author (NSA)

N75-16996# California Univ., Livermore. Lawrence Radiation Lab.

USE OF METHANOL IN TRANSPORTATION

W. T. Crothers 1 Jul. 1974 37 p refs

(Contract W-7405-eng-48)

(UCID-16528) Avail: NTIS HC $3.75

The methanol process has the highest efficiency in converting coal to a liquid fuel and an energy recovery factor between 50 and 55 percent. Other fuels, such as synthetic gasoline result in about 20 percent additional loss and have an energy recovery factor between 40 and 45 percent. Technology for the conversion to this clean fuel is a proven chemical processing technique. Other coal liquefaction methods are in the pilot plant stages. Methanol and gasoline performance in various engines is compared. Methanol is as hazardous as gasoline and similar in other respects. It can be blended with gasoline and has the potential of less emissions than gasoline. With slight engine modifications, it will perform well in gasoline-powered vehicles. Author (NSA)

N75-16997# Oak Ridge National Lab., Tenn.

RECOMMENDED RESEARCH PROGRAM IN GEOTHERMAL CHEMISTRY

R. N. Lyon, comp. and G. A. Kolstad, comp. Oct. 1974 48 p Sponsored by AEC

(WASH-1344) Avail: NTIS HC $3.75

The research program is aimed at obtaining fundamental chemical data for geothermal processes. The program covers five general areas: thermodynamic and physical properties of geothermal solutions, minerals, and metals; kinetics of chemical reactions and deposition; collection, evaluation, and dissemination of physical and chemical data; natural systems and rock-water interactions; and theoretical modeling of geothermal systems. NSA

N75-17003# Massachusetts Univ., Amherst.

TECHNICAL AND ECONOMIC FEASIBILITY OF THE OCEAN THERMAL DIFFERENCES PROCESS AS A SOLAR-DRIVEN ENERGY PROCESS *Semiannual Progress Report, 1 Apr. - 30 Jun. 1974*

W. E. Heronemus 31 Jul. 1974 47 p refs

(Grant NSF GI-34979)

(PB-236422/2; SAPR-1; NSF/RANN/SE/GI-34979/PR/74/2; NSF/RA/N-74-086) Avail: NTIS HC $3.75 CSCL 10B

The feasibility of the ocean thermal differences process practiced along the southeast coast of the United States in the Gulf Stream is considered. The complete thermal cycle has been integrated into both a complex computer simulation and an abbreviated simulation. The heat transfer correlation used is conservative and is though to reflect film and fouling conditions typical in clean sea water. The turbine has set the sized of the optimal power package: the power package condenser then sets size and shape of containment, and the total system evolves from that nucleus. The system baseline configuration method is being employed with perturbations in all subsystems and components related back to the baseline. (Modified author abstract) GRA

N75-17004# Bureau of Mines, Washington, D.C.

FUEL AND ENERGY DATA: UNITED STATES BY STATES AND REGIONS, 1972 Information Circular

Lulie H. Crump and Charles L. Reading Sep. 1974 88 p refs

(Contract DI-BM-IC-8647)

(PB-236581/5; BM-IC-8647) Avail: NTIS MF $2.25; SOD HC $1.25 as I28.27:8647 CSCL 21D

Salient information on reserves, production, and consumption of fuels and energy by state are summarized. Data are broken down by fossil fuels (coal, petroleum, and natural gas) and hydropower and nuclear for the major consuming sectors: household-commercial, industrial, transportation, electric power, and miscellaneous. In addition, total energy consumption in the Nation in 1972 is compared with consumption in 1971 and 1973. GRA

N75-17005# *National Center for Energy Management and Power,* Philadelphia, Pa.

LATENT HEAT AND SENSIBLE HEAT STORAGE FOR SOLAR HEATING SYSTEMS

Harold G. Lorch May 1974 33 p refs Revised

(Grant NSF GI-27976)

(PB-236190/5; NSF/RANN/SE/GI-27976/TR/72/20; NSF/RA/N-74-059) Avail: NTIS HC $3.75 CSCL 10A

Thermal energy storage suitable for solar heating and off-peak air conditioning was investigated in devices using either sensible heat or latent heat. Parametric designs for two latent heat materials (sodium thiosulfate pentahydrate and a paraffin wax) and for a sensible heat material (a 1:1 mixture of water and ethylene glycol) were compared as to cost, performance, and space requirements. The conditions of equal cost for latent heat and sensible heat storage systems were determined as functions of material properties and the temperature swing allowed in the sensible heat storage tank. The comparative designs include the cost of the heat exchanger required for latent heat storage and the operating penalty due to temperature swings occurring for sensible heat storage. GRA

N75-17006# Rice Univ., Houston, Tex.
PROCEEDINGS OF THE WORKSHOP ON NEEDS FOR FUNDAMENTAL RESEARCH IN CATALYSIS AS RELATED TO THE ENERGY PROBLEM
Joe W. Hightower, W. Keith Hall, George W. Keulks, and Sol W. Weller 25 Jun. 1974 29 p refs Workshop held at Houston, Tex., 24-25 Jun. 1974
(Grant NSF GP-44178)
(PB-236683/9) Avail: NTIS HC $3.75 CSCL 10B

The report includes the proceedings and recommendations of a workshop on fundamental research in catalysis related to energy problems held at Rice University June 24-25, 1974. Research areas given special attention were: the production and use of carbon monoxide and hydrogen mixtures, liquefaction, electrocatalysis, and pollution control. Consideration was also given to non-conventional catalytic processes with particular attention to those, such as photo-catalysis, which may bear on solar energy utilization. It was emphasized that fundamental research in catalysis is very important to the long-range aspects of energy conversion. Singled out for emphasis were: reaction mechanisms, surface characterization, catalyst deactivation, catalytic theory, exploratory research on energy systems, and equipment. GRA

N75-17007# Foster Associates, Inc., Washington, D.C.
PROSPECTIVE REGIONAL MARKETS FOR COAL CONVERSION PLANT PRODUCTS PROJECTED TO 1980 AND 1985. VOLUME 2: CURRENT AND PROJECTED DEMAND, SUPPLY AND PRICE OF ENERGY IN THE UNITED STATES Final Report, Feb. 1973 - Sep. 1974
Nov. 1974 258 p
(Contract DI-14-32-0001-1509)
(PB-236632/6; OCR-102-Vol-2) Avail: NTIS HC $8.50 CSCL 10A

Historical supply of and demand for energy in the U.S. is discussed. Factors considered are: (1) consumption of energy in 1971; (2) energy consumption projected to 1980 and 1985; (3) historical, current, and projected price of energy; (4) supply and price of oil, gas, and coal; and (5) electric power supply and the cost of electricity. GRA

N75-17008# Foster Associates, Inc., Washington, D.C.
PROSPECTIVE REGIONAL MARKETS FOR COAL CONVERSION PLANT PRODUCTS PROJECTED TO 1980 AND 1985. VOLUME 3: CURRENT AND PROJECTED DEMAND, SUPPLY AND PRICE OF ENERGY IN THE UNITED STATES, SCHEDULES Final Report, Feb. 1973 - Sep. 1974
Nov. 1974 311 p
(Contract DI-14-32-0001-1509)
(PB-236633/4; OCR-102-Vol-3) Avail: NTIS HC $9.25
For abstract, see N75-17007.

N75-17023# Southwest Research Inst., San Antonio, Tex.
A PRACTICAL MODEL LAW FOR CHEMICAL EXPLOSIVE FRACTURE OF OIL SHALE Final Technical Report
W. E. Baker, J. Lankford, and A. B. Wenzel Dec. 1974 78 p refs Prepared for Sandia Labs, Albuquerque, N. Mex.
(SwRI Proj. 02-4003)
Avail: NTIS HC $4.75

A scale model law is developed for fracturing of oil shale by chemical explosives. The design of practical model scale experiments to verify the law and to obtain data on fracture characteristics of shale or a brittle simulant of shale under explosive loading is discussed. The compressive failure characteristics of samples of oil shale are determined from small specimens under controlled laboratory conditions. These data are reported for a wide range of strain rates and initial confining pressures simulating overburden stresses, for three grades of shale. Shock Hugoniots for shale are estimated. A review of the literature on rock fracture under explosive loading, and properties of gaseous and condensed explosives, is included. Author

N75-17184# Electricity Council, London (England).
HEAT PUMPS IN LARGE BUILDINGS
H. Juttemann [1974] 27 p Transl. into ENGLISH from Heiz.-Lueft.- Haustechn., (West. Ger.), v. 25, no. 4, Apr. 1974 p 124-130
(OA-Trans-939) Avail: NTIS HC $3.75

A heat pump which can provide heating in the winter and cooling in the summer is proposed for large buildings. The working principles are detailed, and the effective performance factor (ratio of useful heat output to energy expended) is calculated. The utilization of external heat sources, including atmospheric air, river water, ground water, and soil is examined. Economic considerations are discussed. N.E.R.

N75-17188*# Chamber of Commerce, Houston, Tex.
PROCEEDINGS OF THE FIRST 1974 TECHNOLOGY TRANSFER CONFERENCE
Albuquerque New Mexico Univ. 1974 486 p refs Conf. held at Houston, Tex., 24-25 Sep. 1974 Sponsored in part by NASA
(NASA-CR-142119) Avail: NTIS HC $12.00 CSCL 14A

Commercially successful applications of NASA developed aerospace technology to industrial processes are discussed.

N75-17189* Rockwell International Corp., El Segundo, Calif.
TECHNOLOGY APPLICATION AT ROCKWELL INTERNATIONAL
C. J. Meechan *In* Chamber of Commerce Proc. of the 1st 1974 Technol. Transfer Conf. 1974 p 9-14

CSCL 14A

Technology diffusion at Rockwell International has progressed from the application of special skills to solve specific problems to the transfer of the required people and skills to allow the commercial divisions to solve their own problems and develop or improve their own products. Our prime effort is concentrated on commercial industrial applications. Rockwell's major emphasis on advanced technology utilization is directed through three operational modes, namely, transfer from technologically developed to underdeveloped organizations within the company; transfer between technologically developed organizations to form new operations within the company; and formation of high technology spin-off organizations beyond the corporate entity. Author

N75-17193* Environmental Protection Agency, Washington, D.C.
THE ENVIRONMENTAL PROTECTION AGENCY INDUSTRIAL TECHNOLOGY TRANSFER PROGRAM
Kenneth H. Suter *In* Chamber of Commerce Proc. of the 1st 1974 Technol. Transfer Conf. 1974 p 35-42

CSCL 13B

Today TAC consists of a full service information center and five programs, which are: (1) our industrial program; (2) the energy information center; (3) the business and industry extension program; (4) the remote sensing program; and (5) the center for environmental research and development. Author

N75-17195* National Aeronautics and Space Administration, Washington, D.C.
TRANSFER OF SPACE TECHNOLOGY TO INDUSTRY

Jeffrey T. Hamilton *In* Chamber of Commerce Proc. of the 1st 1974 Technol. Transfer Conf. 1974 p 51-60

CSCL 13H

Some of the most significant applications of the NASA aerospace technology transfer to industry and other government agencies are briefly outlined. The technology utilization program encompasses computer programs for structural problems, life support systems, fuel cell development, and rechargeable cardiac pacemakers as well as reliability and quality research for oil recovery operations and pollution control. G.G.

N75-17197* Denver Research Inst., Colo.
APPLICATIONS OF AEROSPACE TECHNOLOGY IN THE ELECTRIC POWER INDUSTRY
F. Douglas Johnson and Conrad F. Heins *In* Chamber of Commerce Proc. of the 1st 1974 Technol. Transfer Conf. 1974 p 89-96 ref
CSCL 10B

Existing applications of NASA contributions to disciplines such as combustion engineering, mechanical engineering, materials science, quality assurance and computer control are outlined to illustrate how space technology is used in the electric power industry. Corporate strategies to acquire relevant space technology are described. Author

N75-17200* Houston Univ., Tex.
ENERGY RECOVERY FROM SOLID WASTE
Charles Dalton and C. J. Huang *In* Chamber of Commerce Proc. of the 1st 1974 Technol. Transfer Conf. 1974 p 121-132 refs
CSCL 10A

A recent group study on the problem of solid waste disposal provided a decision making model for a community to use in determining the future for its solid waste. The model is a combination of the following factors: technology, legal, social, political, economic and environmental. An assessment of local or community needs determines what form of energy recovery is desirable. A market for low pressure steam or hot water would direct a community to recover energy from solid waste by incineration to generate steam. A fuel gas could be produced by a process known as pyrolysis if there is a local market for a low heating value gaseous fuel. Solid waste can also be used directly as a fuel supplemental to coal in a steam generator. An evaluation of these various processes is made. Author

N75-17203* Los Alamos Scientific Lab., N.Mex.
THE INITIATIVES OF THE LOS ALAMOS SCIENTIFIC LABORATORY IN THE TRANSFER OF A NEW EXCAVATION TECHNOLOGY
R. J. Hanold, C. A. Bankston, J. C. Rowley, and W. W. Long *In* Chamber of Commerce Proc. of the 1st 1974 Technol. Transfer Conf. 1974 p 153-166 refs Sponsored in part by AEC and NSF
CSCL 14A

A system for making vertical or horizontal holes in rock or soil by progressive local melting is described. In one operation the three major tasks of excavation are performed with the Subterrene concept: (1) rock fracturing; (2) debris removal; and (3) wall stabilization. Potential applications of the Subterrene system are indicated, with emphasis on extraction of geothermal energy and development of superconduction transmission lines for electrical power. A program in technology dissemination implemented by the staff members is described. It is indicated that a large scale commercial utilization of the technology is required to complete the transfer of technology. J.M.S.

N75-17210* Houston Univ., Tex.
ECONOMIC MODELING AND ENERGY POLICY PLANNING
Russell G. Thompson, Andrew Schwartz, Jr., Rodrigo J. Lievano, and John C. Stone *In* Chamber of Commerce Proc. of the 1st 1974 Technol. Transfer Conf. 1974 p 239-243

CSCL 10A

A structural economic model is presented for estimating the demand functions for natural gas and crude oil in industry and in steam electric power generation. Extensions of the model to other commodities are indicated. Author

N75-17279# California Univ., Berkeley. Lawrence Berkeley Lab.
COMPARISON OF COMPUTER PROGRAMS USED FOR MODELING SOLAR HEATING AND AIR CONDITIONING SYSTEMS FOR BUILDINGS
R. M. Graven Jun. 1974 21 p refs Presented at the Intern. Solar energy Soc., Fort Collins, Colorado, 19 Aug. 1974
(Contract W-7405-eng-48)
(LBL-3066; Conf-740811-1) Avail: NTIS HC $3.25

A comparison of the major architectural structure of computer programs available to aid in the design of solar heating and cooling systems for buildings is presented. A brief description of each program including the size, availability, inputs required, and the flow of information through the program is outlined. The equipment required to run the programs and the costs of obtaining and running the programs is summarized. The pertinent details required to select a computer program for educational or commercial applications are summarized. Author (NSA)

N75-17336*# Lockheed-California Co., Burbank.
STUDY OF ACTIVE COOLING FOR SUPERSONIC TRANSPORTS Final Report
G. D. Brewer and R. E. Morris Feb. 1975 152 p refs
(Contract NAS1-13226)
(NASA-CR-132573) Avail: NTIS HC $6.25 CSCL 01C

The potential benefits of using the fuel heat sink of hydrogen fueled supersonic transports for cooling large portions of the aircraft wing and fuselage are examined. The heat transfer would be accomplished by using an intermediate fluid such as an ethylene glycol-water solution. Some of the advantages of the system are: (1) reduced costs by using aluminum in place of titanium, (2) reduced cabin heat loads, and (3) more favorable environmental conditions for the aircraft systems. A liquid hydrogen fueled, Mach 2.7 supersonic transport aircraft design was used for the reference uncooled vehicle. The cooled aircraft designs were analyzed to determine their heat sink capability, the extent and location of feasible cooled surfaces, and the coolant passage size and spacing. Author

N75-17339*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FUTURE LONG-RANGE TRANSPORTS: PROSPECTS FOR IMPROVED FUEL EFFICIENCY
A. L. Nagel, W. J. Alford, Jr., and J. F. Dugan, Jr. Feb. 1975 19 p refs
(NASA-TM-X-72659) Avail: NTIS HC $3.25 CSCL 01C

A status report is provided on current thinking concerning potential improvements in fuel efficiency and possible alternate fuels. Topics reviewed are: (1) historical trends in airplane efficiency; (2) technological opportunities including supercritical aerodynamics, (3) vortex diffusers, (4) composite materials, (5) propulsion systems, (6) active controls, and terminal-area operations; (7) unconventional design concepts, and (8) hydrogen-fueled airplane. Author

N75-17464# Naval Air Systems Command, Washington, D.C.
ENERGY CONVERSION. 1: NON-PROPULSIVE ASPECTS Research Program Review
Mar. 1974 166 p refs
(AD-A000077) Avail: NTIS CSCL 21/2

The papers included here were presented at the review of Energy Conversion (non-propulsive aspects) programs which was held 26-27 March 1974 at the University of Denver, Phipps Memorial Conference Center. Sessions were devoted to Fuels and to Pyrotechnics. Papers are entitled: Aluminum soap hydrocarbon gel structures; Mechanisms of flame inhibition by chemical agents; High-density and low-viscosity missile fuels; Infrared spectral distribution of high temperature sources; Pyrotechnic flare spectroscopy; Alkali metal flame emitters; A mathematical model of flare plume combustion and radiation; Research on endothermic binders; Precursor smoke formulations; Chemiluminescence for the determination of the kinetics and mechanism of jet fuel oxidative degradation. GRA

N75-17456# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
SUMMARY REPORT OF WORKSHOP ON ENERGY

RELATED BASIC COMBUSTION RESEARCH
Irvin Glassman and William A. Sirignano Aug. 1974 35 p Workshop held at Princeton, N. J., 19-21 Jun. 1974
(Grant NSF GP-44105)
(PB-236714/2; AMS-1177) Avail: NTIS HC $3.75 CSCL 21B

A workshop on energy related basic research in combustion was held a Princeton University on June 19-21, 1974. The discussions covered four main topics: Practical combustion devices, heterogeneous combustion, homogeneous combustion and combustive kinetics. The workshop identified the following research topics as being of most important: turbulent reacting flows, instrumentation, hydrocarbon reaction kinetics, nitric oxide formation from organic bound nitrogen, burning of heavy and emulsified fuels, flame behavior near the fuel lean and rich extinction and ignition limits, spray combustion, coal reactions and ash, and conversion of fuel form. Each of these topics is discussed in some detail. The above research areas were not priority ordered. GRA

N75-17467 British Library Lending Div., Boston Spa (England).
UTILIZING FUEL MORE EFFICIENTLY IN REHEATING AND HEAT TREATMENT FURNACES
V. N. Grigorev and V. L. Gusovskii 1974 10 p Transl. into ENGLISH from Stal (USSR), v. 3, 1974 p 274-276
(BLL-M-21957-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The proceedings of a conference on supplying natural gas to ferrous metallurgy undertakings are summarized. Also discussed were problems involved in more efficient use of gas in rolling mill furnaces. N.E.R.

N75-17712*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STRUCTURAL ANALYSIS OF WIND TURBINE ROTORS FOR NSF-NASA MOD-0 WIND POWER SYSTEM
David A. Spera Washington Mar. 1975 39 p refs
(NASA-TM-X-3198; E-8133) Avail: NTIS HC $3.75 CSCL 20K

Preliminary estimates of vibratory loads and stresses in hingeless and teetering rotors for the proposed 100-kW wind power system are presented. Stresses in the shank areas of the 19-m (62.5-ft) blades are given for static, rated, and overload conditions. The teetering rotor has substantial advantages over the hingeless rotor with respect to shank stresses, fatigue life, and tower loading. A teetering rotor will probably be required in order to achieve a long service life in a large wind turbine exposed to periodic overload conditions. Author

N75-17722 British Library Lending Div., Boston Spa (England).
EXPLORATION OF ANTARCTICA: PAST AND PRESENT
E. Tolstikov 18 Jan. 1974 4 p refs Transl. into ENGLISH from Prauda (Moscow), 29 Dec. 1974
(BLL-M-23343-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Discoveries of the Soviet explorers in the Antarctic are discussed. The economic potential including mineral, coal, oil and gas mining are briefly discussed along with the hunting and fishing potential. F.O.S.

N75-17749# National Communications System, Arlington, Va.
LEGAL ECONOMIC, AND ENERGY CONSIDERATIONS IN THE USE OF UNDERGROUND SPACE
H. W. Young, R. R. Wright, R. W. Swenson, A. W. Stone, and I. Hoch Sep. 1974 129 p refs
(Contract NSF C-310; Grant NSF SSH-73-07142)
(PB-236755/5; NAS/TT-74-01; NSF/RA/S-74-002) Avail: NTIS HC $5.75 CSCL 13B

The development of a policy for use of airspace, underground space, and mineral deposits is discussed. Other topics discussed include coal strip mining, legal problems and aspects of using underground space, economic trends and demand for the development of underground space, and conservation of energy. M.J.S.

N75-17783# Resources for the Future, Inc., Washington, D.C.
US ENERGY R AND D POLICY: THE ROLE OF ECONOMICS
John E. Tilton Sep. 1974 138 p refs
(Grant NSF ATA-73-07742-A02)
(RFF-Working-Paper-EN-4) Avail: NTIS HC $5.75

Issues concerning the government funding of energy research and development are investigated from an economic perspective. The evolution of present-day energy R and D funding is described, and economic reasons for government intervention in the R and D effort are outlined. The importance of establishment public goals and priorities in energy policy-making is stressed. Major shortcomings of government funding policies are considered, with possible alternatives given. N.E.R.

N75-17784*# Texas Southern Univ., Houston.
COLLECTION AND CONCENTRATION OF SOLAR ENERGY USING FRESNEL TYPE LENSES Final Summary Report
Ray F. Wilson 7 Feb. 1975 13 p Original contains color illustrations
(Contract NsG-9009)
(NASA-CR-142194) Avail: NTIS HC $3.25 CSCL 10A

The efficiency of collecting solar energy using a Fresnel type lens was measured for two different collectors. A flow collector utilizes the temperature difference and heat capacity in water measurements to determine the amount of absorbed energy retained from sun rays passing through the Fresnel lens. A static collector is a hollow copper box filled with vegetable heating oil for absorption of focused solar radiation. G.G.

N75-17785*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. California Inst. of Technology.
ASSESSMENT OF THE TECHNOLOGY REQUIRED TO DEVELOP PHOTOVOLTAIC POWER SYSTEM FOR LARGE SCALE NATIONAL ENERGY APPLICATIONS
Ralph Lutwack 15 Oct. 1974 45 p refs
(Contract NAS7-100; Grant NSF AG-485)
(NSF-RA/N-74-072) Avail: NTIS HC $3.75 CSCL 10A

A technical assessment of a program to develop photovoltaic power system technology for large-scale national energy applications was made by analyzing and judging the alternative candidate photovoltaic systems and development tasks. A program plan was constructed based on achieving the 10 year objective of a program to establish the practicability of large-scale terrestrial power installations using photovoltaic conversion arrays costing less than $0.50/peak W. Guidelines for the tasks of a 5 year program were derived from a set of 5 year objectives deduced from the 10 year objective. This report indicates the need for an early emphasis on the development of the single-crystal Si photovoltaic system for commercial utilization; a production goal of 5 x 10 to the 8th power peak W/year of $0.50 cells was projected for the year 1985. The developments of other photovoltaic conversion systems were assigned to longer range development roles. The status of the technology developments and the applicability of solar arrays in particular power installations, ranging from houses to central power plants, was scheduled to be verified in a series of demonstration projects. The budget recommended for the first 5 year phase of the program is $268.5M. Author

N75-17786*# Kanner (Leo) Associates, Redwood City, Calif.
WIND POWER MACHINES
U. Hutter Washington NASA Feb. 1975 26 p refs Transl. into ENGLISH from the book "Huette, des Ingenieurs Taschenbuch" Berlin, Wilhelm Ernst and Son, 1954 p 1030-1044
(Contract NASw-2481)
(NASA-TT-F-16195) Avail: NTIS HC $3.75 CSCL 10A

Basic aerodynamic features of wind power and wind wheels are discussed. The adaptation of wind power to running machinery is described. Developments in wind power are illustrated, followed by a brief outline of operating properties. Author

N75-17787*# Kanner (Leo) Associates, Redwood City, Calif.
SOLAR ENERGY
G. Ya. Umarov and A. A. Yershov Washington NASA Feb. 1975 51 p refs Transl. into ENGLISH of the book "Solnechnaya Energetika" Moscow, Znaniye Press, no. 1, 1974 p 1-64
(Contract NASw-2481)
(NASA-TT-F-16155) Avail: NTIS HC $4.25 CSCL 10A

Water pumps, solar power stations, air conditioners, fresh-water stills, solar homes, solar cookers, fruit driers, devices for (low temperature) steaming of reinforced concrete members, solar refrigerators, solar hothouses, welding and melting of metals presents a far from complete list of the devices and areas of the possible broad use of solar energy. The first plant of solar equipment is to be built in the Uzbek city of Bukhara for production of several of these products. Author

N75-17790# Joint Publications Research Service, Arlington, Va.
FIRST JOINT SOVIET-AMERICAN COLLOQUIUM ON THE PROBLEMS OF MHD ENERGY CONVERSION
3 Jan. 1975 255 p refs Transl. into ENGLISH from various Russian articles Colloq. held at Moscow, 25-27 Feb. 1974
(JPRS-63794) Avail: NTIS HC $8.50

Physical and technical aspects of electric power generation by magnetohydrodynamic energy conversion are discussed.

N75-17791 Joint Publications Research Service, Arlington, Va.
PROSPECTS FOR MAGNETOHYDRODYNAMIC ELECTRIC POWER PLANTS IN POWER ENGINEERING
V. A. Kirillin, L. A. Melentyev, and A. Ye. Sheyndlin *In its* 1st Joint Soviet-Am. Colloq. on the Probl. of MHD Energy Conversion (JPRS-63794) 3 Jan. 1975 p 23-41 Transl. into ENGLISH from Russian article

A study is made of thermal circuits of the industrial magnetohydrodynamic electric power plants for various purposes-- peak, maneuverable and basic. Various operating regimes are described, and the maneuverable properties are discussed. The most characteristic values of the parameters of the investigated magnetohydrodynamic devices are presented. An estimate is made of the reduction in calculated expenditures on the production of electric power at the magnetohydrodynamic electric power plants. Author

N75-17792 Joint Publications Research Service, Arlington, Va.
SOME DEVELOPMENTS OF INDUSTRIAL MAGNETOHYDRODYNAMIC ELECTRIC POWER PLANTS
Ye. M. Shelkov, P. P. Ivanov, V. I. Kovbasyuk, G. B. Levental, G. N. Morozov, L. Kh. Parnev, S. A. Pashkov, Yu. D. Sokirko, Ye. V. Shishkov, and B. Ya. Shumyatskiy *In its* 1st Joint Soviet-Am. Colloq. on the Probl. of MHD Energy Conversion (JPRS-63794) 3 Jan. 1975 p 42-60 refs Transl. into ENGLISH from Russian article

The preliminary developments of two types of magnetohydrodynamic electric power plants are presented: (1) Power units with a broad operating range; and (2) semipeak magnetohydrodynamic electric power plants. The characteristics of the semipeak magnetohydrodynamic electric power plant using gas-fuel oil as fuel indicate that the optimal combination is the combination of a forced magnetohydrodynamic generator with a simplified steam turbine unit operating synchronously with respect to a load chart which is close to a stepped chart. The smooth variation of the power consumption regime in the power system is insured by joint operation of several power units in the magnetohydrodynamic power plant. Author

N75-17793 Joint Publications Research Service, Arlington, Va.
EXPERIENCE IN THE FIRST STEP OF THE MASTERY OF THE U-25 DEVICE
A. Ye. Sheyndlin, A. V. Nedospasov, S. A. Pashkov, D. S. Linkhasik, S. I. Pishikov, V. S. Sidorov, G. P. Telegin, Ye. M. Shelkov, and B. Ya. Shumyatskiy *In its* 1st Joint Soviet-Am. Colloq. on the Probl. of MHD Energy Conversion (JPRS-63794) 3 Jan. 1975 p 61-81 Transl. into ENGLISH from Russian article

The U-25 device is an experimental all-purpose power unit with an open cycle magnetohydrodynamic generator. The working medium is the product of combustion of natural gas in an oxidizing agent. A brief description of the equipment control, protection and monitoring systems and the device as a whole is presented. Author

N75-17794 Joint Publications Research Service, Arlington, Va.
ELECTRONIC MODEL OF THE U-25 DEVICE
R. A. Alyautdinov, V. A. Bashkatov, Yu. S. Bondin, S. I. Pishikov, V. N. Sariyev, Ye. M. Shelkov, and E. E. Shpilrayn *In its* 1st Joint Soviet-Am. Colloq. on the Probl. of MHD Energy Conversion (JPRS-63794) 3 Jan. 1975 p 82-93 Transl. into ENGLISH from Russian article

The analog model is based on the mass, momentum and energy transfer equations written in quasistationary approximations considering the specific static integral characteristics of the electrothermal and hydraulic units of the device. The limits of applicability of the model and means of improving it are substantiated, and possible prospects for using the developed models in planning natural experiments, training operating personnel and when planning and designing similar devices are noted. Author

N75-17806# Committee on Interior and Insular Affairs (U. S. Senate).
OVERSIGHT: MANDATORY PETROLEUM ALLOCATION PROGRAMS
Washington GPO 1974 194 p refs Hearings pursuant to S. Res. 45 before Comm. on Interior and Insular Affairs, 93d Congr., 2d Sess., 15 Jan. - 28 Feb. 1974 Prepared by Federal Trade Commisson
(GPO-31-027) Avail: Comm. on Interior and Insular Affairs

Findings and conclusions are presented of a program to monitor the implementation of mandatory petroleum allocation and price regulation under the Emergency Petroleum Allocation Act. Other topics discussed include the effectiveness of the allocation program, the administration of the program, historical trends in petroleum supply and demand, and regional and state allocation programs. M.J.S.

N75-17810# Sandia Labs., Albuquerque, N.Mex.
SOLAR TOTAL ENERGY PROGRAM Quarterly Report, Apr. - Jun. 1974
J. A. Leonard and S. Thunborg Sep. 1974 40 p refs
(Contract AT(29-1)-789)
(SAND-74-0208) Avail: NTIS HC $3.75

Exploratory system studies conducted in response to the need for nonpolluting sources of energy are described. An outgrowth of these studies was the concept of a cascaded solar total energy system, which utilizes the sun as the source of supply of a wide range of energy needs. System operation is described and a hardware program is developed to determine the technical and economic feasibility of a solar total energy system. Such a system offers (1) savings in fossil fuels; (2) is economically competitive with other systems; and (3) minimizes harmful effects on the environment. J.M.S.

N75-17811# Atomic Energy Commission, Oak Ridge, Tenn. Technical Information Center.
COAL PROCESSING: GASIFICATION, LIQUEFACTION, DESULFURIZATION A Bibliography, 1930-1974
Oct. 1974 763 p refs
(TID-3349) Avail: NTIS

The bibliography contains reference to 7441 publications covering the period 1930 (and earlier) to 1974. The subject areas covered are coal product carbonization, gasification, liquefaction, hydrogenation, purification, desulfurization, pyrolysis, cracking, and solvent extraction. Personal author, subject, and report number indexes are included, as well as a glossary of the more important named processes for converting and purifying coal and coal products. Author (NSA)

N75-17813# Los Alamos Scientific Lab., N.Mex.
CONTROL SYSTEM DESIGN AND SIMULATION FOR SOLAR HEATED STRUCTURES
H. S. Murray, J. F. Hafer, J. P. Shipley, T. E. Springer, J. D. Balcomb, and J. C. Hedstrom 1974 29 p refs Presented at the Intern. Solar Energy Soc., Fort Collins, Colo., 19-23 Aug. 1974
(Contract W-7405-eng-36)
(LA-UR-74-1085; Conf-740811-4) Avail: NTIS HC $3.75

Results are given for some methods of control of building environment using solar energy systems. The control problem differs from that of conventional heating and cooling systems in two major respects: (1) the temperature of the energy source of the system is constantly fluctuating, (2) the system performance criteria must include consideration of minimizing the energy requirements of the auxiliary heat source. The model includes a description of the dynamics of a single-glazed flat plate solar collector, energy storage system, auxiliary heating system, and the structure. A hybrid computer implementation is chosen for the model. One year of operation is simulated in 8.76 minutes. This allows an economical evaluation of an entire year of operation using various control modes and parameters. Results of simulation of a year's operation with each of the control schemes are presented, and it is shown that a suboptimal controller works quite well. Implications of each controller are discussed.
Author (NSA)

N75-17814# Los Alamos Scientific Lab., N.Mex.
ENERGY AND CRYOENGINEERING
E. F. Hammel 1974 20 p Presented at the 5th Intern. Cryog. Eng. Conf., Kyoto, 7 May 1974 Sponsored by AEC
(LA-UR-74-741; Conf-740509-8) Avail: NTIS HC $3.25

Cryoengineering technologies relating to energy sources include instrumentation, handling of LNG, and fusion reactions. Cryogenic magnetometers utilizing SQUIDS are now available, sensitive gravimeters are being developed, and bolometers may be deployed in satellites for detecting geothermal anomalies. Two major approaches are discussed in which a plasma is confined magnetically and the recent technology of inertial confinement. Superconducting technology applicable in the mid-term energy requirement is superconducting magnetic separators, large air separation plants for coal gasification, cryopumping for stack gas cleanup, and cryoresistive power transmission. NSA

N75-17815# California Univ., Livermore. Lawrence Livermore Lab.
MATERIALS SCREENING PROGRAM FOR THE LLL GEOTHERMAL PROJECT
L. E. Lorensen 9 Jan. 1974 11 p Presented at the 14th Eng. for the Mater./Energy Challenge Symp., Albuquerque, N. Mex., 28 Feb. - 1 Mar. 1974 Sponsored by AEC
(UCRL-75353; Conf-740222-2) Avail: NTIS HC $3.25

In order to assist in the development of the total flow concept for the utilization of hot geothermal brine, a materials selection and screening program has been started. Polymers and composites resistant to the high temperatures, hot brine, and erosive conditions present in a flowing well are being sought. Ultimately fabrication into pipes, turbine nozzles, and turbine blades will be required. Test specimens and test equipment are being obtained. The program outline is presented and a few limited test results reported. Author (NSA)

N75-17819# Army Foreign Science and Technology Center, Charlottesville, Va.
THERMODYNAMIC ANALYSIS AND PARAMETER OPTIMIZATION OF A SOLAR THERMOELECTRIC POWER UNIT WITH RADIATION HEAT DISSIPATION
L. M. Drabkin 6 Mar. 1974 16 p refs Transl. into ENGLISH from Geliotekhnika (USSR), no. 3, 1972 p 15-23
(AD-A000211; FSTC-HT-23-1592-73) Avail: NTIS CSCL 10/2

The methodology for optimizing the calculation of parameters of a thermoelectric battery obtaining heat at a constant junction temperature and emitting it into the surrounding space by means of radiation at a uniform temperature is examined. An equation for the efficiency factor for the maximum power routine is derived from a formula of A.F. Ioffe. The methodology is applied to an example, and 27 parameters are calculated. GRA

N75-17821# Carnegie-Mellon Univ., Pittsburgh, Pa.
SOLAR SEA POWER Annual Progress Report, 1 Apr. - 30 Jun. 1974
Clarence Zener, L. J. Dykstra, Robert R. Rothfus, Abrahim Lavi, Edward Krokosky, Charles Kriebel, Francis Clay McMichael, and Chin Chang Wu 31 Jul. 1974 139 p refs
(Grant NSF GI-39114)
(PB-236997/3; NSF/RANN/SE/GI-39114/PR/74/4) Avail: NTIS CSCL 10B

After a summary of prior work on design for high heat transfer and low pressure drops, design for maintenance of structural integrity at minimum cost are presented. Since pump costs are approximately proportional to the water flux which they handle, the water pump also threatens to constitute a major cost item. A study of pump designs specifically for solar sea power plants is covered along with cost estimates. GRA

N75-17822# California State Office of Science and Technology, Sacramento.
CALIFORNIA ENERGY WORKSHOP: DEVELOPING A PLAN OF ACTION TO MEET THE ENERGY CRISIS IN CALIFORNIA
Arthur B. Jebins Dec. 1973 52 p refs
(Grant NSF GI-39241)
(PB-237045/0; NSF/RA/G-73/042) Avail: NTIS HC $3.75 CSCL 10A

Supply, demand, and possible directions for an energy policy program to take are discussed. Report briefly covers offshore oil production, deep water ports, secondary and tertiary oil recovery, onshore oil and gas development, nuclear power, and geothermal power development. Also noted is the energy demand by utilities, transportation, industry, and residential and commercial buildings. GRA

N75-17823# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
DESIGN AND CONSTRUCTION OF A RESIDENTIAL SOLAR HEATING AND COOLING SYSTEM Semiannual Progress Report, 1 Jan. - 31 Jul. 1974
George O. G. Lof Aug. 1974 233 p refs
(Grant NSF GI-40457)
(PB-237042/7; NSF/RANN/SE/GI-40457/PR/74/2; NSF/RA/N-74-104) Avail: NTIS HC $7.50 CSCL 10B

The first integrated system providing heating and cooling to a building by use of solar energy was designed and installed in a residential-type building at Colorado State University. Solar heated liquid supplies heat to air circulating in the building and to a lithium bromide absorption air conditioner. Service hot water is also provided. Approximately two-thirds of the heating and cooling loads are expected to be met by solar energy, the balance by natural gas. The report contains details of design and principles of operation. A breakdown of costs of equipment and its installation is provided. GRA

N75-17824# New York State Assembly Scientific Staff, Albany.
ECONOMIC AND ENERGY CONSERVATION RELATIONSHIP RELEVANT TO STATE OF NEW YORK BUILDING DESIGN AND CONTRACT AWARDS Final Report, Nov. 1973 - Jun. 1974
William S. Fleming Jun. 1974 97 p Prepared in cooperation with Syracuse Univ., N.Y.
(Grants NSF ISR-72-05606-A02; NSF GT-32162)
(PB-237006/2; SS-411; NSF/RA/G-74/016) Avail: NTIS HC $4.75 CSCL 13M

An economic and energy conservation analysis procedure that can be used in building design and operation is developed. A listing and analysis of the available computer programs, discussion of the technological and market development factors needed for forecasting energy requirements and consumption, and an in-depth analysis of performance specification alternatives are included. Positive and negative energy conservation technological and economic features are discussed with an itemization of factors which could be implemented. The conclusive recommenda-

tion is to require a performance specification which contains life cycle costing. Some recommendations for legislation are included. GRA

N75-17825# New York State Assembly Scientific Staff, Albany.
USE OF SOLAR ENERGY IN BUILDINGS IN NEW YORK STATE Final Report, Oct. 1973 - Apr. 1974
Clyde G. Oakley Apr. 1974 42 p refs Prepared in cooperation with Syracuse Univ., N.Y.
(Grants NSF ISR-72-05606-A02; NSF GT-32162)
(PB-236974/2; SS-405; NSF/RA/G-74/013) Avail: NTIS HC $3.75 CSCL 10B

A brief history of solar energy use in given and potential advantages and disadvantages of using solar energy are examined. An overview of solar devices is presented and two common types of solar cells and other parts of a solar electrical system are discussed. The impact increased use of solar heating and cooling and factors that have discouraged use of solar energy are discussed along with possible actions the New York State Legislature could take concerning solar energy. GRA

N75-17826# Institute for Defense Analyses, Arlington, Va. Program Analysis Div.
INTERMEDIATE-TERM ENERGY PROGRAMS TO PROTECT AGAINST CRUDE-PETROLEUM IMPORT INTERRUPTIONS: FEASIBLE ALTERNATIVES, PROGRAM COSTS, AND OPERATIONAL METHODS OF FUNDING Final Report
Robert E. Kuenne, Gerald F. Higgins, Robert J. Michaels, and Mary Summerfield Sep. 1974 139 p refs
(Contract DI-14-01-0001-2051)
(PB-237209/2; P-1063) Avail: NTIS HC $5.75 CSCL 10A

The results of a study of likely U.S. energy problems in the intermediate term (5 to 10 years in the future) and policies designed to approach them are presented. A summary of various estimates of demand and supply conditions in different energy submarkets and the total energy market is given. Because of risks associated with import supply cutoff in the intermediate period, the feasibility of a number of stockpiling programs, including in situ storage, salt dome storage and steel dome storage is examined. Estimates of direct cost ('hard costs') and welfare and national security effects ('soft costs') are made. Funding alternatives for the stockpile programs are discussed in theory and practice. GRA

N75-17827# Development Planning and Research Associates, Inc., Manhattan, Kans.
INDUSTRIAL ENERGY STUDY OF SELECTED FOOD INDUSTRIES Final Report
Jul. 1974 582 p refs
(Contract DI-14-01-0001-1652)
(PB-237316/5; FEA/EI-1652) Avail: NTIS HC $13.25 CSCL 10A

The amount of energy used by each of 14 SIC industries within the food and kindred products industry (SIC 20) is given. Report covers the meat packing industry; sausages and other prepared meats industry; fluid milk industry; canned fruits and vegetables industry; frozen fruits and vegetables industry; animal feeds industry; wet corn milling industry; cane sugar and beet sugar industries; malt beverage industry; animal and marine fats and oils industry; manufactured ice industry; bread, cake, and related products industry; and soybean oil mills industry. GRA

N75-17828# Combustion Power Co., Inc., Menlo Park, Calif.
ENERGY CONVERSION FROM COAL UTILIZING CPU-400 TECHNOLOGY Research and Development Report, Jul. 1973 - Jun. 1974
Nov. 1974 130 p refs
(Contract DI-14-32-0001-1536)
(PB-237028/6; TR-74-105; OCR-94-INT-1) Avail: NTIS HC $5.75 CSCL 07A

Results of studies involving combustion of high-sulfur coal using CPU-400 technology are discussed. Combustion of two types of high sulfur coal (caking and non-caking) at various bed velocities and operating temperatures using limestone and dolomite as bed additives for sulfur dioxide suppression were covered. Data also cover modification of the CPU-400 process development unit to provide coal and dolomite storage and feed capability and system engineering and cycle studies. GRA

N75-17829# Martin Marietta Corp., Denver, Colo.
SOLAR THERMAL SUBSYSTEM SPECIFICATION STUDY
9 Sep. 1974 59 p refs
(Grant NSF GI-41305)
(PB-238005/3; NSF/RA/N-74-158) Avail: NTIS HC $4.25 CSCL 10B

The conceptual design of a commercial scale central receiver solar energy power plant is given and scaling considerations for a 10 MWe proof-of-concept experiment and a 5 MW thermal test facility are examined. GRA

N75-17830# Houston Univ., Tex. Dept. of Mechanical Engineering.
THE EVALUATION OF SURFACE GEOMETRY MODIFICATION TO IMPROVE THE DIRECTIONAL SELECTIVITY OF SOLAR ENERGY COLLECTORS Semiannual Progress Report, 1 Jan. - 30 Jun. 1974
John R. Howell and Richard B. Bannerot 30 Jul. 1974 36 p refs
(Grant NSF GI-41003)
(PB-236412/3; UHME/Sol/2; NSF/RA/N-74-093; NSF/RANN/SE/GI-41003/PR/74/2) Avail: NTIS HC $3.75 CSCL 10B

The performance of the flat-plate collector was enhanced with the use of spectrally (wavelength) and/or directionally selective surfaces. This document reports on progress in examining two model geometries to determine the optimum parameters that will maximize the directional selectivity. GRA

N75-17833 British Library Lending Div., Boston Spa (England).
THE ACTION OF EDF IN THE PREVENTION OF ATMOSPHERIC POLLUTION
M. A. Robin 4 Oct. 1974 11 p Transl. into ENGLISH from Pollution Atmospherique (France), v. 14, no. 54, Apr./Jun. 1972 p 137-141
(BLL-CE-Trans-6500-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The prevention of atmospheric pollution in France by expanding nuclear electric power generation and by developing the electric-powered automobile are discussed. Other topics discussed include thermal power stations, coal-burning power stations, electric heating, and desulfurization processes. M.J.S.

N75-17836# Council on Environmental Quality, Washington, D.C.
OCS OIL AND GAS: AN ENVIRONMENTAL ASSESSMENT, VOLUME 3
Apr. 1974 199 p refs
Avail: SOD HC $2.65

The effect of natural phenomena on offshore petroleum development is discussed. Descriptions are provided of the physical systems needed for outer continental shelf petroleum production and of the natural forces to which they are exposed. Individual and collective oil spill probabilities were determined for the physical systems described, and the potential volumes of oil that would be released as a result of the effects of natural phenomena were determined. The natural phenomena considered include severe storms, the tidal surge associated with severe storms, currents, ice, earthquakes, and tsunamis. Data are presented on winds and waves, icing, climate, oceanography, tsunami occurrence and magnitude, and earthquake events. M.J.S.

N75-17837# Council on Environmental Quality, Washington, D.C.
OCS OIL AND GAS: AN ENVIRONMENTAL ASSESSMENT, VOLUME 1
Apr. 1974 229 p refs
Avail: SOD HC $2.90

The potential environmental impacts of oil and gas development on the Atlantic and Gulf of Alaska outer continental shelves (OCS) are discussed. The relative environmental vulnerabilities of the areas studied are assessed, and procedures, requirements, and stipulations for protection and for development are recommended. The recommendations provide environmental guidance on alternative OCS development decisions. An agenda is established for action to improve OCS technology and to tighten regulation and enforcement of OCS operations. Information and methods of analysis are provided for considering environmental aspects when determining those sites of hold back from lease sale and those to offer for lease, and for integrating environmental factors into the design of an optimum leasing schedule. Author

N75-17838# Council on Environmental Quality, Washington, D.C.
OCS OIL AND GAS: AN ENVIRONMENTAL ASSESSMENT, VOLUME 2
Apr. 1974 269 p refs
Avail: SOD HC $3.70

The oil and gas reserves of the outer continental shelves and the environmental impact of their development are discussed. Other topics discussed include a summary of world oil and gas reserves, methodology of selecting hypothetical locations of oil and gas accumulations, a national energy conservation program, environmental considerations in the petroleum refining industry, and environmental quality. M.J.S.

N75-17839# Council on Environmental Quality, Washington, D.C.
OCS OIL AND GAS: AN ENVIRONMENTAL ASSESSMENT, VOLUME 4
Apr. 1974 617 p refs
Avail: SOD HC $6.65

The potential onshore effects of offshore oil and gas development on the Altantic and Gulf of Alaska outer continental shelves is presented. Backup detail on primary industries which were analyzed in depth is included along with a description of the methodology used to measure onshore socio-economic and environmental impacts. Author

N75-17840# Council on Environmental Quality, Washington, D.C.
OCS OIL AND GAS: AN ENVIRONMENTAL ASSESSMENT, VOLUME 5
Apr. 1974 583 p refs
Avail: SOD HC $6.50

Primary biological effects of potential oil discharges resulting from hypothetical oil production activity on the Atlantic/Alaskan OCS are analyzed. Although emphasis is placed on analysis of impacts and recovery from large-volume infrequent accidental oil spills, small volume continuous discharges of hydrocarbons are also considered. Effects of oil releases from offshore platforms and spills occurring at coastal terminals are assessed. Qualitative predictions are attempted which are rough order of magnitude estimates of physical, chemical, and biological changes likely to occur due to oil releases into the marine environment. An attempt is made to identify regional differences, which are relevant to pending OCS petroleum resource development decisions. Regional differences of interest include: (1) oil spill probabilities; (2) physical environmental characteristics-spill trajectories and the fate of oil-in marine subsystems; and (3) biological factors relevant to oil effects. Author

N75-17848# *Environmental Protection Agency, Ada, Okla.* Treatment and Control Technology Branch.
POLLUTIONAL PROBLEMS AND RESEARCH NEEDS FOR AN OIL SHALE INDUSTRY ***Environmental Protection Technology Series***
Fred M. Pfeffer Jun. 1974 44 p refs
(PB-236608/6; EPA-660/2-74-067; W75-00012) Avail: NTIS MF $2.25; SOD HC $0.85 as EP1.23:660-2-74-067 CSCL 08G

The oil shale resources and surface stream drainage within the Green River Formation of Colorado, Utah, and Wyoming are presented briefly. The above-ground retorting processes of the Bureau of Mines, Union Oil Company, and The Oil Shale Corporation are described, as are the physical and leaching characteristics of spent shale residues derived from each process. Oil shale retorting in place (in situ) is summarized. The area of major concern, stabilization of spent shale residues, is covered in detail. Other areas of environmental concern discussed are: retort waste water, process water from shale-oil upgrading, dewatering operations, mineral recovery, and contamination of ground-water by radioactivity. GRA

N75-17853# Institute of Gas Technology, Chicago, Ill.
STUDY OF INDUSTRIAL USES OF ENERGY RELATIVE TO ENVIRONMENTAL EFFECTS **Final Report**
M. E. Fejer and D. H. Larson Jun. 1974 324 p refs
(Contract EPA-68-02-0643)
(PB-237215/9) Avail: NTIS HC $9.25 CSCL 13B

The energy use patterns and air pollutant emissions of the 10 largest energy consuming industries in the U.S. are presented. Each industry is described in terms of basic energy consuming processes, and the amount and types of energy consumed and the air pollutant emissions for each process are presented. The energy use efficiency of each process in discussed with a view toward increasing efficiency either by improvement of the existing process or by replacement with a new process. In addition, the effects of such changes on the air pollutant emissions are determined. GRA

N75-17858# Interagency Working Group on Health and Environmental Effects of Energy Use, Washington, D.C.
REPORT OF THE INTERAGENCY WORKING GROUP ON HEALTH AND ENVIRONMENTAL EFFECTS OF ENERGY USE
Final Report
Nov. 1974 714 p
(PB-237937/8) Avail: NTIS HC $15.25 CSCL 21D

A multi-agency review of proposed energy generating technologies is presented. A list of health and environmental problems associated with each technology is given, with estimates of when each technology will be operational. Qualitative assessments are prepared for each technology identifying areas in which supplemental research needs are indicated. Research objectives and projects responsive to these needs are developed. Two program options are offered. GRA

N75-18220*# Boeing Vertol Co., Philadelphia, Pa.
DOCUMENTING HELICOPTER OPERATIONS FROM AN ENERGY STANDPOINT
S. J. Davis and W. Z. Stepniewski Nov. 1974 127 p refs
(Contract NAS1-13142)
(NASA-CR-132578; D210-10901-1) Avail: NTIS HC $5.75 CSCL 01C

Results are presented of a study of the relative and absolute energy consumption of helicopters, including limited comparisons with fixed-wing aircraft, and selected surface transportation vehicles. Additional comparisons were made to determine the level of reduction in energy consumption expected from the application of advanced technologies to the helicopter design and sizing process. It was found that improvements in helicopter consumption characteristics can be accomplished through the utilization of advanced technology to reduce drag, structures weight, and powerplant fuel consumption. Author

N75-18241*# National Aeronautics and Space Administration. *Lewis Research Center, Cleveland, Ohio.*
PRELIMINARY STUDY OF ADVANCED TURBOFANS FOR LOW ENERGY CONSUMPTION
G. Knip Feb. 1975 54 p refs
(NASA-TM-X-71663; E-8241) Avail: NTIS HC $4.25 CSCL 21E

This analysis determines the effect of higher overall engine pressure ratios (OPR's), bypass ratios (BPR's), and turbine rotor-inlet temperature on a Mach-0.85 transport having a range of 5556 km (3000 nmi) and carrying a payload of 18144 kg

(40,000 lbs-200 passengers). Sideline noises (jet plus fan) of between 91 and 106 EPNdB (FAR36) are considered. Takeoff gross weight (TOGW), fuel consumption (kg/pass. km) and direct operating cost (DOC) are used at the figures of merit. Based on predicted 1985 levels of engine technology and a noise goal of 96 EPNdB, the higher-OPR engine results in an airplane that is 18 percent lighter in terms of TOGW, uses 22.3 percent less fuel, and has a 14.7 percent lower DOC than a comparable airplane powered by a current turbofan. Cooling the compressor bleed air and lowering the cruise Mach number appear attractive in terms of further improving the figures of merit. Author

N75-18319*# Rockwell International Corp., Canoga Park, Calif. Space Div.
SOLAR ELECTRIC PROPULSION SYSTEM THERMAL ANALYSIS Final Report
L. E. Ruttner 28 Feb. 1975 193 p refs
(Contract NAS8-30542)
(NASA-CR-120622; SD-75-SA-0012) Avail: NTIS HC $7.00 CSCL 21C

The results of the analysis of thermal control concepts for solar electric propulsion are reported. Thermal control technology is analyzed along with the boundary conditions. The evaluation and selection of thermal control concepts are discussed. F.O.S.

N75-18442# Alabama Energy Management Board, Montgomery.
PETROLEUM IN ALABAMA
A. K. Barakeh Sep. 1974 30 p Sponsored in part by Appalachian Regional Comm., Washington, D.C.
(PB-237353/8; ALA-EMB-X996-149R-04) Avail: NTIS HC $3.75 CSCL 21D

Petroleum supplies a significant portion of Alabama's total energy needs and especially for transportation. Despite increased production, drilling and exploration activities, consumption far exceeded production, and the rate of discovery of new reserves lagged in relation to growth in output. These led to substantial shipments of petroleum products from out-of-state sources into Alabama, and caused a modest decline in proved and recoverable crude oil reserves. Refining capacity in the State was growing at rates more or less commensurate with the rate of growth in oil production. GRA

N75-18443# Exxon Research and Engineering Co., Linden, N.J.
EFFECTS OF CHANGING THE PROPORTIONS OF AUTOMOTIVE DISTILLATE AND GASOLINE PRODUCED BY PETROLEUM REFINING
F. H. Kant, A. R. Cunningham, and M. H. Farmer Jul. 1974 54 p
(Contract EPA-460/3-74-018)
(PB-236900/7; EPA-68-01-2112) Avail: NTIS HC $4.25 CSCL 21D

This study examines the effects of changing the proportions of automotive distillate fuel and gasoline produced by refining petroleum. It provides a partial answer to whether a shift to increased distillate production, that would be necessary if there were a widespread use of vehicles requiring distillate fuel, would result in significant improvements in resource utilization. Calculations for a grass-roots refinery, that would come on stream in the 1990-2000 time-frame, indicate that the maximum theoretical energy saving is about 2% of the crude oil charged when approximately equal quantities of automotive distillate and gasoline are produced. Savings in refinery investment and manufacturing cost would be achieved, too. However, the external impacts of major changes in gasoline/distillate ratio need to be analyzed to establish the practicality of moving in the direction of equal quantities of distillate and gasoline. The impact on petrochemicals and other industries may be substantial. GRA

N75-18594# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
THE MULTIRIM SUPERFLYWHEEL
D. W. Rabenhorst Aug. 1974 46 p refs
(Contract N00017-72-C-4401)
(AD-A001081; APL/JHU-TG-1240) Avail: NTIS CSCL 13/9

A new concept called the multirim superflywheel offers the prospect of combining many of the advantages of the circular brush superflywheel with the volume advantages of the solid disc flywheel. The result is a configuration enabling greater performance than any known flywheel concept in terms of system weight, volume, and cost. GRA

N75-18702# Battelle-Northwest, Richland, Wash
METHANOL FROM FORESTRY, MUNICIPAL, AND AGRICULTURAL ORGANIC RESIDUES
C. A. Rohrmann, L. K. Mudge, and V. L. Hammond Jul. 1974 32 p refs Presented at the Eng. Found. Conf., Henniker, N.H. Sponsored by ERDA
(BNWL-SA-5053; Conf-740727-2) Avail: NTIS HC $3.75

The potentials for the use of renewable resources, specifically forestry, municipal, and agricultural residues, as primary raw materials for the production of methanol are considered. The basis for such processing would involve the conversion of the residues to a gaseous mixture of suitable composition such that methanol could be obtained by more-or-less conventional synthesis methods. The largest U.S. synthetic methanol plants in operation today produce 200 million gallons per year and this indicates a need for about 1,250,000 tons per year of residues to provide equivalent production. Composition and properties of residues are tabulated for paper; food waste; wood; textiles; leather; rubber; plastic; yard waste; separable inerts such as glass, metal, rock; and dirt. NSA

N75-18713# Bureau of Mines, Pittsburgh, Pa. Eastern Field Operation Center.
THE RESERVE BASE OF BITUMINOUS COAL AND ANTHRACITE FOR UNDERGROUND MINING IN THE EASTERN UNITED STATES
Oct. 1974 432 p refs
(PB-237815/6; BM-IC-8655) Avail: NTIS MF $2.25; SOD HC $4.80 CSCL 08I

The Eastern United States coal reserve base is defined which has sufficient thickness for underground mining with a depth range compatible with economic recovery. The bituminous coal and anthracite reserve bases recoverable by underground mining methods are determined. The reserve data were compiled by the U.S. Bureau of Mines by updating and reevaluating previous estimates of the U.S. Geological Survey, State geological surveys, and others. Through the application of computer techniques the coal reserve base is compiled by State, County, and coalbed. Additional summations are made by rank. Coal reserves are allotted to sulfur categories by statistical apportionment of data from available Bureau of Mines reports and records. Excluding those coals of less than 28 inches in thickness to a depth of 1,000 feet, the deep-minable reserve base is estimated to be 168 billion tons as follows: 161 billion tons of bituminous coal and 7 billion tons of anthracite. Of this 28 billion tons contains 1.0 percent or less sulfur. Most of this is in the southern Appalachian area. GRA

N75-18714 British Library Lending Div., Boston Spa (England).
STEPS INTO THE FUTURE. DEVELOPMENT OF THE POWER INDUSTRY IN THE USSR
V. Popkov 8 Jan. 1974 5 p Transl. into ENGLISH from Krasnaya Zvezda (USSR), 22 Dec. 1973
(BLL-M-23330-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The rational use of existing power resources, the development of new sources of energy and new methods to produce energy are the main problems of power engineering in U.S.S.R. Fossil fuels provide about 80 to 85 percent of the energy requirements, hydro resources supply another 15 percent, and the rest is available through nuclear power stations. Controlled thermonuclear fusion reactors, electrochemical generators, and magnetohydrodynamic conversion methods are projected for power stations. G.G.

N75-18716* National Aeronautics and Space Administration, Washington, D.C.

NUCLEAR SYSTEM THAT BURNS ITS OWN WASTES SHOWS PROMISE
Kenneth Atchison 14 Feb. 1975 4 p
(NASA-News-Release-75-44) Avail: NASA Scientific and Technical Information Facility P. O. Box 8757 Baltimore/Washington International Airport, Md. 21240 CSCL 10A

A nuclear fission energy system, capable of eliminating a significant amount of its radioactive wastes by burning them, is described. A theoretical investigation of this system conducted by computer analysis, is based on use of gaseous fuel nuclear reactors. Gaseous core reactors using a uranium plasma fuel are studied along with development for space propulsion.
Author

N75-18718# Columbia Univ., New York.
WORKSHOP IN GAS-PHASE MOLECULAR INTERACTIONS AND THE NATION'S ENERGY PROBLEM
Richard Zare 1974 94 p Workshop held at Harriman, New York, 27-29 May 1974
(Grant NSF GP-43738)
(PB-236712/6) Avail: NTIS HC $4.75 CSCL 07D

The deliberations of a workshop on gas-phase molecular interactions and energy problems are summarized. The discussions were organized around five panels each of which focused on one of the general areas of energy transfer, ion and electron-neutral reactions, neutral-neutral reactions, spectroscopy, and theory. The relationship of the general area to perceived energy problems was considered, with special attention given to research areas of particular promise.
GRA

N75-18719*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
SOLAR ENERGY CONCENTRATOR SYSTEM FOR CRYSTAL GROWTH AND ZONE REFINING IN SPACE Final Report
J. H. McDermit Feb. 1975 104 p refs
(Contract NAS8-30268)
(NASA-CR-120623; LMSC-HREC-TR-D390666) Avail: NTIS HC $5.25 CSCL 10A

The technological feasibility of using solar concentrators for crystal growth and zone refining in space has been performed. Previous studies of space-deployed solar concentrators were reviewed for their applicability to materials processing and a new state-of-the-art concentrator-receiver radiation analysis was developed. The radiation analysis is in the form of a general purpose computer program. It was concluded from this effort that the technology for fabricating, orbiting and deploying large solar concentrators has been developed. It was also concluded that the technological feasibility of space processing materials in the focal region of a solar concentrator depends primarily on two factors: (1) the ability of a solar concentrator to provide sufficient thermal energy for the process and (2) the ability of a solar concentrator to provide a thermal environment that is conductive to the processes of interest. The analysis indicate that solar concentrators can satisfactorily provide both of these factors.
Author

N75-18721# Missouri Univ., Rolla.
SOLAR KINE: ANSWER TO THE AGRICULTURAL ENERGY CHALLENGE OF OUR TIME
[1974] 9 p
Avail: NTIS HC $3.25

A machine is projected which will utilize concentrated solar energy, water and air to manufacture anhydrous ammonia. The device will be designed for in situ farm use or for use by a farm cooperative. It has as a seondary function the manufacture of methanol as a tractor power fuel and of fuels usable in grain drying and for building space heating.
Author

N75-18722*# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
PYROLYSIS SYSTEM EVALUATION STUDY Final Report
Dec. 1974 610 p
(Contract NAS9-14306)
(NASA-CR-141664) Avail: NTIS HC $15.25 CSCL 13H

An evaluation of two different pyrolysis concepts which recover energy from solid waste was conducted in order to determine the merits of each concept for integration into a Integrated Utility System (IUS). The two concepts evaluated were a Lead Bath Furnace Pyrolysis System and a Slagging Vertical Shaft, Partial Air Oxidation Pyrolysis System. Both concepts will produce a fuel gas from the IUS waste and sewage sludge which can be used to offset primary fuel consumption in addition to the sanitary disposal of the waste. The study evaluated the thermal integration of each concept as well as the economic impact on the IUS resulting from integrating each pyrolysis concepts. For reference, the pyrolysis concepts were also compared to incineration which was considered the baseline IUS solid waste disposal system.
Author

N75-18723# Los Alamos Scientific Lab., N.Mex.
PROSPECT FOR GEOTHERMAL POWER
M. C. Smith 1974 9 p Presented at Summer Meeting and Energy Resources Conf., IEEE Power Eng. Soc., Anaheim, Calif., 16 Jul. 1974
(Contract W-7405-eng-36)
(LA-UR-74-1111; Conf-740709-2; Paper-C74-500-5) Avail: NTIS HC $3.25

Only that small fraction of this vast resource is considered useful which exists near the earth's surface in the convenient forms of natural steam or superheated water of relatively low salinity. Research and development are now in progress by both industry and government to learn to use economically the energy contained in the more saline superheated waters, the lower temperature but less highly mineralized natural waters, the combination of heat and temperature and dissolved natural gas contained in geopressured water, and the abundant heat contained in dry hot rock. There is every reason to suppose that the problems associated with utilization of these energy sources will eventually be overcome. The problems are, however, sufficiently formidable to make it unlikely that even ten years from now, more than 1 to 2% of the United States' requirement for electrical power will be satisfied by energy from geothermal sources.
Author (NSA)

N75-18724# Oak Ridge National Lab., Tenn.
COAL REFINING
H. D. Schilling Apr. 1974 6 p refs Transl. into ENGLISH from Brennst.-Waerme-Kraft (West Germany), v. 26, no. 4, Apr. 1974 p 137-140 Sponsored by ERDA
(ORNL-TR-2827) Avail: NTIS HC $3.25

A brief review of developments in coal research during the period 1965-1974 is given. Subjects discussed are chemical and physical structure of coals, gasification, liquefaction, desulfurization, coke production, combustion, and mining techniques.
NSA

N75-18725# Brookhaven National Lab., Upton, N.Y.
ENERGY STORAGE FOR UTILITIES VIA HYDROGEN SYSTEMS
J. M. Burger, P. A. Lewis, R. J. Isler, F. J. Salzano, and J. M. King, Jr. 1974 8 p refs Presented at the 9th Intersoc. Energy Conversion Engr. Conf., San Francisco, 26-30 Aug. 1974 Sponsored by ERDA
(BNL-19266; Conf-740805-8) Avail: NTIS HC $3.25

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

N75-18726# Sandia Labs., Livermore, Calif.
SURVEY OF HYDROGEN COMPATIBILITY PROBLEMS IN ENERGY STORAGE AND ENERGY TRANSMISSION APPLICATIONS
J. H. Swisher, S. C. Keeton, A. J. West, and A. T. Jones Sep. 1974 26 p refs
(Contract AT(29-1)-789)
(SAND-74-8219) Avail: NTIS HC $3.75

A study has been made of current energy storage and transmission applications in which containment of hydrogen is a consideration. The applications discussed are hydrogen storage in hydrides, pressure vessels and pipelines for hydrogen, superconducting electrical transmission lines, and superconducting magnets for storing magnetic energy. It is shown that stainless steels may be needed in some applications for safety, but in many applications lower cost substitutes should be adequate if containment hardware is properly designed and manufactured.
Author (NSA)

N75-18727# Sandia Labs., Albuquerque, N.Mex.
IN SITU OIL SHALE: A COST SENSITIVITY ANALYSIS
D. K. Seager and K. G. Adams Aug. 1974 54 p
(Contract AT(29-1)-789)
(SAND-74-0146) Avail: NTIS HC $4.25

The analyses of several configurations of an in situ shale oil recovery model indicate that the methods could be economically competitive with above ground recovery schemes. For a 15% discounted cash flow rate of return, a 100,000 BPD in situ plant can produce upgraded oil for $9.80/bbl (1973 dollars). This price can be significantly reduced, however, by research and development efforts which result in modesty improved retort efficiency and retort preparation methods. Such improvements could result in an oil price reduction of more than $2.00/bbl. Author (NSA)

N75-18728# Oak Ridge National Lab., Tenn.
SURVEY OF GAS AND OIL BURNERS FOR USE WITH NSF/RANN-ORNL POTASSIUM BOILER
A. P. Fraas Aug. 1974 44 p refs
(Contract W-7405-eng-26)
(ORNL-NSF-EP-45) Avail: NTIS HC $3.75

The ORNL boiler tube bundle design is predicted on the use of a cylindrical array of tubes surrounding a long, vertical, cylindrical combustion chamber. The tubes are designed so that the liquid potassium will circulate under natural thermal convection downward from a header drum-vapor separator-expansion tank at the top through a set of downcomers to ring manifolds at the bottom and thence back upward through the tube matrix. The unit is closely integrated with the burner, and its design is heavily dependent on that component. A survey is presented of the various types of burner that might be employed including conventional gas and oil burners, several types of surface combustion gas and oil burners, and catalytic combustion burners together with the possibility of using fluidized bed coal combustion chambers that employ limestone and/or dolomite to absorb most of the sulfur in the coal. A number of conceptual designs for potassium boiler tube bundle and burner configurations are presented. Author (NSA)

N75-18729# Argonne National Lab., Ill.
STATUS AND OUTLOOK FOR ENERGY CONVERSION VIA FUEL CELLS
John P. Ackerman 1974 5 p refs Presented at the UMR-MEC Energy Conf., Rolla, Mo., 25 Apr. 1974 Sponsored by ERDA
(Conf-740462-1) Avail: NTIS HC $3.25

Advantages of fuel cells, applications of fuel cells, choice of fuels, and the status of fuel cells are briefly discussed. NSA

N75-18730# Queen (Douglas M.), Inc., New Canaan, Conn.
INDUSTRIAL ENERGY STUDY OF THE HYDRAULIC CEMENT INDUSTRY Final Report
27 Aug. 1974 117 p Prepared in cooperation with Federal Energy Administration, Washington, D. C.
(Contract DI-14-01-0001-1665)
(PB-237142/5; FEA/EI-1665) Avail: NTIS HC $5.25 CSCL 10A

Information on the basic structure or characteristics of the hydraulic cement industry is provided. Particular emphasis is placed on fuel use by major type and production process and exploring possibilities for fuel substitutability and conservation alternatives. GRA

N75-18732# *International Research and Technology Corp.*, Arlington, Va.
DATA BASE FOR THE INDUSTRIAL ENERGY STUDY OF THE INDUSTRIAL CHEMICALS GROUP Final Report
James C. Saxton, Marc P. Kramer, David L. Robertson, Michael A. Fortune, and Nickolaus E. Leggett Sep. 1974 254 p refs
(Contract DI-14-01-0001-1654)
(PB-237845/3; IRT-352-R) Avail: NTIS HC $8.50 CSCL 10A

All of the tables in this report were generated from information contained in three basic data files: a central data file, detailing process-specific information; a regional production file, relating production of a material in a state to the process used; and a regional fuel use file, containing a breakdown of fuel use by the Industrial Chemicals Industry into five fuel categories listed by state. This basic data was manipulated with the objective of generating a set of tables useful in discerning energy and feedback usage in the industry by process used in production at the state level. The final output in the volume consists of a methodology, setting forth the data manipulation, six sets of tables (one set for each 4-digit SIC contained in 281), a glossary and a conversion table. Author (GRA)

N75-18733# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
SOLAR THERMAL CONVERSION PROGRAM. CENTRAL RECEIVER POCE PROJECT, SUBSYSTEM SPECIFICATIONS STUDIES Final Report
J. C. Powell and J. C. Grosskreutz 3 Oct. 1974 143 p refs Sponsored by NSF Prepared in cooperation with Black and *Veatch Consulting Engr.*
(PB-238002/0; HONEYWELL-2852-41432-FR;
NSF/RA/N-74-155) Avail: NTIS HC $5.75 CSCL 10B

Results of studies dealing with solar thermal conversion are given. Report covers scaling of various subsystems from commercial size plants down to proof-of-concept experiment (POCE) size, and continuing on to bench model sizes suitable for laboratory testing. Specifications suitable for procurement purposes for three significant subsystems out of the totality required for a complete central receiver system are presented. These subsystems include heliostats, the central receiver, and the thermal storage subsystem. GRA

N75-18734# Battelle Columbus Labs., Ohio.
DESIGN INSTALLATION AND OPERATION OF A 25 TON-A-DAY COAL GASIFICATION PROCESS DEVELOPMENT UNIT FOR THE AGGLOMERATING BURNER-GASIFICATION Interim Report, Sep. 1972 - Sep. 1974
William C. Corder and William M. Goldberger Nov. 1974 48 p refs
(Contract DI-14-32-0001-1513)
(PB-237625/9; OCR-97-INT-1) Avail: NTIS HC $3.75 CSCL 10A

Progress on the detailed design, procurement, and construction of a coal gasification process development unit is reported. Results of qualitative and semi-quantitative experimental work are briefly described. GRA

N75-18735# Electric Power Research Inst., Palo Alto, Calif.
CONFERENCE PROCEEDINGS: POWER GENERATION-CLEAN FUELS TODAY
Apr. 1974 110 p refs Conf. held at Monterey, Calif., 8-10 Apr. 1974
(PB-237661/4; EPRI-SR-1) Avail: NTIS HC $5.25 CSCL 10A

Reserves and availability of fossil fuels and the problems utilities face in obtaining clean fuel for oil- and gas-fired plants are discussed. The status of clean energy production technology is reviewed and current government policy on fuel for power generation is assessed. A variety of technological options, primarily

gasification techniques, to convert oil or coal to clean fuel for electric power generation are presented. GRA

N75-18736# Alabama Energy Management Board, Montgomery.
COAL IN ALABAMA
Frank P. Scruggs, Jr. Sep. 1974 43 p refs Sponsored in part by Appalachian Regional Commission, Washington, D. C.
(PB-236583/1; ALA-EMB-X996-149R-01) Avail: NTIS HC $3.75 CSCL 08I

One of a series of four fact sheets is reported that present data on the availability and use of energy resources in the State of Alabama. It covers coal reserves, production, distribution, and consumption patterns. GRA

N75-18737# Alabama Energy Management Board, Montgomery.
NATURAL GAS IN ALABAMA
Frank P. Scruggs, Jr. Sep. 1974 28 p refs Sponsored in part by Appalachian Regional Commission, Washington, D. C.
(PB-236582/3; ALA-EMB-X996-149R-03) Avail: NTIS HC $3.75 CSCL 08I

Basic data are presented which describe the origin of the natural gas supplied to the State, reserves, and production of gas within Alabama, and consumption patterns. Author (GRA)

N75-18738# Bureau of Mines, Dallas, Tex. Mineral Supply Field Office.
PROFITABILITY ANALYSIS OF PRODUCING CRUDE OIL BY WATERFLOODING USING A SIMULATION TECHNIQUE Information Circular
W. D. Dietzman and J. H. Martin Oct. 1974 86 p refs
(PB-237843/8; BM-IC-8652) Avail: NTIS HC $4.75 CSCL 08I

A profitability analysis of producing crude oil by waterflooding is reported. Included are the estimated costs of installation of equipment for waterfloods at 2,000 and 4,000 ft and the estimated annual operational expenses for each in West Texas. Using these costs as a base for selecting a range of costs that are indicative of producing crude oil by waterflooding, a simulation technique was derived for determining the profitability under various conditions. Because of the large number of combinations of variables used in this study a computer was utilized for the calculations. The variables include operational expenses, capitalized costs, price of oil, annual production, and leasehold acquisition costs. GRA

N75-18739# Battelle Columbus Labs., Ohio.
STUDY OF POTENTIAL PROBLEMS AND OPTIMUM OPPORTUNITIES IN RETROFITTING INDUSTRIAL PROCESSES TO LOW AND INTERMEDIATE ENERGY GAS FROM COAL Final Environmental Protection Technology Series
D. Ball, G. Smithson, R. Engdahl, and A. Putnam May 1974 141 p refs
(Contract EPA-68-02-1323)
(PB-237116/9; EPA-650/2-74-052) Avail: NTIS HC $5.75 CSCL 13B

The report compiles background information, including environmental considerations, on the potential for retrofitting existing industrial processes to the use of low- and intermediate-energy gas from coal. Potential problems in retrofitting processes are analyzed. Processes where retrofit is most attractive are identified, along with estimates of their annual energy requirements. Also, current commercially available gasification systems and representative gas cleanup systems are described and available data summarized. GRA

N75-18740# Combustion Engineering, Inc., Windsor, Conn. Dept. of Research and Product Development.
LOW-BTU GASIFICATION OF COAL FOR ELECTRIC POWER GENERATION Interim Report, Aug. 1972 - Sep. 1973
R. C. Patterson, H. J. Blaskowski, C. R. Bozzuto, R. B. Covell, and F. H. Fenton Sep. 1974 141 p refs
(Contract DI-14-32-0001-1512)
(PB-236972/6; OCR-83-INT-1) Avail: NTIS HC $5.75 CSCL 07A

The work is described completed under Phase 1 of a four-phase program to develop a coal gasification process which is technically and economically suitable for preparation of acceptably-clean, gaseous fuel from coal for use by electric power plants. Phase 1 of the program consisted of various system and component design studies to provide the basis for selection of the entrainment-type gasification system which best meets the future clean-fuel needs of many electric utilities in the United States. GRA

N75-18742# Houston Univ., Tex. Dept. of Physics.
SOLAR THERMAL POWER SYSTEMS BASED ON OPTICAL TRANSMISSION Semiannual Progress Report, 15 Jun. - 31 Dec. 1973
L. L. Vant-Hull 15 Feb. 1974 346 p refs Prepared in cooperation with McDonnell Douglas Astronautics Co., Huntington Beach, Calif.
(Grant NSF GI-39456)
(PB-237005/4; NSF/RANN/SE/GI-39456/PR/73/4; NSF/RA/N-74-115; SAPR-1) Avail: NTIS HC $9.50 CSCL 10A

A technical and economic feasibility study of a solar thermal power system based upon optical transmission of collected solar energy to a central absorber and boiler unit is presented. The study includes system definition, modeling, and preliminary component design and testing. Report includes studies of: (1) The solar flux concentration system including system geometric analysis of the optical characteristics, guidance and control systems and reflector designs; (2) the receiver and energy transfer system including conceptual designs of the tower; (3) system definition and evaluation with particular attention to economic analysis of the collection, energy transfer, and energy conversion system; and (4) a scale model heliostat and collector with hydraulic steering. GRA

N75-18743# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
COAL PROCESSING BY ELECTROFLUIDS Research and Development Report, Apr. 1967 - Mar. 1974
A. H. Pulsifer and T. D. Wheelock Mar. 1974 83 p refs
(Contract DI-14-01-0001-479)
(PB-236588/0; OCR-30-INT-2) Avail: NTIS HC $4.75 CSCL 10A

A process for producing a hydrogen-rich synthesis gas by reacting steam and coal char in an electrofluid reactor is discussed and experimental data collected in a 12-in. diameter, continuous reactor are summarized. Potential applications of the system are also discussed and the preliminary process design of a plant for producing SNG from coal char using an electrofluid reactor is presented. GRA

N75-18744# Hittman Associates, Inc., Columbia, Md.
FUEL AND ENERGY CONSUMPTION IN THE COAL INDUSTRIES Final Report
May 1974 266 p refs
(Contract DI-14-01-0001-1659)
(PB-237151/6; HIT-575; FEA/EI-1659) Avail: NTIS HC $8.50 CSCL 10A

Information on the basic structure and characteristics of the coal mining industry is presented. Particular emphasis is placed on fuel use by major type and production process and exploring possibilities for fuel substitutability and conservation alternatives. GRA

N75-18745# Sundstrand Aviation-Rockford, Ill.
ORGANIC RANKINE CYCLE SILENT POWER PLANT 1.5 kW, 28 VOLTS dc Final Report, 13 Jun. 1972 - 31 Dec. 1973
Ronald F. McKenna May 1974 262 p
(Contract DAAK02-72-C-0472)
(AD-A000900; SA/ATR-1182) Avail: NTIS CSCL 10/2

The report describes the design, fabrication and test of components subsystems and organic Rankine Cycle Power Plant. Design point net output power is 1.5 KW at 28 V.D.C. Power is produced by combustion of an air/fuel mixture and transferring the thermal energy to CP-25, the working fluid, which is expanded

through a turbine. The turbine is part of a turbo-alternator which also powers internal accessory components. Specific design criteria involves precise quality of power, weight, volume, efficiency, life and noise limitations, severe environment and shock, and multi-fuel operating requirements. The set is portable, self-contained except for fuel supply and is intended to operate as a silent power plant. Author (GRA)

N75-18747# Westinghouse Electric Corp., Lester, Pa. Heat Transfer Div.

ADVANCED COAL GASIFICATION SYSTEM FOR ELECTRIC POWER GENERATION Interim Report, Aug. 1972 - Jun. 1973

May 1974 250 p refs

(Contract DI-14-32-0001-1514)

(PB-236971/8; OCR-81-INT-1) Avail: NTIS MF $2.25; SOD HC $4.20 CSCL 07A

The objective of this program is to build and operate an advanced gasification system and electric generating plant on an existing electric utility distribution network. The program covers six phases, including the construction and operation of a process development unit with a capacity of 1200 lbs/hr and completing the design of a suitable generating pilot plant gasifier and a fuel gas study. Work covered by this report has been concentrated on development of the fluidized-bed gasifier. The latter phases will be concerned with the design, construction and operation of a full-size gasifier and generating pilot plant of about 120 MW. Desulfurization/devolatilization processes, turbine design, and combustor design are also discussed. GRA

N75-18749# Army Foreign Science and Technology Center, Charlottesville, Va.

THE MHD GENERATOR: A STEP TOWARD THE ENERGY SUPPLY OF TOMORROW

Berd Hanselman 22 Aug. 1974 11 p Transl. into ENGLISH from Significant Accomplishments I.P.P.-M.A.N. (West Germany), 1971

(AD-A000087; FSTC-HT-23-2518-72) Avail: NTIS CSCL 10/2

The increasing demand for electrical energy emphasizes more and more the problem of an economical energy supply. One possibility to solve this problem is the socalled MHD generator which converts hot working gases directly into electrical energy. Cooperation between M. A. N. (West German Concern) and the Institute for Plasma Physics (IPP) in Garening, West Germany, has resulted in an MHD generator beginning to be developed, which in its first development phase will have a capacity of 10MW and a length of operation of 10 seconds. GRA

N75-18754# Army Foreign Science and Technology Center, Charlottesville, Va.

THE GENERATOR OF THE FUTURE

V. Kirillov 1 Jun. 1974 11 p Transl. into ENGLISH from Starshina-Serzhant (USSR), no. 12, 1973 p 18-19

(AD-A001515; FSTC-HT-23-0854-74) Avail: NTIS CSCL 10/2

The basic principles and present operational parameters of Soviet magneto-gas dynamic generators are simply described. The characteristics of MHD generators are contrasted with those of conventional steam turbine plants. An optimistic view of the future of MHD generator is expressed despite the technical difficulties discussed in the article. GRA

N75-18755# Hittman Associates, Inc., Columbia, Md.

ASSESSMENT OF THE RANKINE CYCLE FOR POTENTIAL APPLICATION TO SOLAR POWERED COOLING OF BUILDINGS Final Report

H. M. Curran, M. Lokmanhekim, and T. Alereza Aug. 1974 146 p refs

(Contract NSF C-858)

(PB-238069/9; NSF/RA/N-74-108; HIT-581) Avail: NTIS HC $5.75 CSCL 20M

This study evaluates the potential of Rankine cycle engines in the solar-powered cooling of buildings. Thermal energy obtained from the sun would be used to drive a Rankine engine, which converts the thermal energy input to a mechanical output. This mechanical output is used to drive a vapor compression refrigeration machine to cool the building. The technical and economic feasibility of the system is assessed. GRA

N75-18756# Sheldahl Co., Northfield, Minn. Advanced Products Div.

SUMMARY OF RESULTS OF SOLAR POWER ARRAYS FOR THE CONCENTRATION OF ENERGY STUDY

24 Oct. 1974. 36 p Prepared in cooperation with Northern States Power Co., Minnesota Univ., Minneapolis, and Foster Wheeler Corp.

(Grant NSF GI-41019)

(PB-238003/8; NSF/RA/N-74-156) Avail: NTIS HC $3.25 CSCL 10B

Topics cover heliostat array design and performance along with evaluation of reflective membrane materials having potential application in the fabrication of heliostat mirrors. Design and test requirements for a representative section of a solar thermal energy receiver designed for use in a 10 MWe solar thermal energy proof of concept system are discussed. GRA

N75-18757# National Oceanic and Atmospheric Administration, Silver Spring, Md. Environmental Research Labs.

REPORT AND RECOMMENDATIONS OF THE SOLAR ENERGY DATA WORKSHOP

Charles Turner Sep. 1974 212 p refs Workshop held 29-30 Nov. 1973

(Grant NSF AG-495)

(PB-238066/5; NSF/RA/N-74-062) Avail: NTIS HC $7.25 CSCL 10B

Considered are the: (1) present status of measurements; (2) ground based monitoring instrumentation; (3) design analysis (general considerations); (4) nonconcentrating devices; (5) concentrating devices; (6) photovoltaic devices; and (7) satellite role in monitoring. GRA

N75-18759# Bureau of Mines, Morgantown, W.Va. Energy Research Center.

RELATIONSHIPS OF EARTH FRACTURE SYSTEMS TO PRODUCTIVITY OF A GAS STORAGE RESERVOIR

W. K. Overbey, Jr., W. K. Sawyer, and B. R. Henniger Oct. 1974 143 p refs

(PB-237894/1; BM-RI-7952) Avail: NTIS HC $5.75 CSCL 08I

Three types of aerial photography and two types of scanner imagery were used to map fracture traces and lineaments in the study area. Much useful information about a gas storage reservoir can be learned by studying: (1) oriented cores for fractures and directional permeability, (2) orientation of induced hydraulic fractures for alignment of well patterns, and (3) aerial photos and scanner imagery for general surface geology comparison, to learn if some development patterns might not be indicated by such results. GRA

N75-18760# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.

METHANE IN THE PITTSBURGH COALBED, WASHINGTON COUNTY, PENNSYLVANIA

Ann G. Kim Oct. 1974 21 p refs

(PB-237848/7; BM-RI-7969) Avail: NTIS HC $3.25 CSCL 08I

Draining the methane from large blocks of coal in advance of mining is an effective method of improving the safety and efficiency of coal mining. Because of the similarity of the two gases, drained methane can be recovered and added to pipeline supplies of natural gas. To effectively apply advance drainage techniques and recover drained gas, a gross estimate of the methane content of coal is necessary. Using data from previous investigations, the virgin reserves of the Pittsburgh coal in the central and southwestern parts of Washington County, Pa., are

estimated at over 1.5 billion tons, with a methane content of 50 to 100 cubic feet/ton. The Pittsburgh bed in this area of approximately 265 square miles contains over 130 billion cubic feet of methane. GRA

N75-18761# Bureau of Mines, San Francisco, Calif. Energy Research Lab.
SOLVENT STIMULATION TESTS IN TWO CALIFORNIA OILFIELDS
H. J. Lechtenberg, G. L. Gates, W. H. Caraway, and O. C. Baptist Oct. 1974 28 p refs
(PB-237849/5; BM-RI-7978) Avail: NTIS HC $3.75 CSCL 08I

Solvent injection can be a means of increasing oil production from low gravity oil fields. California field tests results show increased oil production by using cyclic solvent injection process. The increase in oil production indicates that the process can be economically successful. GRA

N75-18762# Missouri Univ., Rolla. Dept. of Mining, Petroleum, and Geological Engineering.
EVALUATION OF THERMAL METHODS FOR RECOVERY OF VISCOUS OILS IN MISSOURI AND KANSAS
M. D. Arnold and A. Herbert Harvey Jun. 1974 117 p refs (Contract G0133100)
(PB-237831/3; BM-OFR-60-74) Avail: NTIS HC $5.25 CSCL 08I

An economic analysis is reported on four hypothetical heavy oil deposits that were considered to be representative of those found in the Missouri-Kansas border area. Oil production obtainable by various thermal recovery methods was computed for each of the four cases. Development and production costs were estimated, and the oil prices that would yield specified discounted cash flow rate of return on investment were computed. It was concluded that the best deposits are probably economically recoverable at current new oil prices, provided there is no major adverse revision in tax regulations. GRA

N75-18764 Washington Univ., Seattle.
THE EFFECT OF ALASKAN CRUDE OIL AND SELECTED HYDROCARBON COMPOUNDS ON EMBRYONIC DEVELOPMENT OF THE PACIFIC OYSTER, CRASSOSTREA GIGAS Ph.D. Thesis
Richard Stephen Legore 1974 204 p
Avail: Univ. Microfilms Order No. 74-29447

The toxicity of crude oil to larvae of the Pacific oyster was investigated along with the toxicities of hydrocarbon constituents of petroleum and petroleum products. Normal development of oyster embryos was apparently stimulated by very low doses of seawater extracts of the Alaskan crude oil. Higher doses of extract resulted in severe inhibition of normal development, and in significant levels of mortality. The 'threshold dose', at which deleterious effects were first noted, contained a dissolved concentration of 3.1-3.6 mg/liter of benzene, toluene, and the xylenes, combined. The larvae demonstrated no discernible avoidance response to Alaskan crude oil. The oil required 25-40 minutes to exert an obvious deleterious effect, which usually consisted of the loss of ciliary coordination and subsequent sinking of the larvae. Dissert. Abstr.

N75-18769# Oak Ridge National Lab., Tenn.
OPERATIONAL, MAINTENANCE, AND ENVIRONMENTAL PROBLEMS ASSOCIATED WITH A FOSSIL FUEL-FIRED POTASSIUM STEAM BINARY VAPOR CYCLE
A. P. Fraas Aug. 1974 60 p refs
(Contract W-7405-eng-26)
(ORNL-NSF-EP-30) Avail: NTIS HC $4.25

Design studies indicate that superimposing a potassium vapor topping cycle on a conventional steam cycle should increase the thermal efficiency of a fossil fuel-fired plant to over 50%, thus reducing the fuel consumption by about 25% and the rejection of waste heat to the environment by about 50%, both highly desirable objectives. The reactive character of potassium, however, raises serious safety questions. A review of the special operational, maintenance, and environmental problems posed by a fossil fuel-fired potassium vapor cycle plant indicates that such a system would present unusual and difficult problems, but, if the system is properly designed, these appear manageable. Examination of possible failure modes indicates that leaks should be inherently slow to develop, and relatively simple, reliable instrumentation techniques of adequate sensitivity are available to detect them at an early stage. Author (NSA)

N75-18782# Environmental Protection Agency, Corvallis, Oreg. National Ecological Research Lab.
THE BIOENVIRONMENTAL IMPACT OF AIR POLLUTION FROM FOSSIL-FUEL POWER PLANTS Final Report
Aug. 1974 25 p refs
(PB-237720/8; EPA-660/3-74-011) Avail: NTIS HC $3.25 CSCL 13B

The body of information presented is directed to environmental scientists and engineers and to those land managers who will be involved in assessing the effects of energy conversion activities on the environment. A prototype investigation of the bioenvironmental effects of air pollution challenge from coal-conversion facilities is summarized. Objectives, rationale, and the overall design of this research are presented. Recommendations regarding the selection of suitable criteria of environmental damage are also made. GRA

N75-18783# National Transportation Center, Pittsburgh, Pa.
PROJECT CLEAN AIR 1972, LNG CONVERSION OF GM-71 SERIES DIESEL ENGINE Final Report
May 1974 136 p refs
(PB-236585/6; UMTA-PA-06-0005-74-1) Avail: NTIS HC $5.75 CSCL 13B

Air pollution caused by a transit rubber tired vehicle as a result of its emissions is the function of its engine and the type of fuel used. Pollution reduction, at the source, can be obtained by altering the vehicle engine, adapting it to the use of a proper fuel, which lends itself to emission control. A gaseous fuel converted engine, if properly developed, offers the potential of lower exhaust emissions, control of smoke and odor and lower engine noise levels. GRA

N75-18784# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
INSPECTION AND MAINTENANCE OF LIGHT-DUTY GASOLINE POWERED MOTOR VEHICLES: A GUIDE FOR IMPLEMENTATION Final Report
Aug. 1974 91 p refs
(PB-236587/2; EPA-450/2-74-005) Avail: NTIS HC $4.75 CSCL 13B

The document is intended to provide guidance to Federal, state, and local agencies concerned with implementing and monitoring an emissions inspection and maintenance program for motor vehicles. Major inspection and maintenance methods, legal considerations, implementation factors, monitoring and reporting requirements, and Federal and state programs in the field are discussed. GRA

N75-18786# Holt (Ben) Co., Pasadena, Calif.
FIELD SURVEILLANCE AND ENFORCEMENT GUIDE FOR PETROLEUM REFINERIES Final Report
Anker V. Sims Jul. 1974 369 p refs
(Contract EPA-68-02-0645)
(PB-236669/8) Avail: NTIS HC $10.00 CSCL 13B

Petroleum refining and natural gas processing, refinery equipment, process instrumentation, air pollution monitoring instrumentation, maintenance of refinery records for use by air pollution control personnel, estimating and assessing emissions, plan and equipment maintenance, and the qualifications and training requirements of field enforcement personnel are described. It was prepared to familiarize state and local air pollution control officials with the operation of petroleum refineries and natural gas processing plants and to aid agency personnel in developing surveillance, inspection, monitoring, reporting and enforcement procedures. GRA

N75-18788# Southwest Research Inst., San Antonio, Tex.
THE COLLABORATIVE STUDY OF EPA METHODS, 5, 6, AND 7 IN FOSSIL FUEL-FIRED STEAM GENERATORS Final Environmental Monitoring Series
Henry F. Hamil, David E. Bamann, and Richard E. Thomas May 1974 39 p refs
(Contract EPA-68-02-0623)
(PB-237695/2; SwRI-01-3487-001; EPA-650/4-74-013) Avail: NTIS HC $3.75 CSCL 13B

Test methods promulgated for use in the determination of emission levels of specified pollutants from stationare sources are studied. The methods tested were Method 7 (Oxides of Nitrogen), Method 6 (Sulfur Dioxide), and Method 5 (Particulates). In conjunction with the collaborative tests of Methods 6 and 7, auxiliary tests were incorporated into the test plan to allow the partitioning of the methods into field and analytical phases for analysis. The concentrations determined by the collaborators from all sources were submitted to statistical analysis. The results summarize the findings presented in detail in the individual reports on each study. GRA

N75-18797# Environmental Protection Agency, Research Triangle Park, N.C. Emission Standards and Engineering Div.
BACKGROUND INFORMATION FOR STANDARDS OF PERFORMANCE: COAL PREPARATION PLANTS. VOLUME 2: SUMMARY AND TEST DATA
Oct. 1974 39 p refs
(PB-237696/0; EPA-450/2-74-021B) Avail: NTIS HC $3.75 CSCL 13B

A summary of source tests and visible emission measurements cited in Volume 1 is presented. This volume is principally a summary of test results for particulate matter, but also describes the facilities, their operating conditions, and characteristics of exhaust gas streams. GRA

N75-18801# New York State Assembly Scientific Staff, Albany.
PROCEEDINGS OF THE NEW YORK STATE ASSEMBLY/AISLE CONFERENCE ON ENERGY AND THE ENVIRONMENT, VOLUME 1
1974 164 p refs Conf. held at New York, 21-23 Jan. 1974 Prepared in cooperation with InterSociety Liaison Comm. on the Environ.
(PB-237936/0) Avail: NTIS HC $6.25 CSCL 10A

Topic areas covered include: energy policy; allocation of fuel; energy audit; building thermal limitation; heat pumps; solar panels; tax incentives; coal and nuclear power; solid waste; and pollution control. Workshop sessions discussed the following topics: consumer uses of energy; industrial and commercial uses of energy; electric power plants; transportation and fuel distribution; energy use in housing and buildings; and alternative fuels. GRA

N75-19014 British Library Lending Div., Boston Spa (England).
MAN-MADE SUN. THERMONUCLEAR ENGINEERING DEVELOPMENTS
B. Kadomtsev and E. Velikhov 1974 4 p Transl. into ENGLISH from Izv. (USSR), Jan. 1, 1974
(BLL-M-23333-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Cooperation between the United States of America and the U.S.S.R. in controlled nuclear fusion research is advocated in order to develop thermonuclear power stations. Emphasis is placed on tokamak type installations in which a plasma is obtained within a ring shaped chamber and where special windings around the chamber create a strong magnetic field which isolates the plasma from the walls. Also considered are open traps and stellarators. G.G.

N75-19080# Los Alamos Scientific Lab., N.Mex.
ECONOMIC AND SYSTEM ASPECTS OF A SUPERCONDUCTING MAGNETIC ENERGY STORAGE DEVICE AND A dc SUPERCONDUCTING TRANSMISSION LINE
T. E. McDonald and W. V. Hassenzahl 1974 2 p refs Sponsored by ERDA
(LA-UR-74-1145; Conf-741130-1) Avail: NTIS HC $3.25

Preliminary cost studies were made in an effort to gain an indication of the economic viability of superconduction energy storage and dc power transmission. A summary of results is given for the cost of twin-lead, coaxial cable, and single conductor transmission lines. Cost estimates are summarized for various superconducting storage systems. NSA

N75-19224*# Boeing Commercial Airplane Co., Seattle, Wash.
FUEL CONSERVATION POSSIBILITIES FOR TERMINAL AREA COMPATIBLE AIRCRAFT Final Report
Mar. 1975 234 p refs
(Contract NAS1-12018)
(NASA-CR-132608; D6-22421) Avail: NTIS HC $7.50 CSCL 01C

Design features and operational procedures are identified, which would reduce fuel consumption of future transport aircraft. The fuel-saving potential can be realized during the last decade of this century only if the necessary research and technology programs are implemented in the areas of composite primary structure, airfoil/wing design, and stability augmentation systems. The necessary individual R and T programs are defined. The sensitivity to fuel usage of several design parameters (wing geometry, cruise speed, propulsion) is investigated, and the results applied to a candidate 18, 140-kg (40,000-lb) payload, 5556-km (3000-nmi) transport design. Technical and economic comparisons are made with current commercial aircraft and other advanced designs. Author

N75-19339# Xerox Electro-Optical Systems, Pasadena, Calif.
SOLAR COLLECTOR THERMAL POWER SYSTEM. VOLUME 1: PRELIMINARY TECHNOLOGY SYSTEMS STUDY Final Report, 16 Aug. 1971 - 28 Jun. 1974
Robert Richter Nov. 1974 143 p refs 3 Vol.
(Contract F33615-72-C-1092; AF Proj. 3145)
(AD-A000940; Rept-4074-Vol-1; AFAPL-TR-74-89-1) Avail: NTIS CSCL 22/2

Work performed on the Solar Collector Thermal Power System (SCTPS) Program from 16 August 1971 to 28 June 1974 is presented. Volume I contains the system analysis for a solar collector thermal power system supplying thermal energy to a Vuilleumier cooler that is carried on a BMS type satellite. The analysis covers specific requirements of individual components of the power system, including the solar collector, heat pipes, and the thermal energy storage system. An extensive bibliography of pertinent heat transfer, solar collectors, and space power system reports is a part of this volume. GRA

N75-19340# Xerox Electro-Optical Systems, Pasadena, Calif.
SOLAR COLLECTOR THERMAL POWER SYSTEM. VOLUME 2: DEVELOPMENT, FABRICATION, AND TESTING OF FIFTEEN FOOT HEAT PIPES Final Report, 16 Aug. 1971 - 28 Jun. 1974
Robert Richter Nov. 1974 198 p refs 3 Vol.
(Contract F33615-72-C-1092; AF Proj. 3145)
(AD-A000941; Rept-4074-Vol-2; AFAPL-TR-74-89-2) Avail: NTIS CSCL 22/2

Technical effort in the development of a 15-foot long primary heat pipe capable of transferring 6 kW of thermal power and its integration with the remaining components of a complete thermal train is presented. The effort comprised the design, fabrication, and testing of the heat pipe as an individual component and the integration and testing with the secondary heat pipe, the thermal energy storage unit, and a radiation heat transfer joint. GRA

N75-19341# Xerox Electro-Optical Systems, Pasadena, Calif.
SOLAR COLLECTOR THERMAL POWER SYSTEM. VOLUME 3: BASIC STUDY AND EXPERIMENTAL EVALUATION OF THERMAL TRAIN COMPONENTS Final Report, 16 Aug. 1971 - 28 Jun. 1974
Robert Richter Nov. 1974 282 p refs
(Contract F33615-72-C-1092; AF Proj. 3145)
(AD-A000942; Rept-4074-Vol-3; AFAPL-TR-74-89-3) Avail: NTIS CSCL 22/2

Basic studies and the experimental evaluation of thermal train components are collected. This includes the tests of subscale thermal energy storage capsules, the design, fabrication, and testing of the secondary heat pipe with its full scale thermal energy storage unit; the design, fabrication, and testing of subscale heat pipes for the evaluation of material compatibility; the design, fabrication, and testing of a subscale heat pipe with a cavity receiver; and a heat pipe wick study performed in support of the design of a second primary heat pipe and the subscale cavity heat pipe. GRA

N75-19354# General Electric Co., Philadelphia, Pa. Space Div.
MULTI-HUNDRED WATT RADIOISOTOPE THERMOELECTRIC GENERATOR PROGRAM, PART 1 Annual Report, 1 Jan. - 31 Dec. 1973
1973 310 p refs
(Contract AT(29-2)-2831)
(GESP-7107-Pt-1; GEMS-418-Pt-1) Avail: NTIS HC $9.25

Significant events, activities, and achievements during 1973 in the MHW-RTG Program for developing RTG's for space missions are summarized. During the year full-scale qualification and flight hardware and ground support equipment were fabricated and tested. Preliminary tests in the safety program are reported. Radiological protection and safety analysis reports were issued. Performance requirements were developed from systems analyses and test data. In this volume, information is included on the safety analyses and tests, the RTG system, heat source design, fuel form, fuel capsule, fuel sphere assembly and associated hardware, gas management subsystem, and analysis and testing of the heat source assembly. NSA

N75-19355# General Electric Co., Philadelphia, Pa. Space Div.
MULTI-HUNDRED WATT RADIOISOTOPE THERMOELECTRIC GENERATOR PROGRAM, PART 2 Annual Report, 1 Jan. - 31 Dec. 1973
1973 349 p
(Contract AT(29-2)-2831)
(GESP-7107-Pt-2; GEMS-418-Pt-2) Avail: NTIS HC $9.50

Significant events, activities, and achievements during 1973 in the MHW-RTG program for developing RTG's for space missions are summarized. During the year full-scale qualification and flight hardware and ground support equipment were fabricated and tested. In this volume, information is included on converter design, development, and performance testing, product assurance, converter fabrication, acceptance and qualification testing, and ground support equipment such as the electric heat source, power supplies, and shipping and storage containers and handling equipment for the RTG. NSA

N75-19390# Sandia Labs., Albuquerque, N.Mex.
MECHANICAL PROPERTIES OF OIL SHALE FROM ANVIL POINT UNDER CONDITIONS OF UNIAXIAL COMPRESSION
R. A. Schmidt and K. W. Schuler Aug. 1974 29 p refs
(Contract AT(29-1)-789)
(SAND-74-0035) Avail: NTIS HC $3.75

Unconfined compression tests on oil shale from Anvil Point, Colorado, indicate that the material properties measured are strongly dependent on kerogen content. Increased kerogen levels decrease the fracture strength, yield strength, and Young's modulus, and increase the dilatation, fracture strain, and energy to fracture. A model involving kerogen as a lubricant for crack surface sliding is proposed which accounts for most of the trends seen. The model is supported with direct observation of cracks in fractured specimens. Unloading data are also presented indicating that nonlinear elastic behavior predominates.
Author (NSA)

N75-19599# General Electric Co., Philadelphia, Pa.
EVALUATION OF A FOSSIL FUEL FIRED CERAMIC REGENERATIVE HEAT EXCHANGER Interim Report, Oct. 1973 - Aug. 1974
Charles S. Cook Oct. 1974 62 p refs
(Contract DI-14-32-0001-1533)
(PB-236346/3; OCR-92-INT-1) Avail: NTIS HC $4.25 CSCL 10B

A ceramic regenerative heat exchanger with an alumina cored brick matrix was designed and installed for the purpose of determining molecular gas and particulate contaminant levels in the output argon flow. The heat exchanger is viewed as a laboratory scale prototype high temperature heat source for closed cycle energy conversion systems operating with noble gas working fluids with an emphasis on closed cycle MHD application. The heat exchanger has a 29in. inside shell diameter with a 14in. diameter active flow matrix and has design operating conditions of argon flow at 5.45 lbm-sec, 2900F to 3000F and 10 atmospheres stagnation pressure. The blowdown test time is 60 seconds. GRA

N75-19608# Naval Civil Engineering Lab., Port Hueneme, Calif.
HEAT TRANSFER DESIGN AND PROOF TESTS OF A RADIOISOTOPE THERMOELECTRIC GENERATOR Final Report, Nov. 1972 - Jul. 1974
Earl J. Beck Nov. 1974 51 p
(AD-A002218; CEL-TN-1359) Avail: NTIS CSCL 18/14

The object was to design, build, and test the heat rejection portions of a large 2-kw(e) radioisotope thermoelectric generator (RTG). The design was optimized to produce the lowest practicable temperatures at the cold junction of a large number of thermoelectric heat-to-electricity conversion elements. The geometry was largely defined by the size, shape, and required number of thermoelectric elements and by their deployment at the upper end of a large pressure-resistant hull. The work showed the capability of the 12-finned convectors to maintain a temperature below 90F, at the inner face of the convectors both when the unit was vertical and when tilted 60 degrees from the vertical. The solid copper showed no signs of corrosion; the potential corrosion problem is discussed in some detail in the report, as are related problems of flow, protection, and possible fouling from marine growth. GRA

N75-19705# Army Foreign Science and Technology Center, Charlottesville, Va.
IMPROVING THE OIL STORAGE SYSTEM OF WESTERN SIBERIA
N. M. Olenev and G. A. Khoirysh 31 Oct. 1973 9 p refs Transl. into ENGLISH from Transp. Khranenie Nefti Nefteprod. (USSR), No. 2, 1972 p 13-17
(AD-A002717; FSTC-HT-23-1473-73) Avail: NTIS CSCL 13/4

Conventional oil storage tanks are unsuitable for the conditions of western Siberia due to their high construction and maintenance costs, soil and wind conditions and losses of light oil fractions caused by cyclical temperature variations. These problems have been largely overcome in an oil storage system developed at the Tyumen Industrial Institute. It consists of bottomless cylindrical tanks, immersed in a water medium. The tanks are filled with oil from the top, displacing the water. The water provides large safety margins, allows for construction in swampy or inundated areas and serves to insulate the oil against subzero temperatures. GRA

N75-19778 Stanford Univ., Calif.
STATISTICAL ESTIMATION OF WILDCAT WELL OUTCOME PROBABILITIES BY VISUAL ANALYSIS OF STRUCTURE CONTOUR MAPS OF STAFFORD COUNTY, KANSAS Ph.D. Thesis
Alfredo Eduardo Prelat 1974 117 p
Avail: Univ. Microfilms Order No. 74-27084

The development of a method to estimate wildcat well outcome probabilities is described. The work involved analysis of a sequence of structure contour maps of three subsurface horizons (top of the Arbuckle Group, top of the Lansing Group, and top of the Stone Corral Formation) in a 24-by-24 mile area in northern Stafford County, Kansas. The principal technique employed is the so-called re-experience technique in which a

succession of maps is prepared to represent the geology interpreted on the basis of different amounts of information. Each map prepared represents the interpreted subsurface structure based on information available at a particular time in the area's oil-field development history (as for example, at the end of 1940). Geologic data from all wildcat wells and selected infield wells that had been drilled prior to the date of the map were used in preparation of the map, but no geologic information from wells drilled after the date of a particular map was used. *Dissert. Abstr.*

N75-19813# Bureau of Mines, Morgantown, W.Va. Process Evaluation Group (MRED).
AN ECONOMIC ANALYSIS OF OIL SHALE OPERATIONS FEATURING GAS COMBUSTION RETORTING Technical Progress Report
Sidney Katell and Paul Wellman Oct. 1974 22 p
(PB-237851/1; BM-TPR-81) Avail: NTIS HC $3.25 CSCL 0 I

The economics of producing a high-quality, semirefined shale oil (Syncrude) from oil shale are discussed. Options for Syncrude *production, 50,000 and 100,000 barrels per calendar day, with* an integrated system of underground mining, above ground processing, and waste handling are presented. GRA

N75-19814# Science Communication, Inc., McLean, Va.
INTRA INDUSTRY CAPABILITY TO SUBSTITUTE FUELS Final Report
Oct. 1974 150 p
(Contract FEA-C-03-50034-00)
(PB-237605/1; FEA/EI-50034) Avail: NTIS HC $5.75 CSCL 21D

The main purpose of this study was to identify the economic potential for substituting coal as a fossil fuel for oil or natural gas in meeting the fuel needs of the manufacturing sectors. The major objective of the study was to define the amounts of petroleum-based fuels that could be replaced, the conditions or incentives required for their replacement, and the degree to which replacement would be accomplished by the time-line years 1977, 1980, 1985 and 1990. GRA

N75-19821*# Kanner (Leo) Associates, Redwood City, Calif.
WIND MOTORS: THEORY, CONSTRUCTION, ASSEMBLY AND USE IN DRAWING WATER AND GENERATING ELECTRICITY
R. Champly Washington NASA Apr. 1975 253 p refs Transl. into ENGLISH from the book "Theorie, construction, montage, utilisation au puisage de l'eau a la production de l'electricite" Paris, Dunod Publ., 1973 270 p
(Contract NASw-2481)
(NASA-TT-F-16201) Avail: NTIS HC $8.50 CSCL 10A

A brief history of windmills is given. Various models are described, with discussions of their pros and cons, especially in regard to number of blades and method of orientation to the wind. Systems for transmission of power from the wind motor to a pump, generator, or other type of equipment are described. A method for computing the tension and compression stresses on the wind motor pylon is given and the construction of pylons and water tanks is discussed. Foundation and anchoring systems are described, as are several methods for assembling and raising the wind motor on its pylon. Systems using wind motors to draw and elevate water by means of pumps and systems using wind motors in conjunction with generators, storage batteries, etc., to generate electricity are described. Efficiency tables and comparative cost price tables are provided for each of these applications. Author

N75-19823*# Boeing Aerospace Co., Kennedy Space Center, Fla. Field Operations and Support Div.
RISK MANAGEMENT TECHNIQUE FOR DESIGN AND OPERATION OF LIQUEFIED NATURAL GAS FACILITIES AND EQUIPMENT Final Report, Jun. - Dec. 1974
Clyde A. Medkief, Jr., Arthur W. Niergarth, and William N. Parsons 31 Dec. 1974 229 p refs
(Contract NAS10-7200)
(NASA-CR-139183) Avail: NTIS HC $7.50 CSCL 13L

A risk management and facilities certification methodology applicable to liquid natural gas facilities is developed. The proposed 'regulation for manufacture, storage, transportation, delivery, and processing of liquefied gas' prepared by the New York Fire Department was reviewed along with related codes and standards, and applicable experience in the operation of cryogenic facilities. Recommendations for revision are given. A basic description of the system is provided and general guidelines to be followed by the owner of a facility in supporting NYFD Risk Management are included. Working level descriptions of the basic concepts, the step-by-step instructions for preparing the data to be handled, and the procedures for status reporting and control are presented. Preliminary automated data processing requirements are included to support management information and control system planning. The RMS can be implemented in a manual mode and operated to establish the basic requirements and then matched to the data processing capability of the Fire Department for the most effective operation. J.M.S.

N75-19824# Japan Atomic Energy Research Inst., Tokyo.
PRODUCTION OF HYDROGEN FROM WATER USING NUCLEAR ENERGY. A REVIEW
R. Ueda, H. Tagawa, S. Sato, T. Yasuno, S. Ohno, and Mitsuru Maeda Mar. 1974 69 p refs In JAPANESE; ENGLISH summary
(JAERI-M-5642) Avail: ERDA Depository Libraries

Hydrogen, which is inexhaustible in the form of water, can be substituted for petroleum-based fuels and natural gas. Nuclear energy is the primary energy source for decomposing water. Information available for the production of hydrogen from water is reviewed. The following are described: (1) thermodynamics in the decomposition of water-one-step and multistep processes; (2) thermochemical decomposition process-description of MARK, GE, ANL and EOS processes; (3) nuclear energy as heat source and thermal efficiency in MARK 1 process; (4) radiolysis of water and carbon dioxide; and (5) photolysis of water.
Author (NSA)

N75-19825# Sandia Labs., Albuquerque, N.Mex.
IN SITU OIL SHALE CONVERSION AND RECOVERY
H. M. Stoller Sep. 1974 10 p
(Contract AT(29-1)-789)
(SLA-74-0162) Avail: NTIS HC $3.25

The oil shale deposits of the western United States are estimated. In situ conversion and recovery techniques are discussed which will increase the amount of reserves which can be exploited, reduce the need for underground mining, and diminish the associated environmental disturbances and water requirements. Emphasis is placed on the development of remote techniques for the establishment of adequate permeability in the oil shale beds as well as the optimization and control of the conversion process. Author (NSA)

N75-19827# California Univ., Livermore. Lawrence Livermore Lab.
LLL-SOHIO SOLAR PROCESS HEAT PROJECT
W. C. Dickinson 1 Nov. 1974 6 p refs
(Contract W-7405-eng-48)
(UCID-16630-74-1; Rept-1) Avail: NTIS HC $3.25

The Sohio uranium plant will require about 500 gpm of water at 140 F, 24 hr/day. This preliminary report outlines a method for providing 50% or more of this requirement using solar energy. A fuel oil boiler will provide the balance. Estimated yearly savings amount to 22,000 bbl of oil and $80,000. Experimental prototypes are being built and tested. The completed system is expected to be operational by September 1, 1976. Future reports will consider various aspects of the project more specifically. Author (NSA)

N75-19828# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorentwicklung.
NUCLEAR DISTRICT-HEATING AND NUCLEAR LONG-DISTANCE ENERGY

T. Bohn, G. Dietrich, K. Kugeler, M. Kugeler, H. F. Niessen, and H. V. Schlenker Jun. 1974 68 p refs In GERMAN; ENGLISH summary
(JUL-1077) Avail: ERDA Depository Libraries HC $6.50

A survey is given about the possibilities of nuclear energy for heating of residential and industrial buildings. The costs and quantities are only a rough estimate. The results show that nuclear energy will have economical advantages in comparison with conventional systems for district-heating. Nuclear District-Heating is a contribution to relieve the environment of pollution, by using waste heat of electricity producing processes as is Nuclear Long-Distance Energy with its decentralized electricity production. Author (NSA)

N75-19829# Argonne National Lab., Ill.
DEVELOPMENT OF LITHIUM/SULFUR CELLS FOR APPLICATION TO ELECTRIC AUTOMOBILES
E. C. Gay, W. W. Schert, E. J. Martino, and K. E. Anderson 1974 26 p refs Presented at the 9th Intersoc. Energy Conversion Conf., San Francisco, 26 Aug. 1974 Sponsored by ERDA
(Conf-740805-7) Avail: NTIS HC $3.75

Development efforts on cells of the type Li/LiCl-KCl/FeS2 are reported, where negative electrodes containing liquid lithium alloys or solid lithium-aluminum alloys and positive electrodes containing iron sulfide, electrolyte, and current collector were investigated. Lithium sulfide was added to sulfur electrode mixtures for improved cell performance. Electrodes were developed which meet the capacity density requirements for cells of the bicell configuration in a battery for electric automobile propulsion. A high percentage of the theoretical capacity density was measured in these cells with solid LiAl electrodes. A short-time peak power density of up to 1.4 W/sq cm was measured for liquid lithium electrodes with a charge cutoff voltage of 2.4 V IR-included. A power density greater than 0.6 W/sq cm was sustained for up to 55 sec. An operating lifetime of over 2000 hr and a cycle life of over 200 cycles were measured. Author (NSA)

N75-19830# California Univ., Livermore. Lawrence Livermore Lab.
FRACTURE-INDUCED PERMEABILITY: PRESENT SITUATION AND PROSPECTS FOR COAL
D. R. Stephens 20 Sep. 1974 23 p refs
(Contract W-7405-eng-48)
(UCID-16593) Avail: NTIS HC $3.25

Creation of permeability by explosive fracturing is considered. Permeability data correlate well with R/R sub c, where R sub c is the cavity radius, or with failure shear strain. Simultaneous detonations are quantitatively predicted to produce much flatter permeability distributions than for single or sequential detonation. The projected permeability distribution for HE fracturing by chemical explosives emplaced in an array of drilled holes has serious consequences for the LLL in situ coal gasification concept. Realistic gasification calculations are needed to indicate whether the predicted permeability distributions are acceptable or whether modifications or alternate solutions must be found.
Author (NSA)

N75-19831# Brookhaven National Lab., Upton, N.Y. Dept. of Applied Science.
ENERGY SYSTEMS ANALYSIS AND TECHNOLOGY ASSESSMENT PROGRAM Annual Report, fiscal year 1974
K. C. Hoffman and M. Beller Jun. 1974 345 p refs Sponsored by ERDA
(BNL-18984) Avail: NTIS HC $9.50

The second annual progress report describes the overall objectives of the program and a summary of the major activities during 1974. The highlights of the program include the development of the energy model data base and associated manipulative computer programs, the completion of a series of technology assessments, and a study of an intensive electrification strategy. Individual assessments of thirty energy technologies were performed in support of the formulation by the AEC chairman of a $10 billion national energy research and development program. Strategic planning scenarios were prepared. The intensive electrification study involved an evaluation of the substitution of coal and nuclear electric power for imported oil in the 1985 and 2000 time periods. The analytical techniques or models that were developed and are employed in the program are the reference energy system and the Brookhaven energy system optimization model. NSA

N75-19832# Sandia Labs., Albuquerque, N.Mex.
SIZING OF FOCUSED SOLAR COLLECTOR FIELDS WITH SPECIFIED COLLECTOR TUBE INLET TEMPERATURE
D. O. Lee, W. P. Schimmel, Jr., and J. P. Abbin, Jr. 1974 43 p refs Presented at Winter Meeting of the Am. Soc. of Mech. Engr., New York, 17 Nov. 1974 Sponsored by ERDA
(SLA-74-5288; Conf-741104-2) Avail: NTIS HC $3.75

An axial temperature differential analysis was used to size the collector field required to power a demonstration project in which 40 kW (electrical) output is required. The number of collectors required to furnish the desired energy and temperature rise in the collector fluid is determined by the requirements of several typical organic working fluid Rankine-cycle energy conversion systems. Calculations based on heliostatically-mounted collector systems and fixed tilt east-west tracking collector systems are presented. The collector matrix sizes obtained by these calculations are somewhat optimistic because the effects of wind losses and shadowing by adjacent collectors are not considered. No losses are considered for connections between collectors. Losses in the Rankine cycle power conversion loop are considered. This analysis is thus valid for a lossless, infinitely spaced collector field. Author (NSA)

N75-19833# Continental Oil Co., Houston, Tex.
PROJECT RIO BLANCO DATA REPORT: PRODUCTION TESTING (RB-E-01), NOVEMBER 1973 AND JANUARY - FEBRUARY 1974
Sep. 1974 96 p Sponsored by ERDA
(NVO-148) Avail: NTIS HC $4.75

Project Rio Blanco is a government-industry gas reservoir stimulation experiment using three 30-kiloton nuclear explosives, which were detonated simultaneously in a single well, RB-E-01, at depths of 5,838.5, 6,229.7, and 6,689.5 feet. After completion of reentry drilling, initial drawdown testing was performed in two phases: the first phase was conducted during November, 1973, and the second phase during January-February, 1974. Production of approximately 300 million cubic feet of gas had been planned, but a total of only 98 million (dry gas) was produced. Furthermore, most, if not all, of the gas produced came from the top chimney because there is apparently no significant evidence of communication between the top and the two lower chimneys. The testing of the entire secion was therefore considered inconclusive and alternate reentry operations began in May, 1974. Data obtained during the November, 1973, and January-February, 1974, testing periods are presented. NSA

N75-19836# Rensselaer Polytechnic Inst., Troy, N.Y.
ELECTROCHEMICAL POWER SOURCES Final Technical Report, 18 Sep. 1968 - 31 Jan. 1974
David A. Aikens and Howard Littman Sep. 1974 87 p refs
(Contract DAAB07-69-C-0063; DA Proj. 1T6-62705-A-053)
(AD-A001610; ECOM-69-0063-F) Avail: NTIS CSCL 07/4

The report summarizes research in the areas of electrodes and electrolytes and heat and mass transfer in porous media. Heats of solution were determined for alkali metal salts in nitrile solvents and the structure of electrolytes - nitrile solutions has been studied by Raman spectroscopy and conductance. Data on non-aqueous electrolytes has been compiled. Properties of reference electrodes and liquid junctions in propylene carbonate have been studied potentiometrically and the problem of uncompensated resistance has been studied by electrostatic methods. The effect of cycling on sealed Ni-Cd batteries has been studied. Liquid-gas distribution in porous media has been studied by modeling techniques and by gamma scattering. The coupling of thermal and mass transport with electrochemical processes at the three phase interface has been studied using a microelectrode, and theoretical studies of evaporation from thin films have been performed. GRA

N75-19838# Kellogg (M. W.) Co., Houston, Tex.
A SASOL TYPE PROCESS FOR GASOLINE, METHANOL, SNG, AND LOW-BTU GAS FROM COAL Final Report
F. K. Chan Jul. 1974 90 p refs
(Contract EPA-68-02-1308)
(PB-237670/5; EPA-650/2-74-072) Avail: NTIS HC $4.75 CSCL 07A

Costs and feasibility of manufacturing gasoline, methanol, SNG, and low Btu gas from coal using the SASOL-type process are assessed. This process is based on a SASOL plant which has been operated commercially for more than 20 years for the manufacture of gasoline, fertilizers, and other chemicals from coal in South Africa. The SASOL plant has been modified slightly to suit the product spectrum of the projected plants. Capital investments for plants producing various end products are estimates based on published or in-house information on a mine-mouth plant using Western U.S. coal. The capital investment is expressed in 1975 dollars with no forward escalation. GRA

N75-19839# Pittsburg and Midway Coal Mining Co., Kansas City, Mo.
DEVELOPMENT OF A PROCESS FOR PRODUCING AN ASHLESS LOW SULFUR FUEL FROM COAL. VOLUME 4. PRODUCT STUDIES. PART 2. ANNOTATED BIBLIOGRAPHY ON MINERAL FIBER PRODUCTION FROM COAL MINERALS Interim Report, Jun. 1969
Nov. 1974 71 p Prepared in cooperation with Washington State Univ., Pullman 5 Vol.
(Contract DI-14-01-0001-496)
(PB-237763/8; OCR-53-INT-10-Vol-4-Pt-2) Avail: NTIS HC $4.75 CSCL 07A

The literature search performed in support of research on mineral fiber production from the residual solids of the Solvent Refined Coal (SRC) Process is summarized. GRA

N75-19840# Pittsburg and Midway Coal Mining Co., Kansas City, Mo.
DEVELOPMENT OF A PROCESS FOR PRODUCING AN ASHLESS, LOW-SULFUR FUEL FROM COAL. VOLUME 4. PRODUCT STUDIES. PART 3 PRODUCTS FROM COAL MINERALS Interim Report, Jun. 1972
Nov. 1974 51 p refs Prepared in cooperation with Washington State Univ., Pullman 5 Vol.
(Contract DI-14-01-0001-496)
(PB-237764/6; OCR-53-INT-11-Vol-4-Pt-3) Avail: NTIS HC $4.25 CSCL 07A

Feasibility of producing products from mineral residue of the Solvent Refined Coal(SRC) Process is discussed. Experimental studies included the processing of sulfur, iron, and the production of mineral wool. A review of the experimental procedure and results is given. GRA

N75-19841# Pittsburg and Midway Coal Mining Co., Kansas City, Mo.
DEVELOPMENT OF A PROCESS FOR PRODUCING AN ASHLESS, LOW-SULFUR FUEL FROM COAL. VOLUME 4. PRODUCT STUDIES. PART 4. SULFUR REMOVAL FROM COAL MINERALS Interim Report, Jun. 1972
Nov. 1974 40 p refs Prepared in cooperation with Washington State Univ., Pullman 5 Vol.
(Contract DI-14-01-0001-496)
(PB-237765/3; QCR-54-INT-12-Vol-4-Pt-4) Avail: NTIS HC $3.75 CSCL 07A

Sulfur removal from residual solids of the Solvent Refined Coal (SRC) Process is investigated. The residue, called coal minerals, contains various amounts of ferrous oxide, silica, carbon, and alumina. The preferential oxidation technique for sulfur removal was tested on the coal mineral for the oxidation of ferrous sulfide. The process is reviewed and results are reported. GRA

N75-19842# Pittsburg and Midway Coal Mining Co., Kansas City, Mo.
DEVELOPMENT OF A PROCESS FOR PRODUCING AN ASHLESS, LOW-SULFUR FUEL FROM COAL. VOLUME 4. PRODUCT STUDIES. PART 5. DEVELOPMENTAL AND RATE STUDIES IN PROCESSING OF COAL MINERALS Ph.D. Thesis Interim Report, Jun. 1973
Nov. 1974 139 p refs Prepared in cooperation with Washington State Univ., Pullman 5 Vol.
(Contract DI-14-01-0001-496)
(PB-237766/1; OCR-53-INT-13-Vol-4-Pt-5) Avail: NTIS HC $5.75 CSCL 07A

Processing of coal minerals from the Solvent Refined Coal (SRC) Process is discussed. The report reviews the chemical reactions and kinetics of carbon gasification for the production of fuel as synthesis gas and subsequent recovery of elemental iron and sulfur. GRA

N75-19843# Dynatech R/D Co., Cambridge, Mass.
FUEL GAS PRODUCTION FROM SOLID WASTE Semiannual Progress Report, 1 Jan. - 30 Jun. 1974
R. G. Kispert, L. C. Anderson, D. H. Walker, S. E. Sadek, and D. L. Wise 31 Jul. 1974 183 p
(Contract NSF C-827)
(PB-238068/1; NSF-RA-N-74-111) Avail: NTIS HC $7.00 CSCL 13B

A comprehensive computer model of a waste digestion plant was developed. Equipment, size, and processing conditions were selected for producing fuel gas at minimum cost on a scale representative of municipal waste generation. The values of operating and cost parameters were extensively verified and documented. A sensitivity study was applied to the cost calculations to determine the effect of variations from base-line conditions. The economic computations indicate that gas may be produced from solid waste by anaerobic digestion at an acceptable cost. GRA

N75-19847# Minnesota Mining and Mfg. Co., St. Paul.
MANPORTABLE THERMOELECTRIC GENERATOR Final Report, Apr. 1973 - Aug. 1974
K. Magnuson, E. Pitcher, and P. Stroom Nov. 1974 42 p refs
(Contract DAAB07-73-C-0138; DA Proj. 1S7-62705-AH-94)
(AD-A002042; ECOM-73-0138-F) Avail: NTIS CSCL 10/2

The report describes the design, fabrication, and test of the 120 Watt Manportable Thermoelectric Generator (exploratory development model). This portable device is comprised of five functional subsystems: thermoelectric converter, liquid fuel burner, electronics circuitry, fuel system, and cooling system. Two experimental generators were built and evaluated. The test results show that the system operates on all liquid fuels, ranging from gasoline to diesel oil (DF-1) and that it has potential as a portable, 120-Watt, generator for Army field use. GRA

N75-19867# California Univ., Livermore. Lawrence Livermore Lab.
ENVIRONMENTAL ASPECTS OF METHANOL AS VEHICULAR FUEL: HEALTH AND ENVIRONMENTAL EFFECTS
B. J. Berger 25 Sep. 1974 15 p refs Presented at the Eng. Found. Conf., Henniker, N.H., 7-12 Jul. 1974 Sponsored by ERDA
(UCRL-76076; Conf-740727-3) Avail: NTIS HC $3.25

An attempt is made to summarize the environmental effects and health consequences that can be predicted as a result of the use of methanol as transportation fuel. The criteria necessary for this evaluation are: the relative effects of the new fuel as compared with gasoline; and a comprehensive study including automotive emissions and all aspects of fuel use including distribution, industrial exposure, consequences of miscellaneous home use as well as effect on terrestrial and aquatic ecosystems. Results are shown of exhaust analysis for hydrocarbons and aldehydes with methanol fuels. A toxicological comparison of methanol and gasoline is tabulated. NSA

N75-19879# Esso Research and Engineering Co., Linden, N.J. Government Research Lab.
EVALUATION OF POLLUTION CONTROL IN FOSSIL FUEL CONVERSION PROCESSESS, GASIFICATION. SECTION 1: SYNTHANE PROCESS Final Report

C. D. Kalfadelis and E. M. Magee Jun. 1974 93 p refs
(Contract EPA-68-02-0629)
(PB-237113/6; GRU-4DJ-74; EPA-650/2-74-009-b) Avail: NTIS HC $4.75 CSCL 13B

Results of a review of the U.S. Bureau of Mines Synthane Coal Gasification Process are given from the standpoint of its potential for affecting the environment. The quantities of solid, liquid, and gaseous effluents are estimated as well as the thermal efficiency of the process. A number of possible process modifications or alternates are proposed, and new technology needs are discussed. GRA

N75-19880# Exxon Research and Engineering Co., Linden, N.J.
EVALUATION OF POLLUTION CONTROL IN FOSSIL FUEL CONVERSION PROCESSES: GASIFICATION. SECTION 1: LURGI PROCESS Final Report
H. Shaw Jul. 1974 77 p refs
(Contract EPA-68-02-0629)
(PB-237694/5; GRU-5DJ-74; EPA-650/2-74-009-C) Avail: NTIS HC $4.75 CSCL 13B

A process analysis of the Lurgi Dry Ash Gasification Process for high Btu gas was carried out. The process is reviewed from the standpoint of its potential for affecting the environment. The waste stream compositions were calculated for a 250 MM scfd synthetic natural gas plant using a subbituminous coal. Thus, the quantities of solid, liquid, and gaseous pollutants were estimated, where possible. The thermal efficiency for various process alternatives was calculated. A number of process modifications which would reduce pollution and/or increase thermal efficiency were suggested. The technology needs to control pollution were assessed. GRA

N75-20106# Battelle Pacific Northwest Labs., Richland, Wash.
INTERESTING POSSIBILITIES OF FUSION-FISSION
R. W. Werner, J. D. Lee, R. W. Moir, and G. A. Carlson 1974 5 p refs Presented at 5th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Tokyo, 11 Nov. 1974 Sponsored by ERDA
(BNWL-SA-5069; Conf-741105-2) Avail: NTIS HC $3.25

In a world economy highly sensitive to increasing energy demands, it is vital to investigate all viable combinations of energy producing methods. The fusion-fission hybrid is such a combination. The ultimate pure fusion reactor is recognized but it is contended that a step along the way may be fusion-fission. It may decrease the time to a demonstration reactor since the plasma characteristics necessary to achieve fusion-fission are significantly less than those for pure fusion power.
Author (NSA)

N75-20155*# National Aeronautics and Space Administration, Washington, D.C.
RESEARCH AND TECHNOLOGY OPERATING PLAN SUMMARY: FISCAL YEAR 1975 RESEARCH AND TECHNOLOGY PROGRAM
1975 197 p
(NASA-TM-X-70410) Avail: NTIS HC $7.00 CSCL 05B

Summaries are presented of Research and Technology Operating Plans currently in progress throughout NASA. Citations and abstracts of the operating plans are presented along with a subject index, technical monitor index, and responsible NASA organization index. Research programs presented include those carried out in the Office of Aeronautics and Space Technology, Office of Energy Programs, Office of Applications, Office of Space Sciences, Office of Tracking and Data Acquisition, and the Office of Manned Space Flight. M.J.S.

N75-20157# Little (Arthur D.), Inc., Cambridge, Mass.
DEPENDENCE OF THE UNITED STATES ON ESSENTIAL IMPORTED MATERIALS, YEAR 2000; VOLUME 1
Apr. 1974 160 p 2 Vol.
(Contract N00014-74-C-0253; NR Proj. 462-082)
(AD-A000842; ADL-C-76732-Vol-1) Avail: NTIS CSCL 05/3

An appraisal is made of U.S. dependence on imported essential materials which will move to the United States over sea lanes in the latter decades of this century. Topics discussed and summarized include minerals and metals, shipping considerations, energy and petrochemicals, manufactured goods, food, forest products, ocean resources, and the U.S. economy of the future.
Author

N75-20158# Little (Arthur D.), Inc., Cambridge, Mass.
DEPENDENCE OF THE UNITED STATES ON ESSENTIAL IMPORTED MATERIALS, YEAR 2000. VOLUME 2: APPENDICES
Apr. 1974 125 p 2 Vol.
(Contract N00014-74-C-0253; NR Proj. 462-082)
(AD-A000843; ADL-C-76732-Vol-2) Avail: NTIS CSCL 05/3

The forecasting of U.S. imports of essential materials is discussed. Other topics discussed include strategic profiles of mineral imports for the year 2000, small and large quantities, U.S. domestic sources of energy, and U.S. national stockpile management. Author

N75-20160*# Kanner (Leo) Associates, Redwood City, Calif.
THE USA: THE SCIENTIFIC AND TECHNICAL REVOLUTION AND TRENDS IN FOREIGN POLICY
G. A. Arbatov Washington NASA Feb. 1975 235 p refs Transl. into ENGLISH of the book "SShA: Nauchno-tekhnicheskaya revolyutsiya i tendentsii vneshn. politiki" Moscow, Mezhdunarodnaya Otnosheniya, 1974 p 1-255
(Contract NASw-2481)
(NASA-TT-F-16102) Avail: NTIS HC $7.50 CSCL 05D

The influence of the scientific and technical revolution on the foreign policy strategy of the United States is examined, and the interrelationship between the scientific and technical revolution and Washington policy in solving international problems of modern times was investigated. Other areas in the foreign political activities of the U.S. investigated include space, the oceans, and atomic energy. The basic areas of Soviet-American scientific and technical collaboration are briefly reviewed.
Author

N75-20233* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE LONG TERM ENERGY PROBLEM AND AERONAUTICS
Richard A. Rudey *In* Kans. Univ. The Future of Aeron. 1974 p 182-209 refs
CSCL 10B

The projected increase in energy consumption by transportation in general and civil aviation in particular is directly opposed to the dwindling supplies of natural petroleum crude oil currently used to produce aircraft fuels. This fact dictates the need to develop even more energy conservative aircraft and propulsion systems than are currently available and to explore the potential of alternative fuels to replace the current petroleum derived hydrocarbons. Advances in technology are described in the areas of improved component efficiency, aircraft and engine integration, control systems, and advanced light-weight materials that are needed to maximize performance and minimize fuel usage. Also, improved turbofan and unconventional engine cycles which can provide significant fuel usage reductions are described. These advancements must be accomplished within expected environmental constraints such as noise and pollution limits. Alternative fuels derived from oil shale and coal are described, and the possible technological advancements needed to use these fuels in aircraft engines are discussed and evaluated with relation to potential differences in fuel characteristics. Author

N75-20291*# Lockheed Aircraft Corp., Sunnyvale, Calif.
EVALUATION OF ADVANCED LIFT CONCEPTS AND FUEL CONSERVATIVE SHORT-HAUL AIRCRAFT, VOLUME 1 Final Report
J. H. Renshaw, M. K. Bowden, C. W. Narucki, J. A. Bennett, P. R. Smith, R. S. Ferrill, C. C. Randall, J. G. Tibbetts, R. W.

Patterson, R. T. Meyer et al Jun. 1974 312 p refs 2 Vol. (Contract NAS2-6995)
(NASA-CR-137525) Avail: NTIS HC $9.25 CSCL 01C

The performance and economics of a twin-engine augmentor wing airplane were evaluated in two phases. Design aspects of the over-the-wing/internally blown flap hybrid, augmentor wing, and mechanical flap aircraft were investigated for 910 m. field length with parametric extension to other field lengths. Fuel savings achievable by application of advanced lift concepts to short-haul aircraft were evaluated and the effect of different field lengths, cruise requirements, and noise levels on fuel consumption and airplane economics at higher fuel prices were determined. Conclusions and recommendations are presented.
Author

N75-20292*# Lockheed Aircraft Corp., Sunnyvale, Calif.
EVALUATION OF ADVANCED LIFT CONCEPTS AND FUEL CONSERVATIVE SHORT-HAUL AIRCRAFT, VOLUME 2 Final Report
J. H. Renshaw, M. K. Bowden, C. W. Narucki, J. A. Bennett, P. R. Smith, R. S. Ferrill, C. C. Randall, J. G. Tibbetts, R. W. Patterson, R. T. Meyer et al Jun. 1974 367 p refs 2 Vol. (Contract NAS2-6995)
(NASA-CR-137526) Avail: NTIS HC $10.00 CSCL 01C

For abstract, see N75-20291.

N75-20478# Federal Energy Administration, Washington, D.C. Office of Economic Impact.
REPORT TO CONGRESS ON PETROCHEMICALS Final Report
28 Sep. 1974 239 p refs
(PB-238064/0) Avail: NTIS HC $7.50 CSCL 07A

The Report to Congress on Petrochemicals was prepared in response to Section 23, of Public Law 93-275 the Federal Energy Administration Act of 1974. It analyzes the petrochemical industry's current supply/demand situation and its outlook through the end of calendar year 1975. Petroleum products discussed include hydrocarbon feed-stocks, plastics, synthetic fibers and elastomers, coatings, dyes and pigments, surfactants, pharmaceuticals, pesticides, ammonia, and carbon black. Government control of prices and allocation is also discussed. Author

N75-20580# Brookhaven National Lab., Upton, N.Y.
HYDROGEN STORAGE AND PRODUCTION IN UTILITY SYSTEMS Quarterly Progress Report, 1 Jan. - 31 Mar. 1974
F. J. Salzano, ed. Apr. 1974 50 p ref Sponsored by ERDA
(BNL-18920; QPR-2) Avail: NTIS HC $3.75

Work was initiated on the development of break even capital costs for electric storage devices based on the energy modeling work and a preliminary estimate of $2741 kW (75% efficient) was obtained, based on a projection of present practice and cost trends to 1985. The hydrogen reservoir built for PSE&G of New Jersey was completed, tested, and shipped. Two safety reservoir rupture tests were completed and indicated that iron-titanium hydride appears to present no acute hazards in an extreme rupture accident condition even when fully hydrided.
NSA

N75-20693# California Univ., Livermore. Lawrence Livermore Lab.
METHODICAL APPROACH TO TEMPERATURE AND PRESSURE MEASUREMENTS FOR IN SITU ENERGY-RECOVERY PROCESSES
R. H. Cornell 14 Nov. 1974 7 p refs
(Contract W-7405-eng-48)
(UCID-16631) Avail: NTIS HC $3.25

Continuous monitoring of temperature and pressure is critical to in situ energy-recovery processes. Because of the harsh environments to which the instruments will be subjected and the difficulty of emplacing them, a methodical approach to an instrumentation plan in necessary. The aspects of such a methodical approach and areas that will require consideration are discussed.
Author (NSA)

N75-20746# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
WASTE LUBRICATING OIL RESEARCH. A COMPARISON OF BENCH-TEST PROPERTIES OF RE-REFINED AND VIRGIN LUBRICATING OILS
M. L. Whisman, J. W. Goetzinger, and F. O. Cotton Oct. 1974 23 p refs
(PB-238124/2; BM-RI-7973) Avail: NTIS HC $3.25 CSCL 11H

Several commercial processes for reclaiming used lubricating oil were duplicated on a laboratory bench scale. Laboratory tests were selected and in some instances modified to determine the physical properties of each oil produced. The hydrocarbon composition of some samples was determined using a liquid chromatographic technique, and compared with the composition of new oil in order to determine the severity of the re-refining technique. Selected samples of reprocessed oil were reformulated with an additive package for further estimates of quality as determined by wear, corrosion, foaming and oxidation stability tests. Several samples of commerically re-refined oil and new oil were obtained, and physical properties were determined for comparative studies.
GRA

N75-20805# Battelle-Northwest, Richland, Wash.
COAL STRUCTURE AND REACTIVITY
G. L. Tingey and J. R. Morrey Dec. 1973 85 p refs Sponsored by ERDA
(TID-26637) Avail: NTIS HC $4.75

A review of the literature was made to determine those areas of research in coal chemistry that need augmentation. It was found that a more thorough basic understanding of coal structure and reactivity is essential in the further utilization of coal. The petrographic classification of coal is outlined. Ultrafine structures in coal are important from a chemical point of view, as they determine surface areas that are important in heterogeneous reactions. The chemical structure of coal is discussed in terms of its important functional groups. Physical and chemical methods of structural analysis are discussed, and the view is stated that all of these methods need improvement. A review of trace elements in coal is presented. The volatilization, hydrogenation, and solvent extraction of coal are reviewed.
NSA

N75-20829 Michigan State Univ., East Lansing.
ENERGY UTILIZATION BY HOUSEHOLDS AND TECHNOLOGY ASSESSMENT AS A WAY TO INCREASE ITS EFFECTIVENESS Ph.D. Thesis
Otto Frederick Krauss 1974 268 p
Avail: Univ. Microfilms Order No. 74-27437

A management method aimed at reducing the differential between availability and expectancy is developed. A general background of the energy situation in the United States is given along with a description of energy uses and practices, and potentials for improving utilization efficiency. The crital role of the decisions made within family units which control energy consumption in the form of products and services is defined. It is indicated that major benefits to consumer, the environment, and society as a whole could accrue from the application of management methods to family decision making. A management scheme is proposed and illustrated that is an outgrowth of the concept of technology assessment. A 'satisfaction index' is utilized which depends on interrelated 'human-wants categories' to introduce environmental, social, and individual human factors to the familiar provision of goods and services. Trial assessments are made which evaluate the alternatives and identify the advantages and disadvantages in terms of their impact of the 'human-wants categories'. Results indicate a need for: (1) judicious preparation of the assessor; (2) careful selection and description of alternatives; (3) greater specificity with respect to categories; (4) time horizons; and (5) further trials.
Dissert. Abstr.

N75-20830*# Houston Univ., Tex.
ENERGY RECOVERY FROM SOLID WASTE. VOLUME 1: SUMMARY REPORT Final Report
Washington NASA Apr. 1975 30 p refs
(Grant NGT-44-005-114)
(NASA-CR-2525; S-442-Vol-1) Avail: NTIS HC $3.75 CSCL 10A

A systems analysis of energy recovery from solid waste which demonstrates the feasibility of several processes for converting solid waste to an energy form is presented. The social, legal, environmental, and political factors are considered and recommendations made in regard to legislation and policy. A technical and economic evaluation of available and developing energy-recovery processes is given with emphasis on thermal decomposition and biodegradation. A pyrolysis process is suggested. The use of prepared solid waste as a fuel supplemental to coal is considered to be the most economic process for recovery of energy from solid waste. Markets are discussed with suggestions for improving market conditions and for developing market stability. A decision procedure is given to aid a community in deciding on its options in dealing with solid waste. Author

N75-20831*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROCEEDINGS OF THE CONFERENCE ON RESEARCH FOR THE DEVELOPMENT OF GEOTHERMAL ENERGY RESOURCES
31 Dec. 1974 360 p refs Conference held at Pasadena, Calif., 23-25 Sep. 1974
(Contract NAS7-100; Grant NSF AG-545)
(NASA-CR-142556; NSF-RA-N-74-159) Avail: NTIS HC $10.00 CSCL 10A

The proceedings of a conference on the development of geothermal energy resources are presented. The purpose of the conference was to acquaint potential user groups with the Federal and National Science Foundation geothermal programs and the method by which the users and other interested members can participate in the program. Among the subjects discussed are: (1) resources exploration and assessment, (2) environmental, legal, and institutional research, (3) resource utilization projects, and (4) advanced research and technology.

N75-20832* National Science Foundation, Washington, D.C.
THE NATIONAL GEOTHERMAL ENERGY RESEARCH PROGRAM
Richard J. Green *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 7-12
CSCL 10A

The continuous demand for energy and the concern for shortages of conventional energy resources have spurred the nation to consider alternate energy resources, such as geothermal. Although significant growth in the one natural steam field located in the United States has occurred, a major effort is now needed if geothermal energy, in its several forms, is to contribute to the nation's energy supplies. From the early informal efforts of an Interagency Panel for Geothermal Energy Research, a 5-year Federal program has evolved whose objective is the rapid development of a commercial industry for the utilization of geothermal resources for electric power production and other products. The Federal program seeks to evaluate the realistic potential of geothermal energy, to support the necessary research and technology needed to demonstrate the economic and environmental feasibility of the several types of geothermal resources, and to address the legal and institutional problems concerned in the stimulation and regulation of this new industry. Author

N75-20833* National Science Foundation, Washington, D.C.
THE NSF/RANN FY 1975 PROGRAM FOR GEOTHERMAL RESOURCES RESEARCH AND TECHNOLOGY
Paul Kruger *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 13-22
CSCL 10A

The specific goal of the NSF geothermal program is the rapid development by industry of the nation's geothermal resources that can be demonstrated to be commmercially, environmentally and socially acceptable as alternate energy sources. NSF, as the lead agency for the federal geothermal energy research program, is expediting a program which encompasses the objectives necessary for significant utilization. These include: acceleration of exploration and assessment methods to identify commercial geothermal resources; development of innovative and improved technology to achieve economic feasibility; evaluation of policy options to resolve environmental, legal, and institutional problems; and support of experimental research facilities for each type of geothermal resource. Specific projects in each of these four objective areas are part of the NSF program for fiscal year 1975. Author

N75-20834* Atomic Energy Commission, Washington, D.C.
GEOTHERMAL RESEARCH AND DEVELOPMENT PROGRAM OF THE US ATOMIC ENERGY COMMISSION
Louis B. Werner *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 23-32
CSCL 10A

Within the overall federal geothermal program, the Atomic Energy Commission has chosen to concentrate on development of resource utilization and advanced research and technology as the areas most suitable to the expertise of its staff and that of the National Laboratories. The Commission's work in geothermal energy is coordinated with that of other agencies by the National Science Foundation, which has been assigned lead agency by the Office of Management and Budget. The objective of the Commission's program, consistent with the goals of the total federal program is to facilitate, through technological advancement and pilot plant operations, achievement of substantial commercial production of electrical power and utilization of geothermal heat by the year 1985. This will hopefully be accomplished by providing, in conjunction with industry, credible information on the economic operation and technological reliability of geothermal power and use of geothermal heat. Author

N75-20835* Bureau of Reclamation, Boulder City, Nev.
OVERVIEW OF RECLAMATION'S GEOTHERMAL PROGRAM IN IMPERIAL VALLEY, CALIFORNIA
Martin K. Fulcher *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 33-40
CSCL 10A

The Bureau of Reclamation is presently involved in a unique Geothermal Resource Development Program in Imperial Valley, California. The main purpose of the investigations is to determine the feasibility of providing a source of fresh water through desalting geothermal fluids stored in the aquifers underlying the valley. Significant progress in this research and development stage to date includes extensive geophysical investigations and the drilling of five geothermal wells on the Mesa anomaly. Four of the wells are for production and monitoring the anomaly, and one will be used for reinjection of waste brines from the desalting units. Two desalting units, a multistage flash unit and a vertical tube evaporator unit, have been erected at the East Mesa test site. The units have been operated on shakedown and continuous runs and have produced substantial quantities of high-quality water. Author

N75-20836* California Univ., Riverside.
GEOPHYSICAL, GEOCHEMICAL, AND GEOLOGICAL INVESTIGATIONS OF THE DUNES GEOTHERMAL SYSTEM, IMPERIAL VALLEY, CALIFORNIA
W. A. Elders, J. Combs, T. B. Coplen, P. Kolesar, and D. K. Bird *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 45-71 refs
(IGPP-UCR-74-31) CSCL 10A

The Dunes anomaly is a water-dominated geothermal system in the alluvium of the Salton Trough, lacking any surface expression. It was discovered by shallow-temperature gradient

measurements. A 612-meter-deep test well encountered several temperature-gradient reversals, with a maximum of 105 C at 114 meters. The program involves surface geophysics, including electrical, gravity, and seismic methods, down-hole geophysics and petrophysics of core samples, isotopic and chemical studies of water samples, and petrological and geochemical studies of the cores and cuttings. The aim is (1) to determine the source and temperature history of the brines, (2) to understand the interaction between the brines and rocks, and (3) to determine the areal extent, nature, origin, and history of the geothermal system. These studies are designed to provide better definition of exploration targets for hidden geothermal anomalies and to contribute to improved techniques of exploration and resource assessment. Author

N75-20837* Colorado School of Mines, Golden.
THE COLORADO SCHOOL OF MINES NEVADA GEOTHERMAL STUDY
George V. Keller, L. Trowbridge Grose, and Robert A. Crewpson *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 73-84 refs

(Grant NSF GI-43866)
CSCL 10A

Geothermal systems in the Basin and Range Province of the western United States probably differ in many respects from geothermal systems already discovered in other parts of the world because of the unique tectonic setting. To investigate this, a study of the geothermal occurrences at Fly Ranch, approximately 100 miles north of Reno, Nevada, has been undertaken. Ample evidence for a geothermal system exists in this area, including the surface expression of heat flow in the form of hot springs, an extensive area of low electrical resistivity, and a high level of seismicity along faults bounding the thermal area. However, geophysical and geological studies have not yet provided evidence for a local heat source at depth. Additional detailed geophysical and geological studies, as well as drilling, must be completed before the geothermal system can be described fully. Author

N75-20838* Bureau of Reclamation, Boulder City, Nev.
HEAT FLOW AND GEOTHERMAL POTENTIAL OF THE EAST MESA KGRA, IMPERIAL VALLEY, CALIFORNIA
Chandler A. Swanberg *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 85-97 refs
CSCL 10A

The East Mesa KGRA (Known Geothermal Resource Area) is located in the southeast part of the Imperial Valley, California, and is roughly 150 kilometers square in areal extent. A new heat flow technique which utilizes temperature gradient measurements across best clays is presented and shown to be as accurate as conventional methods for the present study area Utilizing the best clay gradient technique, over 70 heat flow determinations have been completed within and around the East Mesa KGRA. Background heat flow values range from 1.4 to 2.4 hfu (1 hfu = .000001 cal. per square centimeter-second) and are typical of those throughout the Basin and Range province. Heat flow values for the northwest lobe of the KGRA (Mesa anomaly) are as high as 7.9 hfu, with the highest values located near gravity and seismic noise maxima and electrical resistivity minima. An excellent correlation exists between heat flow contours and faults defined by remote sensing and microearthquake monitoring. Author

N75-20839* Southern Methodist Univ., Dallas, Tex.
A BRIEF DESCRIPTION OF GEOLOGICAL AND GEOPHYSICAL EXPLORATION OF THE MARYSVILLE GEOTHERMAL AREA
David D. Blackwell, Charles A. Brott, Thomas T. Goforth, Michael J. Holdaway, Paul Morgan, David Petefish, Thomas Rape, John L. Steele, Robert E. Spafford, and A. F. Waibel *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 98-110 refs
CSCL 10A

Extensive geological and geophysical surveys were carried out at the Marysville geothermal area during 1973 and 1974. The area has high heat flow (up to microcalories per square centimeter-second, a negative gravity anomaly, high electrical resistivity, low seismic ground noise, and nearby microseismic activity. Significant magnetic and infrared anomalies are not associated with the geothermal area. The geothermal anomaly occupies the axial portion of a dome in Precambrian sedimentary rocks intruded by Cretaceous and Cenozoic granitic rocks. The results from a 2.4-km-deep test well indicate that the cause of the geothermal anomaly is hydrothermal convection in a Cenozoic intrusive. A maximum temperature of 95 C was measured at a depth of 500 m in the test well. Author

N75-20840* Hawaii Univ., Honolulu.
HAWAII GEOTHERMAL PROJECT
Robert M. Kamins *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 115-121
CSCL 10A

Hawaii's Geothermal Project is investigating the occurrence of geothermal resources in the archipelago, initially on the Island of Hawaii. The state's interest in geothermal development is keen, since it is almost totally dependent on imported oil for energy. Geothermal development in Hawaii may require greater participation by the public sector than has been true in California. The initial exploration has been financed by the national, state, and county governments. Maximization of net benefits may call for multiple use of geothermal resources; the extraction of by-products and the application of treated effluents to agricultural and aquacultural uses. Author

N75-20841* Geological Survey, Menlo Park, Calif.
LEASING OF FEDERAL GEOTHERMAL RESOURCES
Reid T. Stone *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 122-127
CSCL 10A

Pursuant to the Geothermal Steam Act of 1970 and the regulations published on December 21, 1973, the first Federal geothermal competitive lease sale was held on January 22, 1974, by the Department of the Interior, offering 33 tracts totalling over 50,000 acres in three Known Geothermal Resource Areas in California. On January 1, 1974, Federal lands outside Known Geothermal Resource Areas were opened to noncompetitive lease applications, of which, 3,763 had been received by June 1, 1974. During fiscal year 1974, a total of 22 competitive leases had been issued in California and Oregon. The principal components in the Department involved in the leasing program are the Geological Survey and the Bureau of Land Management. The former has jurisdiction over drilling and production operations and other activities in the immediate area of operations. The latter receives applications and issues leases and is responsible for managing leased lands under its jurisdiction outside the area of operations. The interrelationships of the above agencies and the procedures in the leasing program are discussed. Author

N75-20842* Geological Survey, Sacramento, Calif.
MEASURING GROUND MOVEMENT IN GEOTHERMAL AREAS OF IMPERIAL VALLEY, CALIFORNIA
Ben E. Lofgren *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 128-138 refs
CSCL 10A

Significant ground movement may accompany the extraction of large quantities of fluids from the subsurface. In Imperial Valley, California, one of the potential hazards of geothermal development is the threat of both subsidence and horizontal movement of the land surface. Regional and local survey nets are being monitored to detect and measure possible ground movement caused by future geothermal developments. Precise measurement of surface and subsurface changes will be required to differentiate man-induced changes from natural processes in this tectonically active region. Author

N75-20843* The Futures Group, Glastonbury, Conn.
INSTITUTIONAL AND ENVIRONMENTAL PROBLEMS IN GEOTHERMAL RESOURCE DEVELOPMENT
Frank Maslan, Theodore J. Gordon, and Lillian Deitch *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 139-159 ref

(Contract NSF-C-836)
CSCL 10A

A number of regulatory and institutional impediments to the development of geothermal energy exist. None of these seem likely to prevent the development of this energy source, but in the aggregate they will pace its growth as certainly as the technological issues. The issues are associated with the encouragement of exploration and development, assuring a market for geothermal steam or hot water, and accomplishing the required research and development in a timely manner. The development of geothermal energy in the United States at a high level is apt to cause both favorable and unfavorable, though manageable, impacts in eight major areas, which are discussed. Author

N75-20844* Imperial County Dept. of Public Works, El Centro, Calif.
IMPERIAL VALLEY'S PROPOSAL TO DEVELOP A GUIDE FOR GEOTHERMAL DEVELOPMENT WITHIN ITS COUNTY
David E. Pierson *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 160-163
CSCL 10A

A plan to develop the geothermal resources of the Imperial Valley of California is presented. The plan consists of development policies and includes text and graphics setting forth the objectives, principles, standards, and proposals. The plan allows developers to know the goals of the surrounding community and provides a method for decision making to be used by county representatives. A summary impact statement for the geothermal development aspects is provided. Author

N75-20845* California Univ., Berkeley. Lawrence Berkeley Lab.
THE LAWRENCE BERKELEY LABORATORY GEOTHERMAL PROGRAM IN NORTHERN NEVADA
Kenneth F. Mirk and Harold A. Wollenberg *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 167-185 refs Sponsored in part by AEC

CSCL 10A

The Lawrence Berkeley Laboratory's geothermal program began with consideration of regions where fluids in the temperature range of 150 to 230 C may be economically accessible. Three valleys, located in an area of high regional heat flow in north central Nevada, were selected for geological, geophysical, and geochemical field studies. The objective of these ongoing field activities is to select a site for a 10-MW demonstration plant. Field activities (which started in September 1973) are described. A parallel effort has been directed toward the conceptual design of a 10-MW isobutane binary plant which is planned for construction at the selected site. Design details of the plant are described. Project schedule with milestones is shown together with a cost summary of the project. Author

N75-20846* California Univ., Livermore. Lawrence Livermore Lab.
THE TOTAL FLOW CONCEPT FOR GEOTHERMAL ENERGY CONVERSION
A. L. Austin *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 186-192

CSCL 10A

A geothermal development project has been initiated at the Lawrence Livermore Laboratory (LLL) to emphasize development of methods for recovery and conversion of the energy in geothermal deposits of hot brines. Temperatures of these waters vary from 150 C to more than 300 C with dissolved solids content ranging from less than 0.1% to over 25% by weight. Of particular interest are the deposits of high-temperature/high-salinity brines, as well as less saline brines, known to occur in the Salton Trough of California. Development of this resource will depend on resolution of the technical problems of brine handling, scale and precipitation control, and corrosion/erosion resistant systems for efficient conversion of thermal to electrical energy. Research experience to date has shown these problems to be severe. Hence, the LLL program emphasizes development of an entirely different approach called the Total Flow concept. Author

N75-20847* San Diego Gas and Electric Co., Calif.
SAN DIEGO GAS AND ELECTRIC COMPANY IMPERIAL VALLEY GEOTHERMAL ACTIVITIES
Thomas C. Hinrichs *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 194-206
CSCL 10A

San Diego Gas and Electric and its wholly owned subsidiary New Albion Resources Co. have been affiliated with Magma Power Company, Magma Energy Inc. and Chevron Oil Company for the last 2-1/2 years in carrying out geothermal research and development in the private lands of the Imperial Valley. The steps undertaken in the program are reviewed and the sequence that must be considered by companies considering geothermal research and development is emphasized. Activities at the south end of the Salton Sea and in the Heber area of Imperial Valley are leading toward development of demonstration facilities within the near future. The current status of the project is reported. Author

N75-20848* Los Alamos Scientific Lab., N.Mex.
PROGRESS OF THE LASL DRY HOT ROCK GEOTHERMAL ENERGY PROJECT
Morton C. Smith *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 207-212 Sponsored by ERDA

CSCL 10A

The possibilities and problems of extracting energy from geothermal reservoirs which do not spontaneously yield useful amounts of steam or hot water are discussed. The system for accomplishing this which is being developed first is a pressurized-water circulation loop intended for use in relatively impermeable hot rock. It will consist of two holes connected through the hot rock by a very large hydraulic fracture and connected at the surface through the primary heat exchanger of an energy utilization system. Preliminary experiments in a hole 2576 ft (0.7852 km) deep, extending about 470 ft (143 m) into the Precambrian basement rock underlying the Jemez Plateau of north-central New Mexico, revealed no unexpected difficulties in drilling or hydraulically fracturing such rock at a temperature of approximately 100 C, and demonstrated a permeability low enough so that it appeared probable that pressurized water could be contained by the basement rock. Similar experiments are in progress in a second hole, now 6701 ft (2.043 km) deep, about 1.5 miles (2.4 km) south of the first one. Author

N75-20849* Battelle-Northwest, Richland, Wash.
THE MARYSVILLE, MONTANA GEOTHERMAL PROJECT
W. R. McSpadden, D. H. Stewart, and J. T. Kuwada (Rogers Eng. Company, Inc., San Francisco) *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 213-224 ref
CSCL 10A

Drilling the first geothermal well in Montana presented many challenges, not only in securing materials and planning strategies for drilling the wildcat well but also in addressing the environmental, legal, and institutional issues raised by the request for permission to explore a resource which lacked legal definition. The Marysville Geothermal Project was to investigate a dry hot rock heat anomaly. The well was drilled to a total depth of 6790 feet and many fractured water bearing zones were encountered below 1800 feet. Author

N75-20850* Bureau of Reclamation, Holtville, Calif.
PRELIMINARY RESULTS OF GEOTHERMAL DESALTING OPERATIONS AT THE EAST MESA TEST SITE IMPERIAL VALLEY, CALIFORNIA
Sus H. Suemoto and Ken E. Mathias *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 225-235 refs

CSCL 10A

The Bureau of Reclamation has erected at its Geothermal Resource Development site two experimental test vehicles for the purpose of desalting hot fluids of geothermal origin. Both plants have as a feed source geothermal well Mesa 6-1 drilled to a total depth of 8,030 feet and having a bottom hole temperature of 400 F. Formation fluid collected at the surface contained 24,800 mg/1 total dissolved solids. The dissolved solids consist mainly of sodium chloride. A multistage distillation (3-stage) plant has been operated intermittently for one year with no operational problems. Functioning at steady-state conditions with a liquid feed rate of 70 g/m and a temperature of 221 F, the final brine blowdown temperature was 169 F. Product water was produced at a rate of about 2 g/m; average total dissolved solids content of the product was 170 mg/1. A product quality of 27.5 mg/1 at a pH of 9.5 was produced from the first stage. Author

N75-20851* Los Alamos Scientific Lab., N.Mex.
ROCK MELTING TECHNOLOGY AND GEOTHERMAL DRILLING
John C. Rowley *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 239-255 refs
CSCL 10A

National awareness of the potential future shortages in energy resources has heightened interest in exploration and utilization of a variety of geothermal energy (GTE) reservoirs. The status of conventional drilling of GTE wells is reviewed briefly and problem areas which lead to higher drilling costs are identified and R and D directions toward solution are suggested. In the immediate future, an expanded program of drilling in GTE formations can benefit from improvements in drilling equipment and technology normally associated with oil or gas wells. Over a longer time period, the new rock-melting drill bits being developed as a part of the Los Alamos Scientific Laboratory's Subterrene Program offer new solutions to a number of problems which frequently hamper GTE drilling, including the most basic problem - high temperature. Two of the most favorable characteristics of rock-melting penetrators are their ability to operate effectively in hot rock and produce glass linings around the hole as an integral part of the drilling process. The technical advantages to be gained by use of rock-melting penetrators are discussed in relation to the basic needs for GTE wells.
Author

N75-20852* Geological Survey, Reston, Va.
GEOTHERMAL RESERVOIR SIMULATION
James W. Mercer, Jr., Charles Faust, and George F. Pinder (Princeton Univ., N.J.) *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 256-267 refs
CSCL 10A

The prediction of long-term geothermal reservoir performance and the environmental impact of exploiting this resource are two important problems associated with the utilization of geothermal energy for power production. Our research effort addresses these problems through numerical simulation. Computer codes based on the solution of partial-differential equations using finite-element techniques are being prepared to simulate multiphase energy transport, energy transport in fractured porous reservoirs, well bore phenomena, and subsidence. Author

N75-20853* Stanford Univ., Calif.
GEOTHERMAL RESERVOIR ENGINEERING RESEARCH
Henry J. Ramey, Jr., Paul Kruger, William E. Brigham, and A. Louis London *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 268-280 refs
CSCL 10A

The Stanford University research program on the study of stimulation and reservoir engineering of geothermal resources commenced as an interdisciplinary program in September, 1972. The broad objectives of this program have been: (1) the development of experimental and computational data to evaluate the optimum performance of fracture-stimulated geothermal reservoirs; (2) the development of a geothermal reservoir model to evaluate important thermophysical, hydrodynamic, and chemical parameters based on fluid-energy-volume balances as part of standard reservoir engineering practice; and (3) the construction of a laboratory model of an explosion-produced chimney to obtain experimental data on the processes of in-place boiling, moving flash fronts, and two-phase flow in porous and fractured hydrothermal reservoirs. Author

N75-20854* Sperry Rand Research Center, Sudbury, Mass.
GEOTHERMAL DOWN WELL PUMPING SYSTEM
Hugh B. Matthews and Warren D. Mcbee *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 281-291

CSCL 10A

A key technical problem in the exploitation of hot water geothermal energy resources is down-well pumping to inhibit mineral precipitation, improve thermal efficiency, and enhance flow. A novel approach to this problem involves the use of a small fraction of the thermal energy of the well water to boil and super-heat a clean feedwater flow in a down-hole exchanger adjacent to the pump. This steam powers a high-speed turbine-driven pump. The exhaust steam is brought to the surface through an exhaust pipe, condensed, and recirculated. A small fraction of the high-pressure clean feedwater is diverted to lubricate the turbine pump bearings and prevent leakage of brine into the turbine-pump unit. A project demonstrating the feasibility of this approach by means of both laboratory and down-well tests is discussed. Author

N75-20855* Holt (Ben) Co., Pasadena, Calif.
INVESTMENT AND OPERATING COSTS OF BINARY CYCLE GEOTHERMAL POWER PLANTS
Ben Holt and John Brugman In JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 292-300 refs
CSCL 10A

Typical investment and operating costs for geothermal power plants employing binary cycle technology and utilizing the heat energy in liquid-dominated reservoirs are discussed. These costs are developed as a function of reservoir temperature. The factors involved in optimizing plant design are discussed. A relationship between the value of electrical energy and the value of the heat energy in the reservoir is suggested. Author

N75-20856* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELICAL ROTARY SCREW EXPANDER POWER SYSTEM
Richard A. McKay and Roger S. Sprankle (Hydrothermal Power Co., Ltd., Pasadena, Calif.) *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 301-309 refs
CSCL 10A

An energy converter for the development of wet steam geothermal fields is described. A project to evaluate and characterize a helical rotary screw expander for geothermal applications is discussed. The helical screw expander is a positive displacement machine which can accept untreated corrosive mineralized water of any quality from a geothermal well. The subjects of corrosion, mineral deposition, the expansion process, and experience with prototype devices are reported. Author

N75-20857* Bechtel Corp., San Francisco, Calif.
ELECTRIC POWER GENERATION USING GEOTHERMAL BRINE RESOURCES FOR A PROOF OF CONCEPT FACILITY

J. W. Hankin *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 310-311
CSCL 10A

An exploratory systems study of a geothermal proof-of-concept facility is being conducted. This study is the initial phase (Phase 0) of a project to establish the technical and economic feasibility of using hot brine resources for electric power production and other industrial applications. Phase 0 includes the conceptual design of an experimental test-bed facility and a 10-MWe power generating facility. Author

N75-20858* TRW Systems Group, Redondo Beach, Calif.
PHASE 0 STUDY FOR A GEOTHERMAL SUPERHEATED WATER PROOF OF CONCEPT FACILITY
R. H. Douglass and R. O. Pearson *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 312-315
CSCL 10A

A Phase 0 study for the selection of a representative liquid-dominated geothermal resource of moderate salinity and temperature is discussed. Selection and conceptual design of a nominal 10-MWe energy conversion system, and implementation planning for Phase 1: subsystem (component, experiments) and Phase 2: final design, construction, and operation of experimental research facilities are reported. The objective of the overall program is to demonstrate the technical and economic viability of utilizing moderate temperature and salinity liquid-dominated resources with acceptable environmental impact, and thus encourage commercial scale development of geothermal electrical power generation. Author

N75-20859* Pacific Gas and Electric Co., San Ramon, Calif.
THE HYDROGEN SULFIDE EMISSIONS ABATEMENT PROGRAM AT THE GEYSERS GEOTHERMAL POWER PLANT
G. W. Allen and H. K. McCluer *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 319-323 refs
CSCL 10A

The scope of the hydrogen sulfide (H2S) abatement program at The Geysers Geothermal Power Plant and the measures currently under way to reduce these emissions are discussed. The Geysers steam averages 223 ppm H2S by weight and after passing through the turbines leaves the plant both through the gas ejector system and by air-stripping in the cooling towers. The sulfide dissolved in the cooling water is controlled by the use of an oxidation catalyst such as an iron salt. The H2S in the low Btu ejector off gases may be burned to sulfur dioxide and scrubbed directly into the circulating water and reinjected into the steam field with the excess condensate. Details are included concerning the disposal of the impure sulfur, design requirements for retrofitting existing plants and modified plant operating procedures. Discussion of future research aimed at improving the H2S abatement system is also included. Author

N75-20860* Lloyd Corp., Los Angeles, Calif.
COMBINING TOTAL ENERGY AND ENERGY INDUSTRIAL CENTER CONCEPTS TO INCREASE UTILIZATION EFFICIENCY OF GEOTHERMAL ENERGY
B. P. Bayliss *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 325-330
CSCL 10A

Integrating energy production and energy consumption to produce a total energy system within an energy industrial center which would result in more power production from a given energy source and less pollution of the environment is discussed. Strong governmental support would be required for the crash drilling program necessary to implement these concepts. Cooperation among the federal agencies, power producers, and private industry would be essential in avoiding redundant and fruitless projects, and in exploiting most efficiently our geothermal resources. Author

N75-20861* Chevron International Oil Co., Inc., San Francisco, Calif.
COOPERATIVE EFFORTS BY INDUSTRY AND GOVERNMENT TO DEVELOP GEOTHERMAL RESOURCES
David R. Butler *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 331-334 refs
CSCL 10A

The Federal government's current plans for participation in the geothermal field appear to affect four major areas of interest: (1) resources exploration and assessment, (2) resources utilization projects, (3) advanced research and technology, and (4) environmental, legal, and institutional research. Private industry is also actively involved in these same areas of interest. Because of lack of coordination and communication between the private and public sector, it appears that there will be considerable duplication of effort, and, in some cases, serious conflict. It is also likely that this lack of coordination and communication may result in lack of effort in some key areas. Close coordination and communication between government and industry may resolve some of the major problems that are clearly evident. Author

N75-20862* City of Burbank, Calif.
A CITY INVESTS IN ITS FUTURE
Joseph N. Baker *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 335-339 ref
CSCL 10A

Events occurring during the past four years which led to the City of Burbank's decision to acquire an energy source adequate for the city's present and future power requirements are discussed. The community reaction to this unprecedented move is also covered. Burbank's long-range plans for the development of geothermal energy are outlined as well as the challenges which confront a public utility in implementing its projected goals. There are several advantages accruing to the city which in the opinion of the Burbank City Council and the administration justify this venture. The need for a cooperative climate which will enable all electrical utilities to better meet their obligations to the public, which is their prime responsibility before all other considerations, is analyzed. Author

N75-20863* Union Oil Co. of California, Santa Rosa.
GEOTHERMAL STEAM CONDENSATE REINJECTION
A. J. Chasteen *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 340-344
CSCL 10A

Geothermal electric generating plants which use condensing turbines and generate and excess of condensed steam which must be disposed of are discussed. At the Geysers, California, the largest geothermal development in the world, this steam condensate has been reinjected into the steam reservoir since 1968. A total of 3,150,000,000 gallons of steam condensate has been reinjected since that time with no noticeable effect on the adjacent producing wells. Currently, 3,700,000 gallons/day from 412 MW of installed capacity are being injected into 5 wells. Reinjection has also proven to be a satisfactory method of disposing of geothermal condensate a Imperial Valley, California, and at the Valles Caldera, New Mexico. Author

N75-20864* San Diego Gas and Electric Co., Calif.
UTILITY COMPANY VIEWS OF GEOTHERMAL DEVELOPMENT
Thomas C. Hinrichs *In* JPL Proc. of the Conf. on Res. for the Develop. of Geothermal Energy Resources 31 Dec. 1974 p 345-348
CSCL 10A

The views of geothermal development from a utility company standpoint are presented. The impediments associated with such developments as required reliability and identification of risks are discussed. The utility industry historically is not a risk-taking industry. Support of rapid geothermal development by the utility industry requires identification and elimination of risks or absorption of the risks by other agencies. Suggestions

as to the identification and minimization of risks are made.
Author

N75-20867# Committee on Science and Astronautics (U. S. House).
SYNTHETIC LIQUID FUEL RESEARCH AND DEVELOPMENT ACT OF 1974
Washington GPO 1975 130 p Hearing on H.R. 17400 before Subcomm. on Sci., Res., and Develop. and the Subcomm. on Energy of Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., 17 Dec. 1974
(GPO-44-818) Avail: Subcomm. on Sci., Res., and Develop.

A program is discussed which would deal with research into the methods and feasibility of producing low-cost synthetic fuels, including a sufficient number of demonstration projects to test out various possibilities on a large scale basis. The program would also encourage the production of synthetic fuels from coal, oil shale, and other substances. A cost analysis of research and development is presented along with present and future coal research contracts. M.J.S.

N75-20868*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SYNTHETIC FUELS FOR GROUND TRANSPORTATION WITH SPECIAL EMPHASIS ON HYDROGEN
Jag J. Singh 22 Jan. 1975 50 p refs
(NASA-TM-X-72652) Avail: NTIS HC $3.75 CSCL 21D

The role of various synthetic fuels, for ground transportation in the United States, was examined for the near term (by 1985) and the longer term applications (1985-2000 and beyond 2000). Feasible options include synthetic oil, methanol, electric propulsion, and hydrogen. It is concluded that (1) the competition during the next 50 years will be for the fuels of all types, rather than among the fuels; (2) extensive domestic oil and gas exploration should be initiated concurrent with the development of several alternate fuels and related ancillaries; and (3) hydrogen, as an automotive fuel, seems to be equivalent to gasoline for optimum fuel to air mixtures. As a pollution free, high energy density fuel, hydrogen deserves consideration as the logical replacement for the hydrocarbons. Several research and development requirements, essential for the implementation of hydrogen economy for ground transportation, were identified. Extensive engineering development and testing activities should be initiated to establish hydrogen as the future automotive fuel, followed by demonstration projects and concerted efforts at public education. Author

N75-20869# Sandia Labs., Albuquerque, N.Mex.
FUEL CELLS: DIRECT CONVERSION OF ELECTROCHEMICAL ENERGY INTO ELECTRICITY
R. T. Johnson, Jr. Aug. 1974 49 p refs
(Contract AT(29-1)-789)
(SAND-74-0125) Avail: NTIS HC $3.75

Fuel cells which convert electrochemical energy directly into electrical power and have higher conversion efficiencies than most methods of electrical generation, especially for low power systems, are discussed. Applications in communication systems, residential and commercial utilities (generation of electricity from natural gas), vehicular transportation, and dispersed large-scale power generation and distribution systems are described. The operation and various types of fuel cells and fuels, the principal advantages and problems, and potential applications are outlined. Fuel cells are considered for electrical power for small communities, for remote sites for providing utilities for individual residences, and for commercial buildings and industrial sites as well as for power distribution network, as energy storage devices for handling peak power loads, and for generating electrical energy from coal gasification plants and wastes. NSA

N75-20870# Brookhaven National Lab., Upton, N.Y.
HYDROGEN ECONOMY: A UTILITY PERSPECTIVE
Michael Lotker, Elihu Fein, and Frank J. Salzano 1974 9 p refs Presented at the Winter Power Meeting, New York, 27 Jan. - 2 Feb. 1974 Sponsored by ERDA
(BNL-19267) Avail: NTIS HC $3.25

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

N75-20871# Atomic Energy Commission, Oak Ridge, Tenn. Technical Information Center.
SOLAR ENERGY: A BIBLIOGRAPHY
Dec. 1974 360 p refs
(TID-3351) Avail: NTIS HC $10.00

References are arranged in broad subject categories. Within a given category the arrangement is chronological. The references are made up of complete bibliographic citations. These are followed by a listing of the subject descriptors used to describe each reference for machine storage and retrieval. Three indexes are provided: personal author, subject, and report number. NSA

N75-20872# Oak Ridge National Lab., Tenn.
COMPARATIVE PERFORMANCE CHARACTERISTICS OF CYLINDRICAL PARABOLIC FOCUSING AND FLAT PLATE SOLAR ENERGY COLLECTORS
J. W. Tester, R. M. Mayer, and A. P. Fraas 1974 32 p refs Presented at the ASME Winter Meeting, New York, 17-21 Nov. 1974 Sponsored by ERDA
(Conf-741104-3) Avail: NTIS HC $3.75

Experimental performances of flat plate and cylindrical parabolic focusing solar energy collectors were compared for simulatenous operation under Oak Ridge, Tennessee weather conditions. The flat plate collection system was of conventional design while the focusing collector was a low concentration factor, fixed orientation device that employed a finned tube receiver. The seasonal and diurnal variations in the sun's alignment was critical to performance of the focusing collector. Performance models were developed to predict monthly operation under Oak Ridge weather conditions. The economics of utilizing either system for domestic space heating and air conditioning are discussed.
Author (NSA)

N75-20873# Brookhaven National Lab., Upton, N.Y.
HYDROGEN STORAGE AND PRODUCTION IN UTILITY SYSTEMS Annual Report, 1 Nov. 1973 - 30 Jun. 1974
F. J. Salzano, ed. Jul. 1974 87 p refs Sponsored by ERDA
(BNL-19249; AR-1) Avail: NTIS HC $4.75

Progress is reported in a program for the development of the technology of electrolytic hydrogen production, storage, and reconversion to electricity as a technique for electric energy storage. The program emphasizes the use of metal hydrides (particularly iron-titanium) for hydrogen storage. NSA

N75-20874# Battelle-Northwest, Richland, Wash.
ENERGY AND FIXED NITROGEN FROM AGRICULTURAL RESIDUES
C. A. Rohrman 1974 18 p refs Presented at the Ann. Meeting of the Western Agr. Econ. Assoc., Moscow, Idaho, 26 Jul. 1974 Sponsored by ERDA
(BNWL-SA-5070; Conf-740732) Avail: NTIS HC $3.25

The nature of agriculture residues is examined from the standpoint of carbon content. Conversion of this carbon to a useful energy form and/or processing it to principal forms of fixed nitrogen fertilizers is considered along with the potential or capable forms of fixed nitrogen fertilizers is considered along with the potential or capable magnitude of such conversions based on wheat straw. The economic and engineering problems to be solved in order to acheive such production are identified. Conversion of the organic and carbonaceous constituents of agricultural residues into a gaseous form, primarily hydrogen and carbon monoxide, is discussed. The Pacific northwest wheat production is investigated. It is shown that the energy value of the wheat produced exceeds the energy inputs in the form of fuel and fertilizer by a factor 22.5 not including the recoverable fuel value of the straw. It is indicated that the near future and

long-range energy and fertilizer situations may be alleviated by the carbon resource that exists in the form of recoverable agricultural wastes. NSA

N75-20875# California Univ., Livermore. Lawrence Livermore Lab.

ACOUSTIC ARRAY METHODS FOR INSTRUMENTATION OF IN SITU COAL GASIFICATION

J. W. Sherman and J. W. Woods 22 Oct. 1974 14 p refs (Contract W-7405-eng-48)

(UCID-16591) Avail: NTIS HC $3.25

Geophysical and seismic signal processing are reviewed. The assumed physical properties of the coal burn front are discussed. Several ways in which acoustic arrays can be used for in situ coal gasification are presented and discussed. Author (NSA)

N75-20876# Brookhaven National Lab., Upton, N.Y.

METAL HYDRIDES AS A SOURCE OF HYDROGEN FUEL

J. J. Reilly, R. H. Wiswall, Jr., and K. C. Hoffman 1970 19 p refs Presented at the 160th National Meeting of the Am. Chem. Soc., Chicago, 14 Sep. 1970 Sponsored by ERDA

(BNL-14804-R; Conf-700911-4) Avail: NTIS HC $3.25

The use of reversible metal hydrides as a convenient, cheap, and safe source of hydrogen fuel is investigated. The heat of dissociation is supplied by the waste heat of the energy converter or from the surrounding environment. The hydride is exhausted and then regenerated by supplying hydrogen at a pressure above its dissociation pressure. Metal hydrides studied are: vanadium dihydride, magnesium nickel hydride, and magnesium hydride. The hydrogen composition and dissociation pressure is given for each system. These systems are shown to be ideal for use as a *hydrogen source for fuel cell power systems and for modified* internal combustion engines, gas turbines, etc. Author (NSA)

N75-20878# European Space Research Organization, Paris (France).

REFLECTOR-ABSORBER SYSTEMS FOR SOLAR THERMIONIC CONVERTERS

Siegfried Kelm Jan. 1975 59 p refs Transl. into ENGLISH of Reflektor-Absorbersysteme fuer Solarthermionische Energiewandler, DLR-FB-74-23, DFVLR, 19 Jun. 1974 Original GERMAN report available from DFVLR, Porz, West Ger. 27 DM

(ESRO-TT-123; DLR-FB-74-23) Avail: NTIS HC $4.25

Some reflector-absorber systems are described for attaining temperatures from 1000 - 1300 C by using solar energy. Thermionic converters can operate in this temperature range suitable for the production of electric energy. The absorber is designed in such a way that the absorber is accommodated to the converter as regards the operating temperature and heat transfer. Some applications of solar thermionic energy systems for space and earth are discussed. For large-scale solar energy conversion a conventional steam power station can be added to the thermionic system for producing more electric power.

Author (ESRO)

N75-20879# General Electric Co., Philadelphia, Pa. Space Div.

SOLAR HEATING AND COOLING OF BUILDINGS STUDY CONDUCTED FOR DEPARTMENT OF THE ARMY. VOLUME 1: EXECUTIVE SUMMARY AND IMPLEMENTATION PLANS

Jun. 1974 66 p Sponsored by Army

(AD-A002576; DOC-74SD4226-Vol-1; CERL-TR-E-65-Vol-1) Avail: NTIS CSCL 13/1

Feasibility studies on solar heating and cooling of buildings are summarized. Report covers site and building selection, technology assessment, and implementation plan summaries dealing with the retrofitting of existing buildings. GRA

N75-20880# General Electric Co., Philadelphia, Pa. Space Div.

SOLAR HEATING AND COOLING OF BUILDINGS STUDY CONDUCTED FOR DEPARTMENT OF THE ARMY. VOLUME 2: TECHNICAL REPORT

Jun. 1974 616 p refs Sponsored by Army

(AD-A002563; DOC-74SD4226-Vol-2; CERL-TR-E-65-Vol-2) Avail: NTIS CSCL 13/1

A study of the use of solar energy for the heating and cooling of buildings at Army installations was conducted with two principal objectives: (1) the preliminary design of a solar heating system for retrofitting on an existing building and (2) the evaluation of solar system concepts for the combined heating and cooling of a building in the construction planning phase. A two story administration building at Fort Belvoir, Virginia was selected for the retrofit heating only application and a single story classroom building planned for Fort Huachuca, Arizona was selected for the evaluation of combined solar heating and cooling system concepts. In both applications, the solar energy was absorbed by roof mounted, flat-plate collectors, heating a circulating water flow which was collected in large thermal storage tanks until needed. Assessments were made of the principal technologies associated with solar collectors, thermal energy storage, and cooling by means of solar energy. Implementation plans for follow-on phases describing further design activities, schedules, and cost estimates are provided for both the Fort Belvoir and Fort Huachuca Buildings. GRA

N75-20881# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

MANAGEMENT OF POWER PLANT WASTE HEAT IN COLD REGIONS

Haldor W. C. Aamot Dec. 1974 195 p refs

(DA Proj. 4A0-62103-A-896; DA Proj. 4A1-62121-A-896) (AD-A003217; CRREL-257) Avail: NTIS CSCL 13/1

This report is divided into three principal parts and one concluding part. Part I examines the basic possible methods of waste heat disposal and the available heat sinks. Then it describes alternatives for waste heat utilization because waste heat is a large, free resource and because better utilization reduces the disposal problem. Part II evaluates the economic feasibility of the promising alternatives for waste heat utilization and selects the best choice for detailed analysis. Part III develops and evaluates a design for the city of Fairbanks based on the most promising *concept. The design of a heat pump system using power plant* cooling water to heat homes in Fairbanks, Alaska, shows that, compared with oil burning and electric resistance heating, waste heat disposal from the plant is reduced, air pollution is reduced and its control improved, overall energy needs are reduced, and opportunities for fuel substitution are increased. GRA

N75-20882# EIC, Inc., Newton, Mass.

SULFUR-BASED LITHIUM-ORGANIC ELECTROLYTE SECONDARY BATTERIES Quarterly Report, 4 Jun. - 3 Sep. 1974

Gerhard L. Holleck, S. Barry Brummer, and Fred S. Shuker Dec. 1974 48 p refs

(Contract DAAB07-74-C-0072; DA Proj. 1T1-61102-A-34A) (AD-A003309; C-405-3; ECOM-74-0072-3; QR-3) Avail: NTIS CSCL 10/3

This program is aimed at developing a rechargeable organic-electrolyte lithium battery to operate over the range -40 to +160F, have an energy density approaching 100 Whr/lb, a cycle life in excess of 500, and high charge retention. The approach is to use positive electrodes based on higher sulfides of Nb, Ti and V. Nb and Ti disulfides and trisulfides were prepared thermally. They were characterized by scanning electron microscopy and by X-ray diffraction. All sulfides are electrochemically active and show similar overall behavior. The discharge mechanism involves a change in the valence of the transition metal, while maintaining the original layer structure, and compensation of the negative charge by intercalation of cations. Nature and concentration of the cations affect the discharge behavior. Non-metals such as S and I could either not be intercalated or were electrochemically inactive. Differences in the electrochemical behavior of the various *sulfides and electrode structures are discussed.* GRA

N75-20883# National Center for Energy Management and Power, Philadelphia, Pa.

TECHNOLOGY FOR THE CONVERSION OF SOLAR ENERGY TO FUEL GAS Annual Report

31 Jan. 1974 153 p refs
(Grants NSF GI-2729; NSF GI-34991)
(PB-238103/6; NSF/RANN/SE/GI34991/PR73/4;
NSF/RA/N-74-153) Avail: NTIS HC $6.25 CSCL 07A

The formation of methane by biological conversion of a number of organic materials was examined. The materials exposed to the anaerobic fermentation process included paper, grass, household garbage, fresh water algae, water hyacinth, seaweed, cattle manure, dry manure, dry dog food. These materials were examined separately and in various combinations. During operation of the digester, the amount and composition (methane and carbon dioxide) of the gases produced by the fermentation were determined and extensive chemical analyses of the composition of the liquid contents of the digesters were carried out. Similar chemical analyses of the various materials fed to the digester were carried out as well as analyses of the sea water used in several of the studies. GRA

N75-20884# Delaware Univ., Newark. Inst. of Energy Conversion.
ENVIRONMENTAL ASPECTS OF CADMIUM SULFIDE USAGE IN SOLAR ENERGY CONVERSION. PART 1: TOXICOLOGICAL AND ENVIRONMENTAL HEALTH CONSIDERATIONS, A BIBLIOGRAPHY
Nurtan A. Esmen, Larry L. Olson, and Gale C. Quist 1 Jun. 1973 53 p refs
(Grant NSF GI-34872)
(PB-238285/1; NSF/RANN/SE/GI34872/TR73/5;
NSF/RA/N-73-022) Avail: NTIS HC $4.25 CSCL 06T

The use of cadmium sulfide solar cells was proposed in order to solve a very pressing problem of the energy needs of this civilization. Extensive studies to ensure that the introduction of this new technology will not create environmental problems detrimental to the health and well being of the society have been undertaken. Cadmium is known to be a toxic substance and ought to be treated with respect. It is necessary to investigate first the possible routes of introduction of cadmium to the environment due to the development of the proposed technology. If cadmium is to be used in solar cells to a great extent, the first problem arises in the procurement and manufacturing operations. GRA

N75-20885# Alaska Univ., College. Geophysical Inst.
WIND POWER POTENTIAL OF ALASKA. PART 1: SURFACE WIND DATA FROM SPECIFIC COASTAL SITES Scientific Report
Tunis Wentink, Jr. Aug. 1974 136 p refs
(Grant NSF GI-43098)
(PB-238507/8; UAG-R-225; NSF/RANN/SE/GI-43098;
NSF/RA/N-74-127) Avail: NTIS HC $5.75 CSCL 10A

Near surface wind speed conditions for eleven Aleutian Island sites and five west coast mainland locations in Alaska are given. The data are presented in tables and through speed frequency or so-called velocity duration curves. Emphasis in this report is on characterization of the wind regimes as these may apply to the design and installation of windmills for power generation at specific sites in Alaska. It is already clear that Cold Bay is of major importance for possible plants, and energy export. Also, Adak and Shemya have considerable potential for local power generation from winds, for military use. St. Paul, Kotzebue, and Tin City have similar above average (for Alaska) potential for civilian use of wind power. GRA

N75-20886# Arizona State Univ., Tempe.
TERRESTRIAL PHOTOVOLTAIC POWER SYSTEMS WITH SUNLIGHT CONCENTRATION Quarterly Report
Charles E. Backus, Donovan L. Evans, Leon W. Florschuetz, Dean L. Jacobson, and David T. Nelson 1 May 1974 132 p refs
Prepared in cooperation with Textron Electronics, Inc., Sylmar, Calif.
(Grant NSF GI-41894)
(PB-238582/1; NSF/RANN/SE/GI-41894/PR/74/1;
NSF/RA/N-74-055; QR-1) Avail: NTIS HC $5.75 CSCL 10B

A program was initiated to investigate the basic parametric relationships inherent in a solar system that concentrates sunlight onto solar cells. These relationships can be used to determine the optimum combination of components that minimize the cost per watt of these systems. The first quarter of this investigation was directed to literature surveys and preliminary analysis of all the components starting primarily with the lower concentration ratios. Existing analytical models were used to study solar cell response to high intensities and the characteristics of several optical concentrators operating over a time period of a year. Methods were developed to predict the 'direct' incident radiation. Land-space utilization was shown to be related to the number of hours of tracting, and hence the watt-hours of power that can be generated. GRA

N75-20887# Wisconsin Univ., Madison. Engineering Experiment Station.
WISCONSIN SUPERCONDUCTIVE ENERGY STORAGE PROJECT, VOLUME 1
R. W. Boom, H. A. Peterson, and W. C. Young 1 Jul. 1974 468 p refs Sponsored by NSF
(PB-238082/2; NSF/RA/N-74-065-Vol-1) Avail: NTIS HC $11.50 CSCL 10C

The initial feasibility and conceptual design study phase of superconductive energy storage project was completed. A thyristorized Graetz bridge converter, widely used and accepted by the power industry around the world, serves as the interface between the three phase power system and the energy storage inductor. The combination of inductor and converter permits energy to be taken out of the system under conditions of light load and returned to the system under conditions of heavy or peak load. Reversibility is achieved very quickly without switching delays. Such units installed in a power system, with appropriate control, can be beneficial from a system damping and stability point of view. GRA

N75-20888# California Polytechnic State Univ., San Luis Obispo.
RESEARCH ON THE APPLICATION OF SOLAR ENERGY TO THE FOOD DRYING INDUSTRY Progress Report, 1 Jul. - 30 Sep. 1974
Thomas Lukes Oct. 1974 312 p refs
(Grant NSF GI-42944)
(PB-238073/1; NSF/RA/N-74-130; PR-3) Avail: NTIS HC $9.25 CSCL 06C

Feasibility of substituting solar energy for natural gas in the food dehydration industry is discussed. The drying of vegetables at lower than normal temperatures is investigated. Design of solar collector is described. The following tasks are covered: literature review of dehydrated food industry; current and projected energy demands; cost study for dehydration of carrots and prunes, and projections for 1975, 1985, 2000; socio-legal implications of solar collectors; and economic and technical feasibility of solar energy to the food drying industry. GRA

N75-20889# McDowell-Wellman Engineering Co., Cleveland, Ohio.
LARGE DIAMETER 300 PSI GASIFIER. PRELIMINARY ENGINEERING REPORT. VOLUME 1: DESCRIPTION Interim Report, Dec. 1973 - Sep. 1974
Wallace Hamilton Dec. 1974 80 p refs
(Contract DI-14-32-0001-1524)
(PB-238360/2; OCR-103-INT-1) Avail: NTIS HC $4.75 CSCL 10A

The preliminary engineering design of a twenty-five foot diameter high pressure gas producer is presented. At is nominal design capacity the producer will gasify 70 tons per hour of highly caking bituminous coal at a pressure of 300 psi. Air blown, it will produce about 170,000 SCFM of low Btu gas (165 Btu/SCF). The containment structure is designed for ease of fabrication, a minimum of field welding, and rail shipment of all components. A multiple unit grate system provides individual control of fire zone and coal bed conditions. The gas producer system is under an automatic control which provides a log of production rates, gas quality, and operating conditions. GRA

N75-20890# Texas Instruments, Inc., Dallas.
DEVELOPMENT OF LOW COST THIN FILM POLYCRYSTALLINE SILICON SOLAR CELLS FOR TERRESTRIAL APPLICA-

TIONS Quarterly Progress Report, 1 Jul. - 30 Sep. 1974
Ting L. Chu Oct. 1974 41 p refs
(Grant NSF GI-38981)
(PB-238505/2; QPR-3; NSF/RANN/SE/GI-38981/PR/74/3; NSF/RA/N-74-144) Avail: NTIS HC $3.75 CSCL 10B

Development of low-cost thin film polycrystalline silicon solar cells suitable for large-scale terrestrial utilization was investigated. Deposition of silicon on graphite substrates by the thermal reduction of trichlorosilane was studied along with fabrication of silicon solar cells on graphite and metallurgical-grade silicon substrates. A voltage-doubler was designed and constructed. GRA

N75-20891 Rutgers Univ., New Brunswick, N.J.
BENTHAL DECOMPOSITION OF ADSORBED OCTADECANE Ph.D. Thesis
Harry Lesley Allen, III 1974 351 p
Avail: Univ. Microfilms Order No. 74-27578

The behavior of a benthal deposit containing octadecane under varying conditions of seed concentration, flow rate, dissolved oxygen concentration, surface area, nutrient concentration, and salt concentration is investigated. The rate controlling factors, the means by which each of these factors exerts its effect, and the way in which the expression of each of these effects changes with time are identified along with the relationship between the benthal decomposition of adsorbed octadecane and the overall oxygen uptake of the benthal deposits. Benthal deposits composed of chromosorb and octadecane adsorbed onto chromosorb were seeded with acclimatized mixed liquor suspended solids and confined in bottle reactors. Tap water was dosed with ammonia nitrogen and phosphate and with allylthiourea to inhibit nitrification and was passed through the benthal reactors at a fixed flow rate to simulate natural stream conditions. Measurements were taken of influent dissolved oxygen, effluent dissolved oxygen, flow rate, and deposit surface area. Results are presented.
Dissert. Abstr.

N75-20936# Kellogg (M. W.) Co., Houston, Tex.
CHANGES IN THE GLOBAL ENERGY BALANCE Final Report, 15 Jun. - 15 Oct. 1974
Alden McLellan, IV (Wisconsin Univ., Madison) Oct. 1974 26 p refs
(Contract EPA-68-02-1308)
(PB-238075/6; EPA-650/2-74-116) Avail: NTIS HC $3.75 CSCL 04B

The effect is estimated of small changes of independent climatic variables on the global energy budget. The problem was approached from an historical perspective. The components were investigated of these changing variables as to whether or not their change is due to natural causes or to man-related activities. The discussion centers on particulates in the atmosphere, both natural and man made, but solar radiation, carbon dioxide, and heat exchange processes are also considered. At the end of the paper conclusions are reached as to the importance of climatic change and what man can do to better define the problems related to the variables that affect the energy budget. GRA

N75-21028# Herbert H. Lehmann Coll., Bronx, N.Y. Dept. of Family and Consumer Services.
THE ENERGY CRISIS AND DECISION MAKING IN THE FAMILY Final Report, Jun.-Dec. 1974
Rovena Kilkeary Jan. 1975 57 p
(Contract NSF GY-11543)
(PB-238783/5; NSF/SOS-GY-11543) Avail: NTIS HC $4.25 CSCL 05J

The exploratory study in the Queens and Bronx sections of New York City was designed to obtain information about family use of energy during the energy shortage of 1974. The Queens community had experienced an extended power failure the previous summer; the Bronx community had not. A questionnaire which recorded family characteristics, the respondent's energy knowledge, and the respondent's actual practices was used to determine whether exposure to such a crisis situation had resulted in different energy comsumption practices. GRA

N75-21097# Los Alamos Scientific Lab., N.Mex.
MAGNETIC ENERGY TRANSFER AND STORAGE (METS) PROGRAM SCHEDULES FOR A FUSION TEST REACTOR (FTR)
J. D. Rogers, C. E. Swannack, K. I. Thomassen, and D. M. Weldon Sep. 1974 31 p refs
(Contract W-7405-eng-36)
(LA-5748-MS) Avail: NTIS HC $3.75

A plan with schedules for the magnetic energy transfer and storage (METS) program for a fusion test reactor (FTR) is presented for component and materials development. The plan extends into FY's 78 and 79 and leads to the design, fabrication and operation of an applied helical-field half wavelength section of a coupled superconducting prototype system to demonstrate engineering feasibility. Facilities, components, materials, costs, and manpower are discussed in relation to the program plan and schedules.
Author (NSA)

N75-21098# Brookhaven National Lab., Upton, N.Y.
SYNTHETIC FUELS FROM FUSION REACTORS
J. R. Powell, F. J. Salzano, W. Sevian, and P. Bezler [1974] 12 p refs Sponsored by ERDA
(BNL-19351) Avail: NTIS HC $3.25

The technical, environmental, and economic features of a synthetic fuels economy based on fusion reactors are evaluated. Analyses of alternate possible U.S. energy systems for 2020 AD indicate that CTR's can deliver synthetic fuels based on electrolytic hydrogen (H2 gas, H2 liquid, and methanol) at costs competitive with natural fossil fuels and synthetic fuels derived from coal. With less conservative CTR and synthetic fuel production technology, CTR-derived synthetic fuels should be substantially cheaper than fossil fuels. A synthetic fuels economy based on CTR's has substantial environmental benefits, including much lower chemical and radioactive emissions and the elimination of strip mining. The effect of various tokamak reactor parameters is examined, including first wall loading, reactor size, and fuel cycle. Large reactor sizes appear feasible, up to 20 GW(e) electrical, because of the larger market and larger transmission distances with synthetic fuels. Author (NSA)

N75-21099# Atomic Energy of Canada Ltd., Chalk River (Ontario). Nuclear Labs.
REVIEW OF THE PROSPECTS FOR LASER INDUCED THERMONUCLEAR FUSION
Jul. 1974 218 p refs
(AECL-4840) Avail: ERDA Depository Libraries HC $14.00

The report is basically a review and contains the texts of verbal presentations to the AECL Senior Management Committee. Appendices which give a historical background and enlarge upon several technical aspects of laser fusion are included.
Author (NSA)

N75-21101# Massachusetts Inst. of Tech., Cambridge.
MIT FUSION TECHNOLOGY PROGRAM Technical Progress Report
30 Jun. 1974 21 p refs
(Contract AT(11-1)-2431)
(COO-2431-1) Avail: NTIS HC $3.25

Technical progress is summarized for the following research areas: (1) simulation of radiation effects in fusion materials, (2) assessment of the thermal design of fusion reactor systems, (3) pellet fueling of fusion reactors, and (4) technology assessments related to fusion reactors. NSA

N75-21104# Brookhaven National Lab., Upton, N.Y.
SYNOPSIS OF STUDIES ON SYNTHETIC FUELS PRODUCTION BY FUSION REACTORS
J. Powell Jun. 1973 22 p Sponsored by AEC
(BNL-19336) Avail: NTIS HC $3.25

The principal conclusions of this study are: (1) synthetic fuels derived from fusion reactors can supply most of the U.S. energy needs, eliminating all oil and gas imports, coal gasification,

and coal strip mining. Fusion reactors can supply the synthetic fuels indefinitely into the future. (2) Synthetic fuels from fusion reactors will probably be more expensive than synthetic fuels derived from coal. (3) Fusion reactors seem preferable to fission reactors for the production of synthetic fuels. (4) CTR power generation in the U.S. is almost an order of magnitude larger if CTRs are used for synthetic fuel production rather than only for electric generation. (5) CTR unit reactor size can be much larger if synthetic fuels are produced. (6) Catalyzed DD fuel cycles appear competitive with DT fuel cycles for large power ratings. (7) The large reactor ratings possible with synthetic fuel production should significantly ease plasma containment problems. NSA

N75-21153 Arizona Univ., Tucson.
REGIONAL ECONOMICS: A SUBSET OF SIMULATION OF THE EFFECTS OF COAL-FIRED POWER DEVELOPMENT IN THE FOUR CORNERS REGION Ph.D. Thesis
Wayne Leonard Everett 1974 148 p
Avail: Univ. Microfilms Order No. 74-28304

An analysis of how a particular resource, energy (i.e., energy *in the form of electric power derived from strip-mined coal*) is embedded in the economic growth of the Southwest. The basic econometric tool that was utilized is a regional input-output model which evolved from a California-Arizona linked input-output model. The decision space developed, which effectively acted as a mechanism for restricting coal-fired power availability in future years, was based on a schedule of electric energy capacity additions as delineated by the U.S. Department of Interior's Southwest Energy Study. The regional economic analysis described suggests there is a definite relationship between coal-fired power availability and regional economic growth in the Southwest. Furthermore, the estimates of incremental decreases in regional economic activity associated with certain levels of decreased coal-fired power development are of such a magnitude that one could characterized the relationship as very significant.
Dissert. Abstr.

N75-21154*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
UNITED STATES TRANSPORTATION FUEL ECONOMICS (1975 - 1995)
Arthur D. Alexander, III Washington Apr. 1975 30 p refs
(NASA-TM-X-3197; A-5878) Avail: NTIS HC $3.75 CSCL 05C

The United States transportation fuel economics in terms of fuel resources options, processing alternatives, and attendant economics for the period 1975 to 1995 are evaluated. The U.S. energy resource base is reviewed, portable fuel-processing alternatives are assessed, and selected future aircraft fuel options - JP fuel, liquid methane, and liquid hydrogen - are evaluated economically. Primary emphasis is placed on evaluating future aircraft fuel options and economics to provide guidance for future strategy of NASA in the development of aviation and air transportation research and technology. Author

N75-21155# Washington Univ., St. Louis, Mo. Center for the Biology of Natural Systems.
THE EFFECT OF RECENT ENERGY PRICE INCREASES ON FIELD CROP PRODUCTION COSTS Final Report
Barry Commoner, Michael Gertler, Robert Klepper, and William Lockeretz 1 Dec. 1974 114 p refs
(Grant NSF GI-04389)
(PB-238659/7; CBNS-AE-1) Avail: NTIS. HC $5.25 CSCL 02B

The cost of the energy used to produce 14 field crops in a total of 29 different production situations has been determined. The following kinds of energy consumption are considered: fertilizers; pesticides; operation of field equipment; crop drying; irrigation; and hauling. The change in the costs of these energy requirements between 1970 and 1974 has been computed, assuming the same production technology. The energy costs are compared to the total variable production costs and to the price received for the crop, for both 1970 and 1974. In most cases, the fraction of total variable costs that is attributable to energy was about the same in 1974 and 1970, while energy costs as a fraction of price received for the crop have generally declined.
GRA

N75-21156# Army War Coll., Carlisle Barracks, Pa.
ECONOMIC IMPACT ON THE FREE WORLD OF THE OIL CRISIS, OCTOBER 1973 - MARCH 1974 Student Essay
Richard L. Nidever 31 Oct. 1974 34 p refs
(AD-A003136) Avail: NTIS CSCL 05/4

The Arab-Israeli October 1973 war resulted in an oil embargo against countries supporting Israel and substantially higher petroleum prices charged by oil-exporting countries. The essay presents pre-war petroleum conditions, the development and effect of the oil embargo, international economic imbalances created by higher oil prices, and the impact of the energy shortage and higher prices on US economy and industrial activities. The seriousness of trade imbalances caused by higher oil prices and the shift of economic power from oil-consuming to oil-producing nations is developed. The newly gained economic strength of oil-producing countries and how the wealth is being used is discussed. The current inability of the Western World to cope with or influence the actions of the oil-producing countries is also presented. GRA

N75-21160# Mitre Corp., McLean, Va.
A COMPARATIVE ANALYSIS OF THE ENERGY CONSUMPTION FOR SEVERAL URBAN PASSENGER GROUND TRANSPORTATION SYSTEMS Final Report
John G. Lieb Feb. 1974 95 p refs Sponsored by DOT
(PB-238041/8; MTR-6606; UMTA-VA-06-0023-74-3) Avail: NTIS HC $4.75 CSCL 10A

The energy consumption rates, or efficiency, of the urban passenger ground transportation modes are compared. In addition, the efficiency of new transit systems being developed including large-and small-vehicle PRT's and Dual Mode, are estimated. Various measures of actual and potential efficiency are used. On an average load basis, mass transit (transit bus and rapid rail) is from 2 to 3 times more efficient than the predominate personal modes (light truck and passenger car) and on a crush load basis, 4 times more efficient. GRA

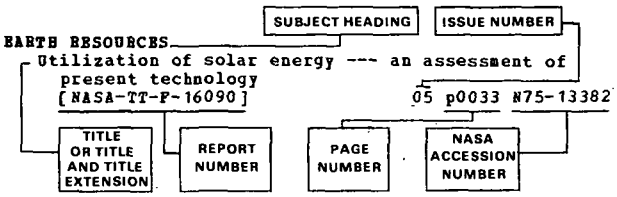
N75-21216 Joint Publications Research Service, Arlington, Va.
SCIENTIFIC RESEARCH SEEKS NEW SOURCES OF ENERGY
Teofil Popovici *In its* Transl. on Eastern Europe: Sci. Affairs, No. 456 (JPRS-64270) 7 Mar. 1975 p 16-20 Transl. into ENGLISH from Era Socialista (Bucharest), no. 24, Dec. 1974 p 14-16

The production of electricity is discussed and it is shown that by 1980 the production of electricity will reach 75-80 billion kilowatt-hours. It is also shown that hydroelectric and thermoelectric power generation will be developed to absorb the increase in electricity. M.C.F.

N75-21218# European Space Research Organization, Paris (France).
PROBLEMS OF THE FUTURE AND POTENTIALITIES OF SYSTEM ENGINEERING
Nov. 1974 149 p refs Transl. into ENGLISH of "Zukunfstprobl. *und Systemtech. Moeglichkeiten,*" DLR-Mitt-74-13, DGLR, Apr. 1974 Original German report available from ZLDI, Munich DM 32.35
(ESRO-TT-110; DLR-Mitt-74-13) Avail: NTIS HC $5.75

Problems related to the shortcoming of raw materials and their substitution are discussed. Models relating to world population development are considered. Future availability of metalic materials is surveyed, and the development of plastic materials is discussed from the viewpoint of chemistry and *production techniques. An outlook for future traffic development* is included along with possible answers to the energy problem.
ESRO

Typical Subject Index Listing



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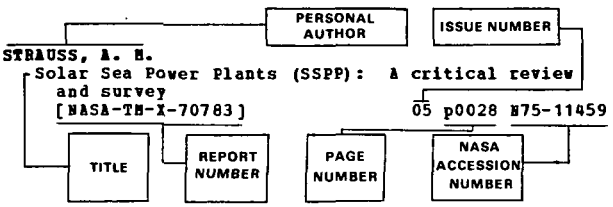

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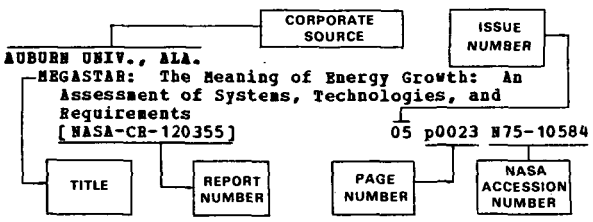

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Chemical to electromagnetic energy conversion techniques
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The 1974 AGARD Annual Meeting: The energy problem: Impacts on military research and development
06 p0075 N75-16977

AEROJET NUCLEAR CO., IDAHO FALLS, IDAHO.
Idaho geothermal R and D project report for period 16 December 1973 - 15 March 1974
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AIR FORCE SYSTEMS COMMAND, WRIGHT-PATTERSON AFB, OHIO.
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[AD-784708] 05 p0025 N75-10597
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Solar collector thermal power system. Volume 3: Basic study and experimental evaluation of thermal train components
[AD-A000942] 06 p0091 N75-19341

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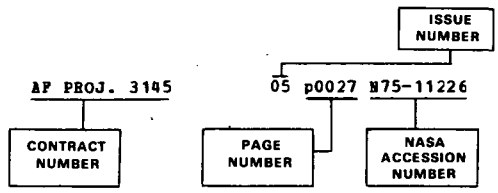

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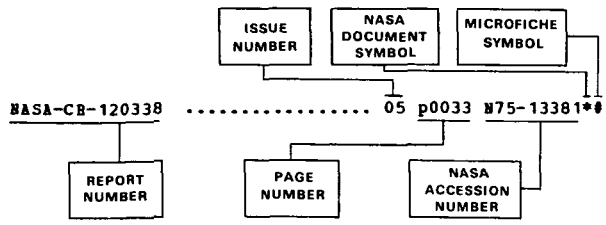

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7. Author(s)	8. Performing Organization Report No.
	10. Work Unit No.
9. Performing Organization Name and Address National Aeronautics and Space Administration Washington, D. C. 20546	11. Contract or Grant No.
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15. Supplementary Notes

16. Abstract

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