

28



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A CONTINUING BIBLIOGRAPHY
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A 75-19577—A 75-29188

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<i>DOCUMENT</i>	<i>DATE</i>	<i>COVERAGE</i>
NASA SP-7042	April 1974	January 1968—December 1973
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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ENERGY

A Continuing Bibliography

With Indexes

Issue 6

44

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)*
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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.

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TABLE OF CONTENTS

IAA Entries	45
STAR Entries	65

Subject Index	A-1
Personal Author Index	B-1
Corporate Source Index	C-1
Contract Number Index	D-1
Report / Accession Number Index	E-1

TYPICAL CITATION AND ABSTRACT FROM STAR

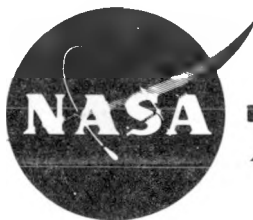
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ACCESSION NUMBER	STUDY OF ACTIVE COOLING FOR SUPERSONIC TRANSPORTS	Final Report	CORPORATE SOURCE
TITLE	G. D. Brewer and R. E. Morris	Feb. 1975 152 p refs	PUBLICATION DATE
AUTHORS	(Contract NAS1-13226)		AVAILABILITY SOURCE
CONTRACT OR GRANT	(NASA-CR-132573)	Avail: NTIS HC \$6.25 CSCL 01C	COSATE CODE
REPORT NUMBER	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		

TYPICAL CITATION AND ABSTRACT FROM IAA

NASA SPONSORED DOCUMENT	A75-24957	#	Effect of attitude constraints on solar-electric geocentric transfers	AVAILABLE ON MICROFICHE
ACCESSION NUMBER	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.	TITLE
AUTHORS	Contract No. NAS3-18886.			AUTHORS AFFILIATION
	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.			TITLE OF PERIODICAL
				PUBLICATION DATE

A Listing of Energy Bibliographies Contained in This Publication :

1. Coal petrography and petrology. A bibliography 1964 - 1973
N75-16123 p0072
2. 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
N75-19839 p0095
3. Solar energy: A bibliography
N75-20871 p0103



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. Iceman (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. AEC-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 upravleniya iadernymi kosmicheskimi energeticheskimi ustanovkami). Edited by B. N. Petrov. Moscow, Izdatel'stvo Mashinostroyeniye, 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 formation 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 Nutzenanwendung 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 presented. 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. Meulenbergh (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 tetrahedra 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 cylindrical 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. Freymy 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 (Radio-technique-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)

A75-24876 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, 1975. 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.

A75-24785 # 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 (RAL, 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 reconvertng 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 (Ketrion, 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 v^2/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. 328-328. 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'tampnykh 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 fotopreobrazovatel'ia). 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 of 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. Baibutayev, 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_xGa_{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_xGa_{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. G1-41305.

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. Blaigher, 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 Elektroenergie-technik). 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 exchangers, 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 Ucení Technické, 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 termo-emissionnykh 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 assembly 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 Astronautical 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 simplification 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 benefits 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 CSCI 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 CSCI 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 CSCI 081

Proceedings of a workshop on basic research needs for tertiary oil recovery are presented. Topic areas cover: Low interfacial tensions and residual oil; behavior of 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)

IUCID-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 rubbleizing 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 rubbleization 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 presented 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 econometric 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 generated in part by reaction of discrete 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-856)

(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 Nikolaus 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 reflectivities 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-36731X/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 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 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-236184/0; 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 YIELD TABLES FOR OIL SHALE SEQUENCES IN CORES FROM THE UINTEA 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 NO_x 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 Vataavuk May 1974 55 p refs (PB-235736/6; AP-42-Suppl-3) Avail: NTIS HC \$4.25 CSCL 138

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 "Plazmennyye 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 Ludwig 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. Blokhin [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. Viktor 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 CSDL 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 CSDL 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. Steunenbergh, 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 $\text{Ca/LiCl-KCl, CaCrO}_4/\text{Fe}$. 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 thought to reflect film and fouling conditions typical in clean sea water. The turbine has set the size 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 128.27:8647 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 Hugoniot 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

N75-17454# 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 at 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. G.R.A.

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-236765/5; 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 ECONOM-
ICS**

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 "Huetten, des Ingenieurs Taschen-
buch" Berlin, Wilhelm Ernst and Sohn, 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. on the Probl. of MHD Energy Conversion (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. Tegin, 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 Commission

(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, Abraham 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

N75-17826# 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-32182)
(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 Atlantic 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 is 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. Stepniowski 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 CSCI 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 CSCI 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. McDermitt Feb 1975 104 p refs

(Contract NAS8-30268)

(NASA-CR-120623, LMSC-HREC-TR-D390666) Avail: NTIS HC \$5.25 CSCI 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 conducive to the processes of interest. The analysis indicates 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 secondary 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 CSCI 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 modestly 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; A LA-EMB-X996-149R-01) Avail: NTIS HC \$3.75 CSCL 081

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; A LA-EMB-X996-149R-03) Avail: NTIS HC \$3.75 CSCL 081

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 081

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 so-called 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 Garching, 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

N75-18765# 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 CSCI 081

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-OF-60-74) Avail: NTIS HC \$5.25 CSCI 081

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 CSCI 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 CSCI 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 CSCI 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 CSCI 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 stationary 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 SUPER-CONDUCTING 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 D1-14-32-0001-1533)

(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. Olenov and G. A. Khoiryshev 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 01

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/FeS_2 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 $R/R_{\text{sub } c}$, where $R_{\text{sub } c}$ 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 section 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; OCR-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 PROCESSES, 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 Synthene 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-tehnicheskaya 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 /n 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/O) 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

N75-20893# California Univ., Livermore. Lawrence Livermore Lab.

METHODOICAL 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 is 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 commercially 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 critical 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 commercially, 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 shutdown 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)
 CSDL 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
 CSDL 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
 CSDL 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
 CSDL 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
 CSDL 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
 CSDL 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

CSSL 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/l 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/l. A product quality of 27.5 mg/l 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

CSSL 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

CSSL 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

CSSL 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

CSSL 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

CSSL 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

CSSL 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 at 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 CSDL 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 simultaneous 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. Rohman 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 achieve 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 tracking, 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 its 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 consumption 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. Sevan, 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 characterize 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 "Zukunftstprobl. 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 metallic 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.

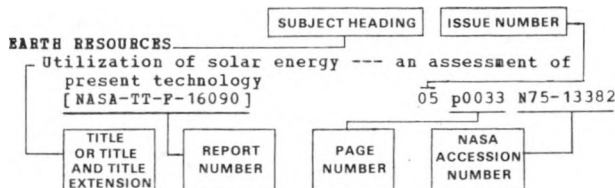
ESRO

SUBJECT INDEX

ENERGY / A Continuing Bibliography (Issue 6)

OCTOBER 1975

Typical Subject Index Listing



The subject heading is a key to the subject content of the document. The title or title and title extension provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The issue page and accession numbers are located beneath and to the right of the title e.g., 05 p0033 N75-13382. Under any subject heading the accession numbers are arranged in sequence with the IAA accession numbers appearing first.

A

ABSTRACTS

- NSF-RANN energy abstracts. A monthly abstract journal of energy research, volume 2, no. 4 [ORNL-EIS-74-52-VOL-2-4] 05 p0029 N75-11469
- NSF-RANN energy abstracts [ORNL-EIS-74-52-VOL-2-5] 06 p0068 N75-16092

AC GENERATORS

- The Harwell thermo-mechanical generator 05 p0009 A75-10579
- Superconducting synchronous machine 06 p0061 A75-27967

ACOUSTIC INSTABILITY

- Possible development of acoustical instability in a system consisting of a combustion chamber and a subsonic MHD generator 06 p0045 A75-19959

ACOUSTICS

- Acoustic array methods for instrumentation of in situ coal gasification [UCID-16591] 06 p0104 N75-20875

ADHESIVES

- Investigations and selection of components and materials for flexible solar generator 06 p0050 A75-24182

AERODYNAMIC CONFIGURATIONS

- Impact on aerodynamic design 06 p0075 N75-16982
- Fuel conservation possibilities for terminal area compatible aircraft [NASA-CR-132608] 06 p0091 N75-19224

AERODYNAMIC STABILITY

- Unsteady aerodynamics of variable pitch vertical axis windmill [AIAA PAPER 75-649] 06 p0063 A75-28604

AEROSPACE ENGINEERING

- The heat pipe - Its development, and its aerospace applications 05 p0015 A75-15054
- The application of aerospace technology in the cryogenics field 06 p0048 A75-23239
- Applications of aerospace technology in the electric power industry 06 p0079 N75-17197

AEROSPACE INDUSTRY

- Technology application at Rockwell International 06 p0078 N75-17189

AEROSPACE SCIENCES

- Research and technology operating plan summary: Fiscal year 1975 research and technology program --- space programs, energy technology, and aerospace sciences [NASA-TM-X-70410] 06 p0096 N75-20155

AEROSPACE SYSTEMS

- Mission and organization of the DFVLR: Two years of integrated society of German aeronautical and space flight research [NASA-TT-F-16086] 05 p0035 N75-13882
- Transfer of space technology to industry 06 p0078 N75-17195

AGRICULTURE

- Energy and fixed nitrogen from agricultural residues [BNWL-SA-5070] 06 p0103 N75-20874

AIR CONDITIONING

- Energy carriers in space conditioning and automotive applications - A comparison of hydrogen, methane, methanol and electricity 05 p0005 A75-10540
- Selection and evaluation of the University of Florida's solar powered absorption air conditioning system [ASME PAPER 74-WA/SOL-6] 05 p0019 A75-16889
- Assessment of Rankine cycle for potential application to solar-powered cooling of buildings [ASME PAPER 74-WA/SOL-7] 05 p0019 A75-16890
- Simulation of a solar heating and cooling system --- for houses 06 p0048 A75-23018
- Solar operation of ammonia-water multistage air conditioning cycles in the tropics 06 p0048 A75-23021
- Solar heating and cooling of buildings, phase 0. Volume 2: Final report [PB-235423/1] 05 p0042 N75-15190
- Solar heating and cooling of buildings, phase 0: Feasibility and planning study. Volume 3, book 1, appendix A, task 1: Development of requirements. Appendix B, task 2: Systems definition [PB-235433/0] 05 p0042 N75-15191
- Solar heating and cooling of buildings. Phase 0: Final report, volume 1 [PB-235427/2] 05 p0042 N75-15192
- Solar heating and cooling of buildings. Phase 0: Final report. Volume 2: Appendices A-N [PB-235428/0] 05 p0042 N75-15193
- Solar heating and cooling of buildings. Phase 0: Final report. Volume 3: Appendices O-Y [PB-235429/8] 05 p0042 N75-15194
- Solar heating and cooling of buildings. Phase 0: Final report. Executive summary [PB-235426/4] 05 p0042 N75-15195
- Solar heating and cooling of buildings. Phase 0: Feasibility and planning study. Volume 1: [PB-235431/4] 06 p0069 N75-16101
- Solar heating and cooling of buildings. Phase 0: Feasibility and planning study. Volume 2: Technical report [PB-235432/2] 06 p0069 N75-16102
- Solar heating and cooling of buildings, phase 0. Volume 3: Appendices [PB-235424/9] 06 p0070 N75-16103
- Solar heating and cooling of buildings, phase 0. Volume 1: Executive summary [PB-235422/3] 06 p0070 N75-16107
- Solar heating and cooling of buildings. Phase 0: Feasibility and planning study. Volume 3, book 2, appendix c, task 3: Assessment of capture potential. Appendix d, task 4: Social and environmental study [PB-235434/8] 06 p0070 N75-16108

Air conditioning of office buildings with all-electric supply. Part 1: Technical conception
[OA-TRANS-938-PT-1] 06 p0074 N75-16970

Comparison of computer programs used for modeling solar heating and air conditioning systems for buildings
[LBE-3066] 06 p0079 N75-17279

Control system design and simulation for solar heated structures
[LA-OR-74-1085] 06 p0082 N75-17813

Solar heating and cooling of buildings study conducted for department of the Army. Volume 1: Executive summary and implementation plans
[AD-A002576] 06 p0104 N75-20879

Solar heating and cooling of buildings study conducted for Department of the Army. Volume 2: Technical report
[AD-A002563] 06 p0104 N75-20880

AIR CONDITIONING EQUIPMENT
A prototype solar powered, Rankine Cycle system providing residential air conditioning and electricity
05 p0004 A75-10523

AIR COOLING
Thermodynamics of multistage air-cooled gas turbine
06 p0050 A75-23817

AIR POLLUTION
Combustion R&D - Key to our energy future --- pollution reduction using hydrocarbon fuels
05 p0009 A75-10596

Meteorological factors and dispersion of pollutants in the atmosphere - A preliminary study about a large power plant
06 p0045 A75-21150

Development of coal fired fluidized-bed boilers
[PB-235899/2] 06 p0065 N75-15668

Development of coal fired fluidized-bed boilers
[PB-235898/4] 06 p0065 N75-15669

Reduction of atmospheric pollution by the application of fluidized-bed combustion
[PB-235840/6] 06 p0072 N75-16151

Compilation of air pollutant emission factors, second edition, supplement no. 3 --- fuel combustion and consumption
[PB-235736/6] 06 p0073 N75-16152

The action of EDF in the prevention of atmospheric pollution --- by expanding nuclear electric power generation
[BLL-CE-TRANS-6500-(9022.09)] 06 p0083 N75-17833

Study of industrial uses of energy relative to environmental effects
[PB-237215/9] 06 p0084 N75-17853

Operational, maintenance, and environmental problems associated with a fossil fuel-fired potassium steam binary vapor cycle
[ORNL-NSF-EP-30] 06 p0090 N75-18769

The bioenvironmental impact of air pollution from fossil-fuel power plants
[PB-237720/8] 06 p0090 N75-18782

Inspection and maintenance of light-duty gasoline powered motor vehicles: A guide for implementation --- emissions inspection program
[PB-236587/2] 06 p0090 N75-18784

Field surveillance and enforcement guide for petroleum refineries
[PB-236669/8] 06 p0090 N75-18786

The collaborative study of EPA methods, 5, 6, and 7 in fossil fuel-fired steam generators
[PB-237695/2] 06 p0091 N75-18788

Background information for standards of performance: Coal preparation plants. Volume 2: Summary and test data
[PB-237696/0] 06 p0091 N75-18797

Environmental aspects of methanol as vehicular fuel: Health and environmental effects
[UCRL-76076] 06 p0095 N75-19867

Evaluation of pollution control in fossil fuel conversion processes. Gasification, section 1: Synthane process
[PB-237113/6] 06 p0095 N75-19879

Changes in the global energy balance --- atmospheric composition and the effect of air pollution
[PB-238075/6] 06 p0106 N75-20936

AIR QUALITY
The bioenvironmental impact of air pollution from fossil-fuel power plants
[PB-237720/8] 06 p0090 N75-18782

AIR TRANSPORTATION

Certain problems of fuel consumption in air transport
05 p0011 A75-11372

Air transportation energy consumption - Yesterday, today, and tomorrow
[AIAA PAPER 75-319] 06 p0047 A75-22515

Lighter than air - A look at the past, a look at the possibilities
06 p0056 A75-25995

Transportation vehicle energy intensities. A joint DOT/NASA reference paper --- energy consumption of air and ground vehicles
[NASA-TM-X-62404] 05 p0035 N75-13690

AIRCRAFT CONTROL
Impact on aerodynamic design
06 p0075 N75-16982

AIRCRAFT DESIGN
Next generation transports will emphasize fuel savings
05 p0011 A75-11426

Fuel outlook dictating technical transport research
05 p0011 A75-11427

Conceptual design of reduced energy transports
[AIAA PAPER 75-303] 06 p0047 A75-22508

Impact on aerodynamic design
06 p0075 N75-16982

Future long-range transports: Prospects for improved fuel efficiency
[NASA-TM-X-72659] 06 p0079 N75-17339

Fuel conservation possibilities for terminal area compatible aircraft
[NASA-CR-132608] 06 p0091 N75-19224

AIRCRAFT ENGINES
Powerplant energy management --- transport aircraft engine thrust control
[AIAA PAPER 74-1066] 05 p0001 A75-10259

Gas turbine engines - A state-of-the-art review
05 p0009 A75-10840

An engine project engineer's view of advanced secondary power systems
[SAE PAPER 740884] 05 p0019 A75-16925

Engine development program for the APL remotely piloted vehicle
[AD-787507] 06 p0065 N75-15658

Impact of future fuels on military aero-engines
06 p0075 N75-16981

Preliminary study of advanced turbofans for low energy consumption
[NASA-TM-X-71663] 06 p0084 N75-18241

AIRCRAFT FUELS
The use of hydrogen in commercial aircraft - An assessment
05 p0006 A75-10542

The 1974 AGARD Annual Meeting: The energy problem: Impacts on military research and development
06 p0075 N75-16977

Alternative fuels for aviation
06 p0075 N75-16980

Impact of future fuels on military aero-engines
06 p0075 N75-16981

Impact on aerodynamic design
06 p0075 N75-16982

United States transportation fuel economics (1975 - 1995)
[NASA-TM-X-3197] 06 p0107 N75-21154

AIRCRAFT PARTS
F-15 secondary power systems
[SAE PAPER 740885] 06 p0048 A75-22948

AIRCRAFT PERFORMANCE
Rating aircraft on energy
05 p0015 A75-14346

Extended energy management methods for flight performance optimization
[AIAA PAPER 75-30] 05 p0021 A75-18269

Floating vs flying - A propulsion energy comparison
06 p0056 A75-25987

AIRCRAFT STABILITY
Impact on aerodynamic design
06 p0075 N75-16982

AIRFOILS
A wind energy conversion system based on the tracked-vehicle airfoil concept
05 p0004 A75-10518

AIRSHIPS
Floating vs flying - A propulsion energy comparison
06 p0056 A75-25987

- Lighter than air - A look at the past, a look at the possibilities
06 p0056 A75-25995
- AIRSPACE**
Legal economic, and energy considerations in the use of underground space
[PB-236755/5] 06 p0080 N75-17749
- ALABAMA**
Degasification of the Mary Lee coalbed near Oak Grove, Jefferson County, Alabama, by vertical borehole in advance of mining
[BM-RI-7968] 05 p0028 N75-11462
Petroleum in Alabama --- including exploration, production, and economics
[PB-237353/8] 06 p0085 N75-18442
Coal in Alabama
[PB-236583/1] 06 p0088 N75-18736
Natural gas in Alabama
[PB-236582/3] 06 p0088 N75-18737
- ALASKA**
The effect of Alaskan crude oil and selected hydrocarbon compounds on embryonic development of the Pacific oyster, *Crassostrea gigas*
06 p0090 N75-18764
- ALKALI HALIDES**
Corrosion studies of materials for auxiliary equipment in MHD power plants
06 p0055 A75-24384
- ALLOCATIONS**
Public works for water and power development and Atomic Energy Commission Appropriation Bill, 1975. Part 6: Tennessee Valley Authority
[GPO-32-403] 05 p0026 N75-10859
Oversight: Mandatory petroleum allocation programs, part 1
[GPO-30-060] 05 p0039 N75-15158
Oversight: Mandatory petroleum allocation programs, part 2
[GPO-31-519] 05 p0039 N75-15159
Fuel availability and allocation in the United States
[GPO-31-711] 06 p0067 N75-16081
- ALUMINUM COMPOUNDS**
High-efficiency graded band-gap Al_x/Ga_{1-x}/As-GaAs solar cell
06 p0058 A75-27519
- ALUMINUM NITRIDES**
Aluminum nitride and silicon nitride for high-temperature vehicular gas turbine engines
05 p0011 A75-11362
- AMMONIA**
Low to high temperature energy conversion system --- using ammonia
[NASA-CASE-NPO-13510-1] 06 p0074 N75-16972
Solar kine: Answer to the agricultural energy challenge of our time
06 p0086 N75-18721
- ANISOTROPIC MEDIA**
Metals and composites in superflywheel energy storage systems
06 p0047 A75-22523
- ANTARCTIC REGIONS**
Exploration of Antarctica: Past and present
[BLL-M-23343-(5828.4F)] 06 p0080 N75-17722
- ANTIKNOCK ADDITIVES**
Limit lead in gasoline
[GPO-29-660] 05 p0023 N75-10259
Impact of motor gasoline lead additive regulations on petroleum refineries and energy resources, 1974-1980, phase 1
[PB-234185/7] 05 p0025 N75-10601
- ANTIREFLECTION COATINGS**
High efficiency silicon solar cells
06 p0052 A75-24217
Thin film coatings in solar-thermal power systems
06 p0056 A75-25679
- AQUIFERS**
Steady state free convection in an unconfined geothermal reservoir
05 p0009 A75-11069
- ARCTIC REGIONS**
A heat pump powered by natural thermal gradients
05 p0006 A75-10550
Improving the oil storage system of western Siberia
[AD-A002717] 06 p0092 N75-19705
- ARRAYS**
Summary of results of solar power arrays for the concentration of energy study
[PB-238003/8] 06 p0089 N75-18756
- ASYMMETRY**
Design analysis of asymmetric solar receivers
[SAND-74-0124] 06 p0076 N75-16986
- ATMOSPHERIC COMPOSITION**
Changes in the global energy balance --- atmospheric composition and the effect of air pollution
[PB-238075/6] 06 p0106 N75-20936
- ATMOSPHERIC DIFFUSION**
Meteorological factors and dispersion of pollutants in the atmosphere - A preliminary study about a large power plant
06 p0045 A75-21150
- AUTOCCLAVING**
Development of a process for producing an ashless, low-sulfur fuel from coal. Volume 2: Laboratory studies. Part 1: Autoclave experiments
[PB-236305/9] 05 p0040 N75-15169
- AUTOMATIC CONTROL**
Fundamentals of automatic control of space nuclear power plants --- Russian book
06 p0048 A75-23229
- AUTOMOBILE ENGINES**
Feasibility demonstration of a road vehicle fueled with hydrogen-enriched gasoline
05 p0008 A75-10574
Liquid hydrogen as an automotive fuel
06 p0048 A75-23238
Methanol as fuel for vehicle engines
06 p0050 A75-23506
Methane gas engines for commercial vehicles and busses
06 p0050 A75-23507
The Stirling engine for vehicle propulsion
06 p0050 A75-23509
State of the art and prospects for electric vehicles
[BLL-OA-TRANS-1250-(6196.3)] 06 p0074 N75-16712
Inspection and maintenance of light-duty gasoline powered motor vehicles: A guide for implementation --- emissions inspection program
[PB-236587/2] 06 p0090 N75-18784
- AUTOMOBILE FUELS**
Some LNG vehicle developments --- for automotive conversion systems and fueling stations
06 p0048 A75-23236
Feasibility study of alternative fuels for automotive transportation. Volume 1: Executive summary
[PB-235581/6] 05 p0041 N75-15187
Feasibility study of alternative fuels for automotive transportation. Volume 2: Technical section
[PB-235582/4] 05 p0041 N75-15188
Feasibility study of alternative fuels and automotive transportation. Volume 3: Appendices
[PB-235583/2] 05 p0041 N75-15189
Development of high specific energy batteries for electric vehicles
[ANL-8058] 06 p0076 N75-16990
Environmental aspects of methanol as vehicular fuel: Health and environmental effects
[UCRL-76076] 06 p0095 N75-19867
Synthetic fuels for ground transportation with special emphasis on hydrogen
[NASA-TM-X-72652] 06 p0103 N75-20868
- AUTOMOBILES**
Energy carriers in space conditioning and automotive applications - A comparison of hydrogen, methane, methanol and electricity
05 p0005 A75-10540
Energy efficiency of current intercity passenger transportation modes
[AIAA PAPER 75-314] 06 p0047 A75-22513
Time factors in slowing down the rate of growth of demand for primary energy in the United States
06 p0059 A75-27780
Iron titanium hydride as a source of hydrogen fuel for stationary and automotive applications
[BNL-78651] 05 p0030 N75-12441
Transportation vehicle energy intensities. A joint DOT/NASA reference paper --- energy consumption of air and ground vehicles
[NASA-TM-X-62404] 05 p0035 N75-13690
Analytical description of the modern steam automobile
[NASA-TM-X-72199] 05 p0035 N75-14134

- Caltech seminar series on energy consumption in private transportation
[PB-235348/0] 05 p0040 N75-15179
- Caltech seminar series on energy consumption in private transportation: Administrative summary
[PB-235349/8] 05 p0041 N75-15184
- High energy battery program at Argonne National Laboratory
[ANL-8064] 06 p0076 N75-16984
- Development of lithium/sulfur cells for application to electric automobiles
[CONF-740805-7] 06 p0094 N75-19829
- AUXILIARY POWER SOURCES**
- Progress in development of auxiliary MHD power plant components at Avco Everett Research Laboratory, Inc
[ASME PAPER 74-WA/ENER-6] 05 p0016 A75-16838
- An engine project engineer's view of advanced secondary power systems
[SAE PAPER 740884] 05 p0019 A75-16925
- F-15 secondary power systems
[SAE PAPER 740885] 06 p0048 A75-22948
- AXIAL FLOW PUMPS**
- Solar sea power --- axial flow pumps
[PB-236997/3] 06 p0082 N75-17821

B

- BEDROCK**
- Theory of heat extraction from fractured hot dry rock
06 p0057 A75-26544
- BEDS (PROCESS ENGINEERING)**
- Gasification of solid wastes in fixed beds
[ASME PAPER 74-WA/PWR-10] 05 p0018 A75-16882
- BENARD CELLS**
- Natural convection in enclosed spaces - A review of application to solar energy collection
[ASME PAPER 74-WA/HT-12] 05 p0017 A75-16860
- BETA PARTICLES**
- Advanced betavoltaic power sources
05 p0007 A75-10563
- BIBLIOGRAPHIES**
- Coal processing: Gasification, liquefaction, desulfurization: A bibliography, 1930 - 1974
[TID-3349] 05 p0023 N75-10578
- NSF-Rann energy abstracts: A monthly abstract journal of energy research
[ORNL-EIS-74-52-VOL-2-NO-1] 05 p0024 N75-10592
- Hydrogen future fuel: A literature survey issued quarterly, issue no. 6 --- bibliographies
05 p0027 N75-11110
- The gasification of coal: A bibliography
[PB-234294/7] 05 p0034 N75-13400
- Coal petrography and petrology. A bibliography 1964 - 1973
[PB-236351/3] 06 p0072 N75-16123
- 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
[PB-237763/8] 06 p0095 N75-19839
- Solar energy: A bibliography
[TID-3351] 06 p0103 N75-20871
- BINARY MIXTURES**
- Operational, maintenance, and environmental problems associated with a fossil fuel-fired potassium steam binary vapor cycle
[ORNL-NSF-EP-30] 06 p0090 N75-18769
- BIOCHEMICAL FUEL CELLS**
- The introduction of the principles of biological energy supply in future technical systems
06 p0050 A75-23511
- BOILERS**
- Solar thermal subsystem specification study
[PB-238005/3] 06 p0083 N75-17829
- Survey of gas and oil burners for use with NSF/RANN-ORNL potassium boiler
[ORNL-NSF-EP-45] 06 p0087 N75-18728
- BREEDER REACTORS**
- Clinch River Breeder Reactor: A combined power and fuel source
[CONF-740609-4] 05 p0038 N75-14593
- BRINES**
- Materials screening program for the LLL geothermal project
[UCRL-75353] 06 p0082 N75-17815

BUILDINGS

- Solar heating and cooling of buildings
06 p0059 A75-27783
- Cooling by solar heat --- heating and cooling system for buildings
[AIAA PAPER 75-609] 06 p0062 A75-28590
- BURNERS**
- Oxides of nitrogen control techniques for appliance conversion to hydrogen fuel
05 p0006 A75-10541
- Design installation and operation of a 25 ton-a-day coal gasification process development unit for the agglomerating burner-gasification
[PB-237625/9] 06 p0087 N75-18734

C

CADMIUM COMPOUNDS

- Research on cadmium stannate selective optical films for solar energy applications
[PB-236208/5] 06 p0071 N75-16117
- CADMIUM SULFIDES**
- CdS-Cu₂S cells - An outlook for terrestrial applications
06 p0052 A75-24223
- Progress in the development of cadmium sulphide terrestrial solar batteries
06 p0052 A75-24224
- Further progress in the technology of silk screened CdS solar cells
06 p0052 A75-24225
- Development of very low cost solar cells for terrestrial power generation
06 p0052 A75-24226
- Direct solar energy conversion for large scale terrestrial use
[PB-236193/9] 06 p0071 N75-16115
- Environmental aspects of cadmium sulfide usage in solar energy conversion. Part 1: Toxicological and environmental health considerations, a bibliography
[PB-238285/1] 06 p0105 N75-20884
- CALIFORNIA**
- Electricity conservation measures in the commercial sector: The Los Angeles experience
[R-1592-PEA] 05 p0034 N75-13388
- California energy workshop: Developing a plan of action to meet the energy crisis in California --- oil recovery, nuclear electric power generation, and offshore energy sources
[PB-237045/0] 06 p0082 N75-17822

CANADA

- A review of the status of MHD power generation technology including suggestions for a Canadian MHD research program
[UTIAS-39] 05 p0035 N75-13641

CAPILLARY FLOW

- An investigation of heat-pipe wick characteristics
05 p0012 A75-12914

CARBON DIOXIDE LASERS

- Interferometric tuning of a 15-atm CO₂ laser
06 p0058 A75-27518

CARNOT CYCLE

- A heat pump powered by natural thermal gradients
05 p0006 A75-10550
- A generalization of the Carnot theorem - The theorem of useful power
06 p0057 A75-26448

CATALYSIS

- Proceedings of the Workshop on Needs for Fundamental Research in Catalysis as Related to the Energy Problem
[PB-236683/9] 06 p0078 N75-17006

CELL ANODES

- Predicted energy densities for nickel-hydrogen and silver-hydrogen cells embodying metallic hydrides for hydrogen storage
05 p0008 A75-10572

CEMENTS

- Industrial energy study of the hydraulic cement industry
[PB-237142/5] 06 p0087 N75-18730

CERAMICS

- Aluminum nitride and silicon nitride for high-temperature vehicular gas turbine engines
05 p0011 A75-11362

CESIUM PLASMA

- MHD energy conversion systems
[AIAA PAPER 74-1071] 05 p0001 A75-10263

- Empirical method of designing the current-voltage characteristics for the discharge mode of a thermionic converter 06 p0057 A75-26332
- CHANNEL FLOW**
Recent MHD generator testing at Avco Everett Research Laboratory, Inc [ASME PAPER 74-WA/ENER-7] 05 p0016 A75-16839
- CHARCOAL**
Coal processing by electrofluids [PB-236588/0] 06 p0088 N75-18743
- CHEMICAL ANALYSIS**
Report to congress on petrochemicals --- analyzing supply/demand in industry [PB-238064/0] 06 p0097 N75-20478
Coal structure and reactivity [TID-26637] 06 p0097 N75-20805
- CHEMICAL COMPOSITION**
Waste lubricating oil research. A comparison of bench-test properties of re-refined and virgin lubricating oils --- materials recovery [PB-238124/2] 06 p0097 N75-20746
- CHEMICAL ENERGY**
Closed loop chemical systems for energy transmission, conversion and storage 05 p0005 A75-10538
Energy supply in a closed cycle --- nuclear energy for nonelectrical use 06 p0049 A75-23503
Chemical to electromagnetic energy conversion techniques --- explosive flux compression technology [AD-783901] 05 p0026 N75-10609
- CHEMICAL ENGINEERING**
Applications of fusion power technology to the chemical industry [BNL-18815] 05 p0029 N75-11730
Data base for the industrial energy study of the industrial chemicals group [PB-237845/3] 06 p0087 N75-18732
- CHEMICAL EXPLOSIONS**
A practical model law for chemical explosive fracture of oil shale 06 p0078 N75-17023
- CHEMICAL FUELS**
Prospects and scientific problems of the utilization of methods of direct electric power generation from chemical fuels /fuel cells/ 05 p0012 A75-12911
Methanol as fuel for vehicle engines 06 p0050 A75-23506
Utilization of plasma exhaust energy for fuel production [COO-3028-7] 05 p0028 N75-11465
- CHEMICAL REACTIONS**
Efficiencies of electrolytic and thermochemical hydrogen production 06 p0045 A75-20300
Recommended research program in geothermal chemistry [WASH-1344] 06 p0077 N75-16997
- CHEMICALS**
Industrial energy study of the Industrial chemicals group [PB-236322/4] 06 p0071 N75-16111
- CHROMIUM ALLOYS**
Cryogenic properties of Fe-Mn and Fe-Mn-Cr alloys [LBL-2764] 06 p0066 N75-15781
- CIVIL AVIATION**
Total energy use for commercial aviation in the US [ORNL-NSF-EP-68] 05 p0023 N75-10039
- CLEAN ENERGY**
Coal-gas combustion in industrial gas turbines [AIAA PAPER 74-1114] 05 p0010 A75-11286
Progress in coal gasification 05 p0013 A75-12993
Tidal power and its integration into the electric system 05 p0013 A75-12994
Coal gasification - A review of status and technology 06 p0059 A75-27781
Evaluation of coal conversion processes to provide clean fuels, part 1 --- coal conversion to clean fuels [PB-234202/0] 05 p0025 N75-10600
Clean power generation from coal [PB-234188/1] 05 p0035 N75-13401
- Conference proceedings: Power Generation-Clean Fuels Today [PB-237661/4] 06 p0087 N75-18735
- CLIMATOLOGY**
Changes in the global energy balance --- atmospheric composition and the effect of air pollution [PB-238075/6] 06 p0106 N75-20936
- COAL**
Evaluation of coal conversion processes to provide clean fuels, part 1 --- coal conversion to clean fuels [PB-234202/0] 05 p0025 N75-10600
Evaluation of coal conversion processes to provide clean fuels, part 2 [PB-234203/8] 05 p0025 N75-10604
Degasification of the Mary Lee coalbed near Oak Grove, Jefferson County, Alabama, by vertical borehole in advance of mining [BM-RI-7968] 05 p0028 N75-11462
Development of a process for producing an ashless, low-sulfur fuel from coal. Volume 2: Laboratory studies. Part 1: Autoclave experiments [PB-236305/9] 05 p0040 N75-15169
Development of coal fired fluidized-bed boilers [PB-235899/2] 06 p0065 N75-15668
Development of coal fired fluidized-bed boilers [PB-235898/4] 06 p0065 N75-15669
Energy conversion from coal utilizing CPU-400 technology [PB-235817/4] 06 p0068 N75-16093
Pollution-free electrochemical power generation from low grade coal [PB-236162/4] 06 p0070 N75-16109
Coal petrography and petrology. A bibliography 1964 - 1973 [PB-236351/3] 06 p0072 N75-16123
Conceptual design of a heat pipe methanator --- conversion of synthesis coal gas to methane [LA-5596] 06 p0074 N75-16774
The reserve base of bituminous coal and anthracite for underground mining in the Eastern United States [PB-237815/6] 06 p0085 N75-18713
Survey of gas and oil burners for use with NSF/RANM-ORNL potassium boiler [ORNL-NSF-EP-45] 06 p0087 N75-18728
Coal in Alabama [PB-236583/1] 06 p0088 N75-18736
Fuel and energy consumption in the coal industries [PB-237151/6] 06 p0088 N75-18744
Methane in the Pittsburgh coalbed, Washington County, Pennsylvania [PB-237848/7] 06 p0089 N75-18760
Background information for standards of performance: Coal preparation plants. Volume 2: Summary and test data [PB-237696/0] 06 p0091 N75-18797
Intra industry capability to substitute fuels [PB-237605/1] 06 p0093 N75-19814
Coal structure and reactivity [TID-26637] 06 p0097 N75-20805
Regional economics: A subset of simulation of the effects of coal-fired power development in the four corners region 06 p0107 N75-21153
- COAL GASIFICATION**
Coal-gas combustion in industrial gas turbines [AIAA PAPER 74-1114] 05 p0010 A75-11286
Progress in coal gasification 05 p0013 A75-12993
Coal gasification by Atomics International's Rockgas process [ASME PAPER 74-WA/PWR-11] 05 p0018 A75-16883
The production of gaseous energy carriers from fossil fuels 06 p0049 A75-23502
Hydrogen as energy carrier in industry and household 06 p0049 A75-23505
Application of thermodynamic and material- and energy-balance calculations to gasification processes 06 p0055 A75-24785
Coal gasification - A review of status and technology 06 p0059 A75-27781

- Coal processing: Gasification, liquefaction, desulfurization: A bibliography, 1930 - 1974 [TID-3349] 05 p0023 N75-10578
- Preliminary evaluation of underground coal gasification at Hanna, Wyoming [BM-TPR-82] 05 p0025 N75-10599
- Char oil energy development [PB-233263/3] 05 p0025 N75-10603
- Process environment effects on heat pipes for fluid-bed gasification of coal [LA-UR-74-984] 05 p0029 N75-12252
- Evaluation of coal-gasification technology. Part 1: Pipeline-W quality gas [PB-234036/2] 05 p0034 N75-13396
- The gasification of coal: A bibliography [PB-234294/7] 05 p0034 N75-13400
- Evaluation of coal-gasification technology. Part 2: Low and intermediate BTU fuel gases [PB-234042/0] 05 p0036 N75-14273
- Application study of a nuclear coal solution gasification process for Oklahoma coal, volume 1 [PB-236156/6] 05 p0037 N75-14279
- Revised cost estimate for the LLL in situ coal gasification concept [UCRL-51578] 05 p0039 N75-15166
- Bureau of Mines energy program, 1973 --- discovery and production of oil, gas, and fluid fuels [PB-234682/3] 05 p0040 N75-15172
- Char oil energy development [PB-234018/0] 05 p0040 N75-15173
- A process for cleaning and removal of sulfur compounds from low Btu gases --- coal gasification [PB-236522/9] 06 p0065 N75-15768
- Hydrogen as a fuel --- analysis of problems involved in generation, transportation, and utilization [AD-787484] 06 p0066 N75-15818
- Prospective regional markets for coal conversion plant products projected to 1980 and 1985. Volume 1: Market analysis [PB-236631/8] 06 p0071 N75-16113
- Low Btu gasification high temperature-low temperature H₂S removal comparison effect on overall thermal efficiency in a combined cycle power plant [PB-235780/4] 06 p0072 N75-16125
- 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 [PB-236632/6] 06 p0078 N75-17007
- 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 [PB-236633/4] 06 p0078 N75-17008
- Coal refining [ORNL-TR-2827] 06 p0086 N75-18724
- Design installation and operation of a 25 ton-a-day coal gasification process development unit for the agglomerating burner-gasification [PB-237625/9] 06 p0087 N75-18734
- Study of potential problems and optimum opportunities in retrofitting industrial processes to low and intermediate energy gas from coal [PB-237116/9] 06 p0088 N75-18739
- Low-BTU gasification of coal for electric power generation [PB-236972/6] 06 p0088 N75-18740
- Coal processing by electrofluids [PB-236588/0] 06 p0088 N75-18743
- Advanced coal gasification system for electric power generation [PB-236971/8] 06 p0089 N75-18747
- Fracture-induced permeability: Present situation and prospects for coal [UCID-16593] 06 p0094 N75-19830
- A SASOL type process for gasoline, methanol, SNG, and low-Btu gas from coal [PB-237670/5] 06 p0095 N75-19838
- Evaluation of pollution control in fossil fuel conversion processes. Gasification, section 1: Synthane process [PB-237113/6] 06 p0095 N75-19879
- Evaluation of pollution control in fossil fuel conversion processes: Gasification. Section 1: Lurgi process [PB-237694/5] 06 p0096 N75-19880
- Methodical approach to temperature and pressure measurements for in situ energy-recovery processes [UCID-16631] 06 p0097 N75-20693
- Acoustic array methods for instrumentation of in situ coal gasification [UCID-16591] 06 p0104 N75-20875
- Large diameter 300 PSI gasifier. Preliminary engineering report. Volume 1: Description [PB-238360/2] 06 p0105 N75-20889
- COAL LIQUEFACTION**
- Coal processing: Gasification, liquefaction, desulfurization: A bibliography, 1930 - 1974 [TID-3349] 05 p0023 N75-10578
- Evaluation of coal-gasification technology. Part 2: Low and intermediate BTU fuel gases [PB-234042/0] 05 p0036 N75-14273
- Development of a process for producing an ashless, low-sulfur fuel from coal. Volume 2: Laboratory studies. Part 1: Autoclave experiments [PB-236305/9] 05 p0040 N75-15169
- Synthetic oil from coal [PB-234460/4] 05 p0040 N75-15176
- Pressurized fluidized bed combustion [PB-235591/5] 06 p0065 N75-15772
- Prospective regional markets for coal conversion plant products projected to 1980 and 1985. Volume 1: Market analysis [PB-236631/8] 06 p0071 N75-16113
- Use of methanol in transportation --- coal liquefaction methods [UCID-16528] 06 p0077 N75-16996
- Coal refining [ORNL-TR-2827] 06 p0086 N75-18724
- 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 [PB-237763/8] 06 p0095 N75-19839
- Development of a process for producing an ashless, low-sulfur fuel from coal. Volume 4. Product studies. Part 3 Products from coal minerals [PB-237764/6] 06 p0095 N75-19840
- Development of a process for producing an ashless, low-sulfur fuel from coal. Volume 4. Product studies. Part 4. Sulfur removal from coal minerals [PB-237765/3] 06 p0095 N75-19841
- 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 [PB-237766/1] 06 p0095 N75-19842
- COAL UTILIZATION**
- Small coal burning gas turbine for modular integrated utility systems 05 p0006 A75-10546
- The MHD power generation system with directly fired coal 05 p0009 A75-10577
- The National Coal Conversion Act and the National Crude Oil Refinery Development Act [GPO-28-964] 05 p0027 N75-10861
- Clean power generation from coal [PB-234188/1] 05 p0035 N75-13401
- Energy conversion from coal utilizing CPU-400 technology [PB-237028/6] 06 p0083 N75-17828
- Coal refining [ORNL-TR-2827] 06 p0086 N75-18724
- COASTAL WATER**
- Technical and economic feasibility of the ocean thermal differences process as a solar-driven energy process [PB-236422/2] 06 p0077 N75-17003
- COATINGS**
- Solar selective surfaces made of semiconducting powders [ASME PAPER 74-WA/HT-13] 05 p0017 A75-16857
- COAXIAL FLOW**
- Energy characteristics of coaxial plasma source [AD-787419] 06 p0073 N75-16368

COLORADO

- Economic impact of the oil shale industry in western Colorado
[GPO-28-608] 05 p0024 N75-10588
- Primary data on economic activity and water use in prototype oil shale development areas of Colorado: An initial inquiry
[PB-236039/4] 05 p0037 N75-14277

COMBUSTION

- Development of coal fired fluidized-bed boilers
[PB-235898/4] 06 p0065 N75-15669
- Energy conversion. 1: Non-propulsive aspects --- fuels and pyrotechnics
[AD-A000077] 06 p0079 N75-17454
- An economic analysis of oil shale operations featuring gas combustion retorting
[PB-237851/1] 06 p0093 N75-19813

COMBUSTION CHAMBERS

- Recent MHD generator testing at Avco Everett Research Laboratory, Inc
[ASME PAPER 74-WA/ENER-7] 05 p0016 A75-16839
- Possible development of acoustical instability in a system consisting of a combustion chamber and a subsonic MHD generator
06 p0045 A75-19959

- Survey of gas and oil burners for use with NSF/RANN-ORNL potassium boiler
[ORNL-NSF-EP-45] 06 p0087 N75-18728

COMBUSTION EFFICIENCY

- Feasibility demonstration of a road vehicle fueled with hydrogen-enriched gasoline
05 p0008 A75-10574
- Use of low grade solid fuels in gas turbines
[ASME PAPER 74-WA/ENER-5] 05 p0016 A75-16837
- Experience in the first step of the mastery of the U-25 device
06 p0081 N75-17793

COMBUSTION PHYSICS

- Combustion dynamics research for 'Project Independence'
[AIAA PAPER 74-1069] 05 p0001 A75-10262
- Combustion R&D - Key to our energy future --- pollution reduction using hydrocarbon fuels
05 p0009 A75-10596
- Pressurized fluidized bed combustion --- combustion physics, gas turbines
[PB-236498/2] 06 p0065 N75-15769
- Impact of future fuels on military aero-engines
06 p0075 N75-16981
- Summary report of workshop on Energy Related Basic Combustion Research
[PB-236714/2] 06 p0079 N75-17456

COMBUSTION PRODUCTS

- The MHD power generation system with directly fired coal
05 p0009 A75-10577
- Compilation of air pollutant emission factors, second edition, supplement no. 3 --- fuel combustion and consumption
[PB-235736/6] 06 p0073 N75-16152
- Impact of future fuels on military aero-engines
06 p0075 N75-16981

COMETS

- Solar electric propulsion spacecraft power subsystem for an Encke comet rendezvous mission
05 p0002 A75-10481

COMMERCE

- Elimination of duty on methanol imported for certain uses
[H-REPT-93-998] 05 p0026 N75-10857
- Technology application at Rockwell International
06 p0078 N75-17189

COMMERCIAL AIRCRAFT

- The use of hydrogen in commercial aircraft - An assessment
05 p0006 A75-10542
- Next generation transports will emphasize fuel savings
05 p0011 A75-11426
- Advanced subsonic transports - A challenge for the 1990's
[AIAA PAPER 75-304] 06 p0049 A75-23251
- Fuel conservation capability and effort by commercial air carriers
[NASA-CR-137624] 05 p0039 N75-15157

COMMERCIAL ENERGY

- Hydrogen as energy carrier in industry and household
06 p0049 A75-23505

- Methane gas engines for commercial vehicles and busses
06 p0050 A75-23507

- Will superconducting magnetic energy storage be used on electric utility systems
06 p0056 A75-25832

- Energy use in the commercial and industrial sectors of the US economy, 1963
[PB-235487/6] 06 p0070 N75-16104

COMMUNICATION SATELLITES

- A design parameter for assessing wicking capabilities of heat pipes
[AIAA PAPER 74-1266] 05 p0010 A75-11107
- Latest developments of the circular solar array --- with deployment structure for central antenna communication satellite
06 p0053 A75-24246
- Development of a flexible, fold-out solar array --- power to weight ratio for communication satellites
06 p0053 A75-24252

- Economic radioisotope thermoelectric generator study program
[IESD-3112-1] 05 p0036 N75-14269
- Economic radioisotope thermoelectric generator study program: Appendices.
[IESD-3112-2] 05 p0036 N75-14270

- SENSE 2: Space applications of nuclear power. Volume 1: Commercial communications satellite
[AEC-SNS-3063-3-VOL-1] 06 p0065 N75-15742

COMMUNICATIONS TECHNOLOGY SATELLITE

- Design and qualification of the CTS solar cell blanket --- onboard Canadian Communications Technology Satellite
06 p0053 A75-24248

COMPOSITE MATERIALS

- Metals and composites in superflywheel energy storage systems
06 p0047 A75-22523
- Study of the costs and benefits of composite materials in advanced turbofan engines
[NASA-CR-134696] 06 p0073 N75-16637

COMPRESSED AIR

- Energy storage underground --- hydroelectric pumped-storage and combustion turbine facilities
05 p0013 A75-12989
- Pumped air storage for electric power generation
05 p0013 A75-12990

COMPRESSED GAS

- Prospects for using dynamic thermocompression converter in solar power plants
05 p0020 A75-17076

COMPRESSION LOADS

- Mechanical properties of oil shale from Anvil Point under conditions of uniaxial compression
[SAND-74-0035] 06 p0092 N75-19390

COMPRESSION TESTS

- Mechanical properties of oil shale from Anvil Point under conditions of uniaxial compression
[SAND-74-0035] 06 p0092 N75-19390

COMPUTER PROGRAMS

- The Energy Systems Optimization Computer Program /ESOP/ developed for Modular Integrated Utility Systems /MIUS/ analysis
05 p0006 A75-10551

- Effect of attitude constraints on solar-electric geocentric transfers
[AIAA PAPER 75-350] 06 p0055 A75-24957

- Comparison of computer programs used for modeling solar heating and air conditioning systems for buildings
[LBL-3066] 06 p0079 N75-17279

COMPUTERIZED DESIGN

- A planning methodology for the analysis and design of wind-power systems
05 p0004 A75-10517
- Solar augmented home heating heat pump system
05 p0004 A75-10524
- Design study of the energy characteristics of thermionic electric power generating components and assemblies
06 p0064 A75-28893

COMPUTERIZED SIMULATION

- A wind energy conversion system based on the tracked-vehicle airfoil concept
05 p0004 A75-10518
- Coal-gas combustion in industrial gas turbines
[AIAA PAPER 74-1114] 05 p0010 A75-11286

- Dynamic simulation for performance analysis of solar heated and cooled buildings
[ASME PAPER 74-WA/SOL-8] 05 p0019 A75-16891
Simulation of a solar heating and cooling system
--- for houses 06 p0048 A75-23018
- SIMSHAC - A simulation program for solar heating and cooling of buildings 06 p0061 A75-28093
- Urban waste energy resources
[AIAA PAPER 75-632] 06 p0062 A75-28598
The design and development of an interactive energy model
[PB-236144/2] 06 p0070 N75-16110
Electronic model of the U-25 device 06 p0081 N75-17794
Profitability analysis of producing crude oil by waterflooding using a simulation technique
[PB-237843/8] 06 p0088 N75-18738
- COMSAT PROGRAM**
The COMSAT non-reflective silicon solar cell - A second generation improved cell 06 p0053 A75-24245
- CONDUCTION**
Solar energy absorber
[NASA-CASE-MPS-22743-1] 05 p0024 N75-10585
- CONDUCTIVE HEAT TRANSFER**
Solar radiation heat transfer to high temperature heat carriers
[ASME PAPER 74-WA/HT-14] 05 p0017 A75-16861
Utilization of tubular thermoelectric modules in solar generators 05 p0020 A75-17067
- CONFERENCES**
Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings 05 p0001 A75-10476
Energy development; Proceedings of the Energy Sources Conference, Anaheim, Calif., July 14-19, 1974 05 p0012 A75-12986
Nonconventional energy systems; Meeting, Duesseldorf, West Germany, June 20, 21, 1974, Reports 06 p0049 A75-23501
Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974 06 p0051 A75-24213
Corrosion problems in energy conversion and generation; Proceedings of the Symposium, New York, N.Y., October 15-17, 1974 06 p0054 A75-24376
Energy Delta: Supply vs. demand; Proceedings of the Energy Symposium, San Francisco, Calif., February 25-27, 1974 06 p0059 A75-27778
Basic research needs for tertiary oil recovery: Proceedings of a National Science Foundation Workshop
[PB-236726/6] 06 p0066 N75-16072
Proceedings of the Solar Heating and Cooling for Buildings Workshop. Part 2: Panel sessions, March 23
[PB-235483/5] 06 p0069 N75-16095
Proceedings of the Workshop on Bio-Solar Conversion
[PB-236142/6] 06 p0069 N75-16096
Photovoltaic conversion of solar energy for Terrestrial Applications. Volume 1: Working group and panel reports
[PB-236163/2] 06 p0072 N75-16121
The 1974 AGARD Annual Meeting: The energy problem: Impacts on military research and development 06 p0075 N75-16977
Proceedings of the first 1974 Technology Transfer Conference
[NASA-CR-142119] 06 p0078 N75-17188
Utilizing fuel more efficiently in reheating and heat treatment furnaces
[BLL-M-21957-(5828.4F)] 06 p0080 N75-17467
Workshop in Gas-Phase Molecular Interactions and the Nation's Energy Problem
[PB-236712/6] 06 p0086 N75-18718
Proceedings of the Conference on Research for the Development of Geothermal Energy Resources
[NASA-CR-142556] 06 p0098 N75-20831
- CONGRESSIONAL REPORTS**
Limit lead in gasoline 05 p0023 N75-10259
Research, development, and the energy crisis
[GPO-27-032] 05 p0023 N75-10580
Independent truckers and the energy crisis
[GPO-31-412] 05 p0023 N75-10581
Economic impact of the oil shale industry in western Colorado
[GPO-28-608] 05 p0024 N75-10588
Advanced nuclear research
[GPO-41-253] 05 p0026 N75-10764
Effects of energy crisis on education, 1974
[GPO-27-765] 05 p0026 N75-10850
Elimination of duty on methanol imported for certain uses
[H-REPT-93-998] 05 p0026 N75-10857
Public works for water and power development and Atomic Energy Commission Appropriation Bill, 1975. Part 6: Tennessee Valley Authority
[GPO-32-403] 05 p0026 N75-10859
National Crude Oil Refinery Development Act, part 2
[GPO-35-578] 05 p0027 N75-10860
The National Coal Conversion Act and the National Crude Oil Refinery Development Act
[GPO-28-964] 05 p0027 N75-10861
Oil shale development, part 2
[GPO-30-368] 05 p0027 N75-11455
Bioconversion --- of solar energy and solid waste energy into useable fuels
[GPO-37-403] 05 p0028 N75-11463
Solar sea thermal energy
[GPO-37-476] 05 p0030 N75-12430
Energy and environmental standards --- environmental standards and energy policy
[GPO-37-171] 05 p0030 N75-12431
Solar photovoltaic energy
[GPO-39-576] 05 p0032 N75-13379
Wind energy
[GPO-37-390] 05 p0033 N75-13387
Conservation and efficient use of energy
[H-REPT-93-1634] 05 p0036 N75-14265
Development, growth, and state of the nuclear industry
[GPO-33-873] 05 p0038 N75-15150
The prospects for gasoline availability: 1974
[GPO-34-969] 05 p0039 N75-15155
Oversight: Mandatory petroleum allocation programs, part 1
[GPO-30-060] 05 p0039 N75-15158
Oversight: Mandatory petroleum allocation programs, part 2
[GPO-31-519] 05 p0039 N75-15159
Prototype oil shale leasing program
[GPO-28-686] 05 p0039 N75-15160
An assessment and analysis of the energy emergency
[GPO-25-382] 06 p0066 N75-16076
Market performance and competition in the petroleum industry, part 1
[GPO-28-503] 06 p0066 N75-16077
Fuel availability and allocation in the United States
[GPO-31-711] 06 p0067 N75-16081
Energy from US and Canadian tar sands: Technical, environmental, economic, legislative, and policy aspects
[GPO-43-005] 06 p0067 N75-16083
Transportation and the new energy policies: Truck sizes and weights, part 2
[GPO-29-802] 06 p0073 N75-16410
Development of oil and gas on the Continental Shelf
[GPO-31-891] 06 p0075 N75-16973
Synthetic Liquid Fuel Research and Development Act of 1974 --- energy conservation and cost analyses
[GPO-44-818] 06 p0103 N75-20867
- CONSERVATION**
Caltech seminar series on energy consumption in private transportation
[PB-235348/0] 05 p0040 N75-15179
- CONSTRUCTION MATERIALS**
Metals and composites in superflywheel energy storage systems 06 p0047 A75-22523
- CONTINENTAL SHELVES**
Offshore investigation: Produccible shut-in leases as of January 1974, phase 2 --- an estimation of natural gas reserves in offshore wells 05 p0027 N75-11458

- Development of oil and gas on the Continental Shelf
[GPO-31-891] 06 p0075 N75-16973
- OCS oil and gas: An environmental assessment,
volume 3 --- effect of natural phenomena on OCS
gas and oil development 06 p0083 N75-17836
- OCS oil and gas: An environmental assessment,
Volume 1 06 p0083 N75-17837
- OCS oil and gas: An environmental assessment,
Volume 2 06 p0084 N75-17838
- OCS oil and gas: An environmental assessment,
volume 4 06 p0084 N75-17839
- OCS oil and gas: An environmental assessment,
volume 5 06 p0084 N75-17840
- CONTOURS**
Statistical estimation of wildcat well outcome
probabilities by visual analysis of structure
contour maps of Stafford County, Kansas 06 p0092 N75-19778
- CONTROLLED FUSION**
Fusion reactors as future energy sources
05 p0011 A75-11735
- Fusion power research - Where do we stand
05 p0013 A75-12995
- Fusion power - Prospects and impact
05 p0021 A75-18080
- An electron beam initiated fusion neutron generator
06 p0045 A75-19657
- Laser compression of matter - Optical power and
energy requirements 06 p0046 A75-22352
- New approaches to CTR: General relativistic power
plants
[UCRL-75443] 06 p0073 N75-16362
- Man-made sun. Thermonuclear engineering
developments
[BLL-M-23333-(5828.4F)] 06 p0091 N75-19014
- Synthetic fuels from fusion reactors
[BNL-19351] 06 p0106 N75-21098
- CONVECTIVE FLOW**
A hot liquid energy storage system utilizing
natural circulation
[ASME PAPER 74-WA/HT-16] 05 p0017 A75-16862
- The nature of the sunspot phenomenon. III - Energy
consumption and energy transport. IV - The
intrinsic instability of the magnetic
configuration 06 p0064 A75-29137
- CONVECTIVE HEAT TRANSFER**
Natural convection in enclosed spaces - A review
of application to solar energy collection
[ASME PAPER 74-WA/HT-12] 05 p0017 A75-16860
- CONVERGENCE**
Convergence and speed of calculations for
thermoelectric heat pump 05 p0020 A75-17084
- COOK INLET (AK)**
Natural gas fields, Cook Inlet Basin, Alaska
[PB-235767/1] 06 p0066 N75-16071
- COOLING**
An intercell heat pipe for fuel cell and battery
cooling
[AD-782888] 05 p0027 N75-11226
- COOLING SYSTEMS**
Solar energy storage within the absorption cycle
[ASME PAPER 74-WA/HT-18] 05 p0017 A75-16864
- Selection and evaluation of the University of
Florida's solar powered absorption air
conditioning system
[ASME PAPER 74-WA/SOL-6] 05 p0019 A75-16889
- Assessment of Rankine cycle for potential
application to solar-powered cooling of buildings
[ASME PAPER 74-WA/SOL-7] 05 p0019 A75-16890
- Dynamic simulation for performance analysis of
solar heated and cooled buildings
[ASME PAPER 74-WA/SOL-8] 05 p0019 A75-16891
- Solar collector performance evaluated outdoors at
NASA-Lewis Research Center 06 p0058 A75-27531
- Solar heating and cooling of buildings
06 p0059 A75-27783
- A high-speed superconducting generator
06 p0060 A75-27960
- SIMSHAC - A simulation program for solar heating
and cooling of buildings 06 p0061 A75-28093
- Cooling by solar heat --- heating and cooling
system for buildings
[AIAA PAPER 75-609] 06 p0062 A75-28590
- Solar energy program plan for heating and cooling
buildings
[WASH-1337-5-DRAFT] 06 p0077 N75-16993
- Heat pumps in large buildings --- a refrigerating
unit for heating and cooling
[OA-TRANS-939] 06 p0078 N75-17184
- Study of active cooling for supersonic transports
[NASA-CR-132573] 06 p0079 N75-17336
- Design and construction of a residential solar
heating and cooling system
[PB-237042/7] 06 p0082 N75-17823
- Use of solar energy in buildings in New York state
[PB-236974/2] 06 p0083 N75-17825
- Assessment of the Rankine cycle for potential
application to solar powered cooling of buildings
[PB-238069/9] 06 p0089 N75-18755
- COPPER SULFIDES**
CdS-Cu₂S cells - An outlook for terrestrial
applications 06 p0052 A75-24223
- Progress in the development of cadmium sulphide
terrestrial solar batteries 06 p0052 A75-24224
- CORROSION**
Corrosion problems in energy conversion and
generation; Proceedings of the Symposium, New
York, N.Y., October 15-17, 1974 06 p0054 A75-24376
- CORROSION RESISTANCE**
Materials screening program for the LLL geothermal
project
[UCRL-75353] 06 p0082 N75-17815
- CORROSION TESTS**
Corrosion studies of materials for auxiliary
equipment in MHD power plants 06 p0055 A75-24384
- COST ANALYSIS**
Hydrogen cycle peak-shaving for electric utilities
05 p0005 A75-10535
- The economics of nuclear power 06 p0047 A75-22734
- Simulation of a solar heating and cooling system
--- for houses 06 p0048 A75-23018
- Heat pipe manufacturing study
[NASA-CR-139140] 05 p0023 N75-10347
- Effect of gas turbine efficiency and fuel cost on
cost of producing electric power
[PB-234159/2] 05 p0034 N75-13397
- Prototype oil shale leasing program
[GPO-28-686] 05 p0039 N75-15160
- Study of the costs and benefits of composite
materials in advanced turbofan engines
[NASA-CR-134696] 06 p0073 N75-16637
- Evaluation of thermal methods for recovery of
viscous oils in Missouri and Kansas
[PB-237831/3] 06 p0090 N75-18762
- Investment and operating costs of binary cycle
geothermal power plants 06 p0101 N75-20855
- Synthetic Liquid Fuel Research and Development Act
of 1974 --- energy conservation and cost analyses
[GPO-44-818] 06 p0103 N75-20867
- United States transportation fuel economics (1975
- 1995)
[NASA-TN-X-3197] 06 p0107 N75-21154
- COST EFFECTIVENESS**
Cost effective designing for the economic RTG ---
radioisotope thermoelectric generators
05 p0003 A75-10507
- Energy storage underground --- hydroelectric
pumped-storage and combustion turbine facilities
05 p0013 A75-12989
- Progress in coal gasification 05 p0013 A75-12993
- Effectiveness of using semiconductor heat pumps
under the conditions of the Turkmen SSR 05 p0020 A75-17083
- Material considerations involved in solar energy
conversion 06 p0047 A75-22522
- The use of solar cells in the lighthouse service
06 p0054 A75-24255

COST ESTIMATES

SUBJECT INDEX

Lighter than air - A look at the past, a look at the possibilities		
Thermoelectric generators --- using semiconductor thermocouples	06 p0056 A75-25995	
Derivation of a total satellite energy system --- solar power station for terrestrial consumption [AIAA PAPER 75-640]	06 p0058 A75-27718	
Prospects for magnetohydrodynamic electric power plants in power engineering	06 p0064 A75-29118	
Economic and energy conservation relationship relevant to state of New York building design and contract awards	06 p0081 N75-17791	
A SASOL type process for gasoline, methanol, SNG, and low-Btu gas from coal	06 p0082 N75-17824	
Prospects for magnetohydrodynamic electric power plants in power engineering	06 p0095 N75-19838	
COST ESTIMATES		
A planning methodology for the analysis and design of wind-power systems		
The use of hydrogen as an energy carrier	05 p0004 A75-10517	
An econometric analysis of fuel selection for power generation	05 p0015 A75-15795	
Solar thermal electric power systems [PB-235475/1]	06 p0055 A75-24751	
Cost and size estimates for an electrochemical bulk energy storage concept	05 p0038 N75-14283	
Revised cost estimate for the LLL in situ coal gasification concept	[NASA-TM-X-3192] 05 p0039 N75-15161	
A generalised analysis of the performance of a variety of drive systems for high Reynolds number, transonic wind tunnels	[UCRL-51578] 05 p0039 N75-15166	
Review of the prospects for laser induced thermonuclear fusion	[RAE-TR-73134] 06 p0073 N75-16572	
Technology utilization - Incentives and solar energy	[AECL-4840] 06 p0106 N75-21099	
COST INCENTIVES		
COST REDUCTION		
Next generation transports will emphasize fuel savings		
Performance of heat pumps using cold-side energy storage and unconventional heat sources	05 p0011 A75-11426	
High-speed silicon processing for low cost solar cells - A comparative analysis	[ASME PAPER 74-WA/HT-17] 05 p0017 A75-16863	
Process development for low cost integrated solar arrays	06 p0052 A75-24222	
RTG electrical power for spacecraft --- Radioisotope Thermoelectric Generators	06 p0054 A75-24259	
GaAs concentrator solar cell	06 p0057 A75-26067	
	06 p0058 A75-27520	
CROP GROWTH		
The oceanic biomass energy plantation --- seaweed harvesting for food and fuel	[AIAA PAPER 75-635] 06 p0063 A75-28599	
CRUDE OIL		
Laser induced luminescence signatures of refined and virgin crude petroleum - Their composition and remote sensing implications		
National Crude Oil Refinery Development Act, part 2	06 p0050 A75-23790	
The National Coal Conversion Act and the National Crude Oil Refinery Development Act	[GPO-35-578] 05 p0027 N75-10860	
Prospects for utilization of underwater houses and chambers in development of marine oil deposits	[GPO-28-964] 05 p0027 N75-10861	
Oil for the free world in the 1970's --- demand and supply	05 p0029 N75-11606	
Oversight: Mandatory petroleum allocation programs, part 1	[AD-779352] 05 p0031 N75-12448	
	[GPO-30-060] 05 p0039 N75-15158	
Oversight: Mandatory petroleum allocation programs, part 2		
Bureau of Mines energy program, 1973 --- discovery and production of oil, gas, and fluid fuels	[GPO-31-519] 05 p0039 N75-15159	
Market performance and competition in the petroleum industry, part 1	[PB-234682/3] 05 p0040 N75-15172	
Oversight: Mandatory petroleum allocation programs	[GPO-28-503] 06 p0066 N75-16077	
Intermediate-term energy programs to protect against crude-petroleum import interruptions: Feasible alternatives, program costs, and operational methods of funding	[GPO-31-027] 06 p0081 N75-17806	
Petroleum in Alabama --- including exploration, production, and economics	[PB-237209/2] 06 p0083 N75-17826	
Effects of changing the proportions of automotive distillate and gasoline produced by petroleum refining	[PB-237353/8] 06 p0085 N75-18442	
Profitability analysis of producing crude oil by waterflooding using a simulation technique	[PB-236900/7] 06 p0085 N75-18443	
The effect of Alaskan crude oil and selected hydrocarbon compounds on embryonic development of the Pacific oyster, Crassostrea gigas	[PB-237843/3] 06 p0088 N75-18738	
Field surveillance and enforcement guide for petroleum refineries	06 p0090 N75-18764	
Mechanical properties of oil shale from Anvil Point under conditions of uniaxial compression	[PB-236669/8] 06 p0090 N75-18786	
Improving the oil storage system of western Siberia	[SAND-74-0035] 06 p0092 N75-19390	
An economic analysis of oil shale operations featuring gas combustion retorting	[AD-A002717] 06 p0092 N75-19705	
In situ oil shale conversion and recovery	[PB-237851/1] 06 p0093 N75-19813	
Report to congress on petrochemicals --- analyzing supply/demand in industry	[SLA-74-0162] 06 p0093 N75-19825	
Benthal decomposition of adsorbed octadecane --- impact of oil pollution, deoxygenation of waterways	[PB-238064/0] 06 p0097 N75-20478	
Economic impact on the free world of the oil crisis, October 1973 - March 1974	06 p0106 N75-20891	
CRYOGENIC EQUIPMENT		
A high-speed superconducting generator	[AD-A003136] 06 p0107 N75-21156	
Main problems met in the study of cryogenic generators		
Energy and cryoengineering	06 p0060 A75-27960	
CRYOGENIC FLUID STORAGE	[LA-UR-74-741] 06 p0061 A75-27962	
The use of hydrogen as an energy carrier		
Liquid hydrogen --- liquefaction, storage, transportation, applications	05 p0015 A75-15795	
Survey of hydrogen compatibility problems in energy storage and energy transmission applications	06 p0046 A75-22043	
CRYOGENICS		
Some LNG vehicle developments --- for automotive conversion systems and fueling stations	[SAND-74-8219] 06 p0087 N75-18726	
The application of aerospace technology in the cryogenics field		
Cryogenics safety in a hydrogen fuel society	06 p0048 A75-23239	
Cryogenic properties of Fe-Mn and Fe-Mn-Cr alloys	06 p0061 A75-27973	
High-speed silicon processing for low cost solar cells - A comparative analysis	[LBL-2764] 06 p0066 N75-15781	
CRYSTAL GROWTH		
Epitaxial silicon solar cell		

- Solar energy concentrator system for crystal growth and zone refining in space
[NASA-CR-120623] 06 p0086 N75-18719
- CURIUM 244**
A modular heat source for curium-244 and plutonium-238 05 p0002 A75-10497
- A 10% efficient economic RTG design --- radioisotope thermoelectric generator 05 p0003 A75-10506
- CZOCHEBSKI METHOD**
High-speed silicon processing for low cost solar cells - A comparative analysis 06 p0052 A75-24222

D**DATA COLLECTION PLATFORMS**

- Remote platform power conserving system
[NASA-CASE-GSC-11182-1] 05 p0032 N75-13007

DATA PROCESSING

- Data base for the industrial energy study of the industrial chemicals group
[PB-237845/3] 06 p0087 N75-18732

DECISION MAKING

- The solution of information-deficiency problems of electroenergy technology --- optimal decision making 06 p0062 A75-28508

- Energy utilization by households and technology assessment as a way to increase its effectiveness --- management methods and family decision making 06 p0097 N75-20829

- The energy crisis and decision making in the family
[PB-238783/5] 06 p0106 N75-21028

DECOMPOSITION

- The generation of hydrogen by the thermal decomposition of water 05 p0005 A75-10532

- Benthal decomposition of adsorbed octadecane --- impact of oil pollution, deoxygenation of waterways 06 p0106 N75-20891

DEGASSING

- Degasification of the Mary Lee coalbed near Oak Grove, Jefferson County, Alabama, by vertical borehole in advance of mining
[BM-RI-7968] 05 p0028 N75-11462

DEHYDRATED FOOD

- Research on the application of solar energy to the food drying industry
[PB-238073/1] 06 p0105 N75-20888

DEMAND (ECONOMICS)

- Oil for the free world in the 1970's --- demand and supply
[AD-779352] 05 p0031 N75-12448

- Interfuel substitution in the consumption of energy in the United States. Part 1: Residential and commercial sector
[PB-234536/1] 05 p0040 N75-15178

- A study of the demand for gasoline
[PB-235254/0] 06 p0070 N75-16105

- Fuel and energy data: United States by states and regions, 1972
[PB-236581/5] 06 p0077 N75-17004

DENMARK

- Exploiting wind power for the production of electricity --- windmill utilization in Denmark
[NASA-TT-P-16058] 05 p0033 N75-13385

- 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
[NP-20023] 06 p0067 N75-16088

DEOXYGENATION

- Benthal decomposition of adsorbed octadecane --- impact of oil pollution, deoxygenation of waterways 06 p0106 N75-20891

DEPOSITS

- Coal in Alabama
[PB-236583/1] 06 p0088 N75-18736

DESERTS

- Some generalizations of sample water-supply calculations for solar-powered pumping plants
05 p0020 A75-17077

DESIGN ANALYSIS

- Dynamic simulation for performance analysis of solar heated and cooled buildings
[ASME PAPER 74-WA/SOL-8] 05 p0019 A75-16891

- An engine project engineer's view of advanced secondary power systems
[SAE PAPER 740884] 05 p0019 A75-16925

- Some generalizations of sample water-supply calculations for solar-powered pumping plants
05 p0020 A75-17077

- Progress in heat pipe and porous heat exchanger technology 06 p0045 A75-20686

- Foreseeable thermal, mechanical, and materials engineering problems of fusion reactor power plants
[SMRT PAPER A2/1] 06 p0046 A75-21713

- Design and qualification of the CTS solar cell blanket --- onboard Canadian Communications Technology Satellite 06 p0053 A75-24248

- Solar cell modules for lightweight solar arrays --- onboard communication satellites 06 p0057 A75-26068

- Design study of the energy characteristics of thermionic electric power generating components and assemblies 06 p0064 A75-28893

- Economic radioisotope thermoelectric generator study program
[IESD-3112-1] 05 p0036 N75-14269

- Test report SEPS solar array root section model
[NASA-CR-120606] 06 p0067 N75-16085

DESULFURIZING

- Coal processing: Gasification, liquefaction, desulfurization: A bibliography, 1930 - 1974
[TID-3349] 05 p0023 N75-10578

- Evaluation of coal conversion processes to provide clean fuels, part 1 --- coal conversion to clean fuels
[PB-234202/0] 05 p0025 N75-10600

- Char oil energy development
[PB-233263/3] 05 p0025 N75-10603

- Evaluation of coal conversion processes to provide clean fuels, part 2
[PB-234203/8] 05 p0025 N75-10604

- A process for cleaning and removal of sulfur compounds from low Btu gases --- coal gasification
[PB-236522/9] 06 p0065 N75-15768

- Low Btu gasification high temperature-low temperature H₂S removal comparison effect on overall thermal efficiency in a combined cycle power plant
[PB-235780/4] 06 p0072 N75-16125

- Development of a process for producing an ashless, low-sulfur fuel from coal. Volume 4. Product studies. Part 3 Products from coal minerals
[PB-237764/6] 06 p0095 N75-19840

- Development of a process for producing an ashless, low-sulfur fuel from coal. Volume 4. Product studies. Part 4. Sulfur removal from coal minerals
[PB-237765/3] 06 p0095 N75-19841

- 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
[PB-237766/1] 06 p0095 N75-19842

DIESEL ENGINES

- Project Clean Air 1972, LNG conversion of GM-71 series diesel engine --- considering automobile exhaust gases control
[PB-236585/6] 06 p0090 N75-18783

DIESEL FUELS

- Independent truckers and the energy crisis
[GPO-31-412] 05 p0023 N75-10581

- Project Clean Air 1972, LNG conversion of GM-71 series diesel engine --- considering automobile exhaust gases control
[PB-236585/6] 06 p0090 N75-18783

DIGITAL SIMULATION

- Numerical simulation of direct energy conversion --- from fusion reactions 06 p0045 A75-19660

DIGITAL TECHNIQUES

- Oil exploration needs for digital processing of imagery 05 p0001 A75-10437

- DIRECT CURRENT**
Superconductive d.c. generator 06 p0061 A75-27961
- DIRECT POWER GENERATORS**
Study of channel-type systems for solar-energy radiative heat transport 05 p0010 A75-11196
Numerical simulation of direct energy conversion --- from fusion reactions 06 p0045 A75-19660
A study of channel systems for radiative solar-heat transfer 06 p0049 A75-23408
Solar electric and thermal conversion system in close proximity to the consumer --- solar panels on house roofs 06 p0062 A75-28597
[AIAA PAPER 75-628]
DART: A simulation code for a direct energy converter for fusion reactors 05 p0043 N75-15462
[UCRL-51557]
Fuel cells: Direct conversion of electrochemical energy into electricity 06 p0103 N75-20869
[SAND-74-0125]
- DOCUMENTATION**
Economic radioisotope thermoelectric generator study program: Appendices. 05 p0036 N75-14270
[IESD-3112-2]
- DOCUMENTS**
NSF-Rann energy abstracts: A monthly abstract journal of energy research 05 p0024 N75-10592
[ORNL-EIS-74-52-VOL-2-NO-1]
- DOMESTIC SATELLITE COMMUNICATIONS SYSTEMS**
Design and qualification of the CTS solar cell blanket --- onboard Canadian Communications Technology Satellite 06 p0053 A75-24248
- DRAINAGE**
Methane in the Pittsburgh coalbed, Washington County, Pennsylvania 06 p0089 N75-18760
[PB-237848/7]
- DYNAMIC CHARACTERISTICS**
Fundamentals of automatic control of space nuclear power plants --- Russian book 06 p0048 A75-23229
- DYNAMIC RESPONSE**
Dynamic response of solar heat storage systems [ASME PAPER 74-WA/HT-22] 05 p0018 A75-16867
- E**
- EARTH CRUST**
Geothermal energy: A new application of rock mechanics 06 p0068 N75-16089
[LA-UR-74-821]
- EARTH MOVEMENTS**
Measuring ground movement in geothermal areas of Imperial Valley, California 06 p0099 N75-20842
- EARTH RESOURCES**
U.S. energy resources - Outlook for the future 05 p0014 A75-12999
Solar energy in earth processes --- review 06 p0061 A75-28437
Utilization of solar energy --- an assessment of present technology 05 p0033 N75-13382
[NASA-TT-F-16090]
Energy resources and utilization 06 p0075 N75-16983
- EARTH SURFACE**
Prospect for geothermal power 06 p0086 N75-18723
[LA-UR-74-1111]
Relationships of earth fracture systems to productivity of a gas storage reservoir 06 p0089 N75-18759
[PB-237894/1]
- ECOLOGY**
Environmental impact of a geothermal power plant 06 p0049 A75-23291
- ECONOMIC ANALYSIS**
Economics analyses of solar energy utilization 05 p0004 A75-10520
The Hydrogen Economy - A utility perspective --- energy technology 05 p0014 A75-12998
International energy problems and environmental policy 05 p0014 A75-13597
Prospects for tapping solar energy on a large scale 05 p0015 A75-14014
- Potential for large-scale energy storage in electric utility systems 05 p0016 A75-16840
[ASME PAPER 74-WA/ENER-9]
Economics of a hydrogen storage peaking power plant 05 p0018 A75-16880
[ASME PAPER 74-WA/PWR-6]
Energy systems - Modeling and policy analysis 06 p0055 A75-24750
An econometric analysis of fuel selection for power generation 06 p0055 A75-24751
The future of silicon solar cells for terrestrial use 06 p0058 A75-27717
Urban waste energy resources 06 p0062 A75-28598
[AIAA PAPER 75-632]
The economics of using wind power for electricity supply in the Netherlands and for water supply on Curacao 05 p0024 N75-10587
[NASA-TT-F-15982]
Primary data on economic activity and water use in prototype oil shale development areas of Colorado: An initial inquiry 05 p0037 N75-14277
[PB-236039/4]
Total energy supply and demand, volume 1, chapter 6 --- natural gas, economic analysis 06 p0067 N75-16082
Legal economic, and energy considerations in the use of underground space 06 p0080 N75-17749
[PB-236755/5]
US energy R and D policy: The role of economics [RFP-WORKING-PAPER-EN-4] 06 p0080 N75-17783
Economic and system aspects of a superconducting magnetic energy storage device and a dc superconducting transmission line 06 p0091 N75-19080
[LA-UR-74-1145]
An economic analysis of oil shale operations featuring gas combustion retorting 06 p0093 N75-19813
[PB-237851/1]
Fuel gas production from solid waste 06 p0095 N75-19843
[PB-238068/1]
Dependence of the United States on essential imported materials, year 2000; volume 1 06 p0096 N75-20157
[AD-A000842]
Dependence of the United States on essential imported materials, year 2000. Volume 2: Appendices 06 p0096 N75-20158
[AD-A000843]
- ECONOMIC DEVELOPMENT**
Advanced subsonic transports - A challenge for the 1990's 06 p0049 A75-23251
[AIAA PAPER 75-304]
Interfuel substitution in the consumption of energy in the United States. Part 1: Residential and commercial sector 05 p0040 N75-15178
[PB-234536/1]
The USA: The scientific and technical revolution and trends in foreign policy 06 p0096 N75-20160
[NASA-TT-F-16102]
Regional economics: A subset of simulation of the effects of coal-fired power development in the four corners region 06 p0107 N75-21153
- ECONOMIC FACTORS**
The economics of nuclear power 06 p0047 A75-22734
Elimination of duty on methanol imported for certain uses 05 p0026 N75-10857
[H-REPT-93-998]
Economic radioisotope thermoelectric generator program: Program plan 05 p0034 N75-13393
[IESD-3112-3]
Economic radioisotope thermoelectric generator study program 05 p0036 N75-14269
[IESD-3112-1]
Economic radioisotope thermoelectric generator study program: Appendices. 05 p0036 N75-14270
[IESD-3112-2]
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 06 p0078 N75-17007
[PB-236632/6]
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 06 p0078 N75-17008
[PB-236633/4]

- Economic modeling and energy policy planning ---
technology transfer, market research 06 p0079 N75-17210
- The effect of recent energy price increases on
field crop production costs [PB-238659/7] 06 p0107 N75-21155
- Economic impact on the free world of the oil
crisis, October 1973 - March 1974 [AD-A003136] 06 p0107 N75-21156
- ECONOMICS**
NSF-RANN energy abstracts. A monthly abstract
journal of energy research, volume 2, no. 4
[ORNL-ENS-74-52-VOL-2-4] 05 p0029 N75-11469
- EDUCATION**
Effects of energy crisis on education, 1974
[GPO-27-765] 05 p0026 N75-10850
- ELECTRIC BATTERIES**
Methanol/air acidic fuel cell system 05 p0008 A75-10566
- An intercell heat pipe for fuel cell and battery
cooling [AD-782888] 05 p0027 N75-11226
- Lead accumulator batteries in telecommunications
[BLL-TRANS-2943-(9022.81)] 06 p0074 N75-16967
- High energy battery program at Argonne National
Laboratory [ANL-8064] 06 p0076 N75-16984
- Development of lithium/sulfur cells for
application to electric automobiles [CONF-740805-7] 06 p0094 N75-19829
- ELECTRIC COILS**
A high-speed superconducting generator 06 p0060 A75-27960
- ELECTRIC DISCHARGES**
Empirical method of designing the current-voltage
characteristics for the discharge mode of a
thermionic converter 06 p0057 A75-26332
- ELECTRIC ENERGY STORAGE**
The impact of advanced batteries on electric power
generation 05 p0013 A75-12991
- Performance of heat pumps using cold-side energy
storage and unconventional heat sources [ASME PAPER 74-WA/HT-17] 05 p0017 A75-16863
- Will superconducting magnetic energy storage be
used on electric utility systems 06 p0056 A75-25832
- DCTR power supply and energy storage review meeting
[WASH-1310] 05 p0031 N75-12445
- Cost and size estimates for an electrochemical
bulk energy storage concept [NASA-TM-X-3192] 05 p0039 N75-15161
- ELECTRIC EQUIPMENT TESTS**
Performance testing of thermoelectric generators
at JPL 05 p0002 A75-10503
- SNAP 19 Viking RTG flight configuration and
integration testing --- Radioisotope
Thermoelectric Generator 05 p0003 A75-10504
- Operational testing of the high performance
thermoelectric generator /HPG-02/ 05 p0003 A75-10505
- Superconducting synchronous machine 06 p0061 A75-27967
- ELECTRIC GENERATORS**
Solar farms utilizing low-pressure closed-cycle
gas turbines 05 p0003 A75-10514
- Evaluation of central solar tower power plant
05 p0003 A75-10515
- A prototype solar powered, Rankine Cycle system
providing residential air conditioning and
electricity 05 p0004 A75-10523
- Report on progress in achieving direct conversion
of a major fraction of sonic flow kinetic power
into electrical power by electrofluid dynamic
/EPD/ processes 05 p0009 A75-10576
- Prospects and scientific problems of the
utilization of methods of direct electric power
generation from chemical fuels /fuel cells/ 05 p0012 A75-12911
- Utilization of solar energy today 05 p0012 A75-12987
- Pumped air storage for electric power generation
05 p0013 A75-12990
- The impact of advanced batteries on electric power
generation 05 p0013 A75-12991
- Tidal power and its integration into the electric
system 05 p0013 A75-12994
- Windpower - Look backward, then move forward
confidently --- for electric power generation in
rural areas 05 p0014 A75-12997
- A comparison of methods for electric power
generation from geothermal hot water deposits
[ASME PAPER 74-WA/ENER-10] 05 p0016 A75-16841
- Power from ocean waves [ASME PAPER 74-WA/PWR-5] 05 p0018 A75-16879
- Wind energy developments in the 20th century 05 p0020 A75-17503
- Material considerations involved in solar energy
conversion 06 p0047 A75-22522
- A superconducting microwave engine 06 p0056 A75-25831
- Fundamental research on the selection of new
electrochemical generators of medium power 06 p0060 A75-27827
- A high-speed superconducting generator 06 p0060 A75-27960
- Superconductive d.c. generator 06 p0061 A75-27961
- Main problems met in the study of cryogenic
generators 06 p0061 A75-27962
- Solar electric and thermal conversion system in
close proximity to the consumer --- solar panels
on house roofs [AIAA PAPER 75-628] 06 p0062 A75-28597
- Standardized wind electric power unit
[AD-783764] 05 p0025 N75-10598
- Effective utilization of solar energy to produce
clean fuel [PB-233956/2] 05 p0026 N75-10605
- Effect of gas turbine efficiency and fuel cost on
cost of producing electric power [PB-234159/2] 05 p0034 N75-13397
- Efficiencies in power generation [PB-234160/0] 05 p0034 N75-13398
- Radioisotope space power generator [GA-A-12848] 05 p0038 N75-14832
- Pollution-free electrochemical power generation
from low grade coal [PB-236162/4] 06 p0070 N75-16109
- Energy conversion from coal utilizing CPU-400
technology [PB-237028/6] 06 p0083 N75-17828
- Electric power generation using geothermal brine
resources for a proof of concept facility 06 p0101 N75-20857
- ELECTRIC POWER**
Space power systems - Retrospect and prospect
[IAF PAPER 74-082] 05 p0014 A75-13714
- Regional economics: A subset of simulation of the
effects of coal-fired power development in the
four corners region 06 p0107 N75-21153
- ELECTRIC POWER PLANTS**
Hydrogen cycle peak-shaving for electric utilities
05 p0005 A75-10535
- Hydrogen for the electric utilities - Long range
possibilities 05 p0005 A75-10536
- Energy storage for utilities via hydrogen systems
05 p0005 A75-10537
- Independent energy systems for better efficiency
05 p0006 A75-10549
- The PCG-1 fuel cell powerplant for electric
utility use 05 p0013 A75-12992
- Potential for large-scale energy storage in
electric utility systems [ASME PAPER 74-WA/ENER-9] 05 p0016 A75-16840
- Economics of a hydrogen storage peaking power plant
[ASME PAPER 74-WA/PWR-6] 05 p0018 A75-16880
- Prospects for using dynamic thermocompression
converter in solar power plants 05 p0020 A75-17076
- Meteorological factors and dispersion of
pollutants in the atmosphere - A preliminary
study about a large power plant 06 p0045 A75-21150

ELECTRIC POWER SUPPLIES

SUBJECT INDEX

Environmental impact of a geothermal power plant
06 p0049 A75-23291

Considerations regarding a utilization of solar
energy --- thermal, electric and wind energy
systems
06 p0050 A75-23510

The solution of information-deficiency problems of
electroenergy technology --- optimal decision
making
06 p0062 A75-28508

Systems aspects of ocean thermal energy conversion
[AIAA PAPER 75-615] 06 p0062 A75-28593

100 MWe solar power plant design configuration and
performance
[AIAA PAPER 75-623] 06 p0062 A75-28595

A central receiver solar power plant in a hybrid
mode of operation --- solar/fossil-fueled steam
power plant
[AIAA PAPER 75-624] 06 p0062 A75-28596

Solar thermal conversion mission analysis
[AIAA PAPER 75-619] 06 p0064 A75-29117

Standardized wind electric power unit
[AD-783764] 05 p0025 N75-10598

Solar Sea Power Plants (SSPP): A critical review
and survey
[NASA-TM-X-70783] 05 p0028 N75-11459

Energy plantations: Should we grow trees for
power plant fuel?
[VP-X-129] 05 p0030 N75-12436

Energy storage for the electric power industry
[LA-OR-74-918] 05 p0031 N75-12447

Clean power generation from coal
[PB-234188/1] 05 p0035 N75-13401

Photovoltaic conversion of solar energy for
terrestrial applications. Volume 2: Invited
papers
[PB-236164/0] 06 p0072 N75-16122

Low Btu gasification high temperature-low
temperature H₂S removal comparison effect on
overall thermal efficiency in a combined cycle
power plant
[PB-235780/4] 06 p0072 N75-16125

Technical and economic feasibility of the ocean
thermal differences process as a solar-driven
energy process
[PB-236422/2] 06 p0077 N75-17003

First Joint Soviet-American Colloquium on the
Problems of MHD Energy Conversion
[JPRS-63794] 06 p0081 N75-17790

Prospects for magnetohydrodynamic electric power
plants in power engineering
06 p0081 N75-17791

Some developments of industrial
magnetohydrodynamic electric power plants
06 p0081 N75-17792

Experience in the first step of the mastery of the
U-25 device
06 p0081 N75-17793

Electronic model of the U-25 device
06 p0081 N75-17794

Solar sea power --- axial flow pumps
[PB-236997/3] 06 p0082 N75-17821

Low-BTU gasification of coal for electric power
generation
[PB-236972/6] 06 p0088 N75-18740

Organic Rankine cycle silent power plant 1.5 kW,
28 volts dc
[AD-A000900] 06 p0088 N75-18745

Advanced coal gasification system for electric
power generation
[PB-236971/8] 06 p0089 N75-18747

The generator of the future --- development of the
magnetohydrodynamic generators
[AD-A001515] 06 p0089 N75-18754

The bioenvironmental impact of air pollution from
fossil-fuel power plants
[PB-237720/8] 06 p0090 N75-18782

The collaborative study of EPA methods, 5, 6, and
7 in fossil fuel-fired steam generators
[PB-237695/2] 06 p0091 N75-18788

Electric power generation using geothermal brine
resources for a proof of concept facility
06 p0101 N75-20857

Geothermal steam condensate reinjection
06 p0102 N75-20863

Utility company views of geothermal development
06 p0102 N75-20864

ELECTRIC POWER SUPPLIES

Electrical power generation subsystem for Space
Shuttle Orbiter
05 p0002 A75-10477

Technology considerations for Organic Rankine
Cycle Electric Power Systems
05 p0002 A75-10484

NASA objectives for improved solar power plants
05 p0002 A75-10485

Solar cell and array standardization for Air Force
spacecraft
05 p0002 A75-10486

Performance testing of thermoelectric generators
at JPL
05 p0002 A75-10503

SNAP 19 Viking RTG flight configuration and
integration testing --- Radioisotope
Thermoelectric Generator
05 p0003 A75-10504

Development of a thermal battery for emergency
radio power under arctic conditions
05 p0007 A75-10560

Metal hydride fuel cell power source
05 p0008 A75-10564

Milliwatt fuel cell system for sensors
05 p0008 A75-10565

60 watt hydride-air fuel cell system
05 p0008 A75-10567

High energy density sintered plate type sealed
nickel cadmium battery cells. I - The positive
electrode/plaque relationships
05 p0008 A75-10569

High energy density sintered plate type
nickel-cadmium battery cells. II -
Electrochemical impregnation methods to produce
nickel oxide electrodes
05 p0008 A75-10570

A novel negative-limited sealed nickel-cadmium cell
05 p0008 A75-10571

Electrically rechargeable redox flow
cells
05 p0008 A75-10573

Advances in space power generation
[IAP PAPER 74-086] 05 p0015 A75-13718

Effectiveness of using semiconductor heat pumps
under the conditions of the Turkmen SSR
05 p0020 A75-17083

Historic development of photovoltaic power
generation
06 p0051 A75-24215

The use of solar cells in the lighthouse service
06 p0054 A75-24255

Terrestrial applications of FEP-encapsulated solar
cell modules --- power systems using Fluorinated
Ethylene Propylene encapsulation
06 p0054 A75-24258

The Mitre solar energy demonstration system
06 p0055 A75-24676

The economics of using wind power for electricity
supply in the Netherlands and for water supply
on Curacao
[NASA-TT-F-15982] 05 p0024 N75-10587

Evaluation of coal conversion processes to provide
clean fuels, part 1 --- coal conversion to clean
fuels
[PB-234202/0] 05 p0025 N75-10600

Energy and the environment: Electric power
05 p0030 N75-12438

Electricity conservation measures in the
commercial sector: The Los Angeles experience
[R-1592-FEA] 05 p0034 N75-13388

Pressurized fluidized bed combustion
[PB-235591/5] 06 p0065 N75-15772

Solar thermal electric power systems
[PB-236368/7] 06 p0071 N75-16118

Development of high specific energy batteries for
electric vehicles
[ANL-8058] 06 p0076 N75-16990

Applications of aerospace technology in the
electric power industry
06 p0079 N75-17197

Steps into the future. Development of the power
industry in the USSR
[BLL-M-23330-(5828.4F)] 06 p0085 N75-18714

Energy storage for utilities via hydrogen systems
[BNL-19266] 06 p0086 N75-18725

Conference proceedings: Power Generation-Clean
Fuels Today
[PB-237661/4] 06 p0087 N75-18735

ELECTRIC POWER TRANSMISSION

- The Electric Power Research Institute's role in applying superconductivity to future utility systems 06 p0056 A75-25827
- Testing of a photoelectric generator in a mountainous region of the Azerbaidzhan SSR 06 p0057 A75-26714

ELECTRIC PROPULSION

- Mission applications of electric propulsion [AIAA PAPER 74-1085] 05 p0010 A75-11284
- Recent advances in components of space power systems [IAP PAPER 74-083] 05 p0014 A75-13715
- Power processor design considerations for a solar electric propulsion spacecraft [NASA-CR-140842] 05 p0029 N75-12064
- High energy battery program at Argonne National Laboratory [ANL-8064] 06 p0076 N75-16984

ELECTRIC PULSES

- Chemical to electromagnetic energy conversion techniques --- explosive flux compression technology [AD-783901] 05 p0026 N75-10609

ELECTRICAL ENGINEERING

- State of the art and prospects for electric vehicles [BLL-OA-TRANS-1250-(6196.3)] 06 p0074 N75-16712

ELECTRICAL PROPERTIES

- Radiation effects on high efficiency silicon-solar cells 06 p0051 A75-24197

ELECTRICAL RESISTANCE

- Dynamic method for calculating the series resistance of a semiconductor photoelectric converter 06 p0057 A75-26713

ELECTRICITY

- Wind power projects of the French electrical authority [NASA-TT-F-16057] 05 p0033 N75-13384
- Exploiting wind power for the production of electricity --- windmill utilization in Denmark [NASA-TT-F-16058] 05 p0033 N75-13385
- Dynamic conversion of solar generated heat to electricity [NASA-CR-134724] 06 p0066 N75-16079
- Fuel cells: Direct conversion of electrochemical energy into electricity [SAND-74-0125] 06 p0103 N75-20869

ELECTRIFICATION

- Energy systems analysis and technology assessment program [BNL-18984] 06 p0094 N75-19831

ELECTROCHEMICAL CELLS

- Development and performance of a miniature, high-voltage thermal battery 05 p0007 A75-10559
- High energy density sintered plate type sealed nickel cadmium battery cells. I - The positive electrode/plaque relationships 05 p0008 A75-10569
- High energy density sintered plate type nickel-cadmium battery cells. II - Electrochemical impregnation methods to produce nickel oxide electrodes 05 p0008 A75-10570
- A novel negative-limited sealed nickel-cadmium cell 05 p0008 A75-10571
- Predicted energy densities for nickel-hydrogen and silver-hydrogen cells embodying metallic hydrides for hydrogen storage 05 p0008 A75-10572
- Electrically rechargeable redox flow cells 05 p0008 A75-10573
- Fundamental research on the selection of new electrochemical generators of medium power 06 p0060 A75-27827
- Cost and size estimates for an electrochemical bulk energy storage concept [NASA-TN-X-3192] 05 p0039 N75-15161
- Development of high specific energy batteries for electric vehicles [ANL-8058] 06 p0076 N75-16990
- Electrochemical power sources --- heat and mass transfer in porous media [AD-A001610] 06 p0094 N75-19836

ELECTROCHEMICAL CORROSION

- Corrosion and related problems in high-temperature cells 06 p0055 A75-24377

ELECTROCHEMISTRY

- Pollution-free electrochemical power generation from low grade coal [PB-236162/4] 06 p0070 N75-16109

ELECTRODES

- High energy density sintered plate type nickel-cadmium battery cells. II - Electrochemical impregnation methods to produce nickel oxide electrodes 05 p0008 A75-10570
- A novel negative-limited sealed nickel-cadmium cell 05 p0008 A75-10571
- Electrochemical power sources --- heat and mass transfer in porous media [AD-A001610] 06 p0094 N75-19836
- Sulfur-based lithium-organic electrolyte secondary batteries [AD-A003309] 06 p0104 N75-20882

ELECTROLYSIS

- Efficiencies of electrolytic and thermochemical hydrogen production 06 p0045 A75-20300
- Production of hydrogen by the electrolysis of water 06 p0046 A75-22044

ELECTROLYTIC CELLS

- Methanol/air acidic fuel cell system 05 p0008 A75-10566
- Photochemical conversion of solar energy --- study of iron-thionine photogalvanic cells [PB-235474/4] 05 p0038 N75-14282

ELECTROMAGNETIC ABSORPTION

- The COMSAT non-reflective silicon solar cell - A second generation improved cell 06 p0053 A75-24245

ELECTRON BEAMS

- An electron beam initiated fusion neutron generator 06 p0045 A75-19657

ELECTRON IRRADIATION

- The effects of irradiation on high-efficiency silicon solar cells 06 p0051 A75-24199
- Electron and proton irradiation of high-efficiency silicon solar cells 06 p0053 A75-24233

ELECTROPLATING

- Thin film coatings in solar-thermal power systems 06 p0056 A75-25679

ELECTROSTATIC GENERATORS

- Electrostatic voltage generation from flowing water 05 p0009 A75-10580

ENCAPSULATING

- Terrestrial applications of FEP-encapsulated solar cell modules --- power systems using Fluorinated Ethylene Propylene encapsulation 06 p0054 A75-24258

ENERGY

- NSF-Rann energy abstracts: A monthly abstract journal of energy research [ORNL-EIS-74-52-VOL-2-NO-1] 05 p0024 N75-10592
- Biological conversion of organic refuse to methane [PB-235468/6] 05 p0041 N75-15183

ENERGY ABSORPTION

- Selection and evaluation of the University of Florida's solar powered absorption air conditioning system [ASME PAPER 74-WA/SOL-6] 05 p0019 A75-16889

ENERGY BUDGETS

- Conservation and efficient use of energy [H-REPT-93-1634] 05 p0036 N75-14265
- A generalised analysis of the performance of a variety of drive systems for high Reynolds number, transonic wind tunnels [RAE-TR-73134] 06 p0073 N75-16572

ENERGY CONSERVATION

- Solar energy and energy conservation in a state-assisted housing for the elderly project [AIAA PAPER 75-611] 06 p0062 A75-28591
- Residential energy conservation [TID-26534] 05 p0031 N75-12442
- Remote platform power conserving system [NASA-CASE-GSC-11182-1] 05 p0032 N75-13007

- MEGASTAR: The meaning of growth. An assessment of systems, technologies, and requirements --- methodology for display and analysis of energy production and consumption
[NASA-CR-120338] 05 p0033 N75-13381
- Electricity conservation measures in the commercial sector: The Los Angeles experience [R-1592-PEA] 05 p0034 N75-13388
- Conservation and efficient use of energy [H-REPT-93-1634] 05 p0036 N75-14265
- Fuel conservation capability and effort by commercial air carriers
[NASA-CR-137624] 05 p0039 N75-15157
- Evaluation of advanced lift concepts and potential fuel conservation for short-haul aircraft
[NASA-CR-2502] 06 p0073 N75-16557
- Legal economic, and energy considerations in the use of underground space
[PB-236755/5] 06 p0080 N75-17749
- Oversight: Mandatory petroleum allocation programs [GPO-31-027] 06 p0081 N75-17806
- Economic and energy conservation relationship relevant to state of New York building design and contract awards
[PB-237006/2] 06 p0082 N75-17824
- Report and recommendations of the Solar Energy Data Workshop
[PB-238066/5] 06 p0089 N75-18757
- Synthetic Liquid Fuel Research and Development Act of 1974 --- energy conservation and cost analyses [GPO-44-818] 06 p0103 N75-20867
- Management of power plant waste heat in cold regions [AD-A003217] 06 p0104 N75-20881
- The energy crisis and decision making in the family [PB-238783/5] 06 p0106 N75-21028
- A comparative analysis of the energy consumption for several urban passenger ground transportation systems
[PB-238041/8] 06 p0107 N75-21160
- ENERGY CONSUMPTION**
- Hydrogen cycle peak-shaving for electric utilities 05 p0005 A75-10535
- Energy efficiency of current intercity passenger transportation modes
[AIAA PAPER 75-314] 06 p0047 A75-22513
- Air transportation energy consumption - Yesterday, today, and tomorrow
[AIAA PAPER 75-319] 06 p0047 A75-22515
- Mode shift strategies in intercity transportation and their effect on energy consumption
[AIAA PAPER 75-315] 06 p0055 A75-25013
- Total energy use for commercial aviation in the US [ORNL-NSF-EP-68] 05 p0023 N75-10039
- MEGASTAR: The Meaning of Energy Growth: An Assessment of Systems, Technologies, and Requirements
[NASA-CR-120355] 05 p0023 N75-10584
- US energy flow charts for 1950, 1960, 1970, 1980, 1985, and 1990
[UCRL-51487] 05 p0024 N75-10593
- The approaching energy crisis: A call for action 05 p0030 N75-12432
- Energy and the environment in Baden-Wuerttemberg [KFK-1966-UF] 05 p0030 N75-12439
- Residential energy conservation [TID-26534] 05 p0031 N75-12442
- Energy consumption by industries in support of national defense: An energy demand model [AD-784964] 05 p0031 N75-12449
- Total energy supply and demand, volume 1, chapter 6 --- natural gas, economic analysis 06 p0067 N75-16082
- Oslo's future power supply [NP-20121] 06 p0067 N75-16087
- NSF-RANN energy abstracts [ORNL-EIS-74-52-VOL-2-5] 06 p0068 N75-16092
- Guidelines to reduce energy consumption through transportation actions
[PB-235983/4] 06 p0068 N75-16094
- Industrial energy studies of ground freight transportation, volume 1
[PB-236016/2] 06 p0069 N75-16099
- Industrial energy studies of ground freight transportation. Volume 2: Appendices
[PB-236017/0] 06 p0069 N75-16100
- Energy use in the commercial and industrial sectors of the US economy, 1963
[PB-235487/6] 06 p0070 N75-16104
- Industrial energy study of the Industrial chemicals group
[PB-236322/4] 06 p0071 N75-16111
- Fuel and energy data: United States by states and regions, 1972
[PB-236581/5] 06 p0077 N75-17004
- Industrial energy study of selected food industries
[PB-237316/5] 06 p0083 N75-17827
- Study of industrial uses of energy relative to environmental effects
[PB-237215/9] 06 p0084 N75-17853
- Report of the Interagency Working Group on health and environmental effects of energy use
[PB-237937/8] 06 p0084 N75-17858
- Documenting helicopter operations from an energy standpoint
[NASA-CR-132578] 06 p0084 N75-18220
- Industrial energy study of the hydraulic cement industry
[PB-237142/5] 06 p0087 N75-18730
- Fuel and energy consumption in the coal industries
[PB-237151/6] 06 p0088 N75-18744
- Intra industry capability to substitute fuels
[PB-237605/1] 06 p0093 N75-19814
- Energy utilization by households and technology assessment as a way to increase its effectiveness --- management methods and family decision making
06 p0097 N75-20829
- Management of power plant waste heat in cold regions [AD-A003217] 06 p0104 N75-20881
- The energy crisis and decision making in the family [PB-238783/5] 06 p0106 N75-21028
- The effect of recent energy price increases on field crop production costs
[PB-238659/7] 06 p0107 N75-21155
- A comparative analysis of the energy consumption for several urban passenger ground transportation systems
[PB-238041/8] 06 p0107 N75-21160
- ENERGY CONVERSION**
- Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings 05 p0001 A75-10476
- Closed loop chemical systems for energy transmission, conversion and storage 05 p0005 A75-10538
- Prospects for tapping solar energy on a large scale 05 p0015 A75-14014
- Corrosion problems in energy conversion and generation; Proceedings of the Symposium, New York, N.Y., October 15-17, 1974 06 p0054 A75-24376
- Temperature sensor for photoelectric energy converters 06 p0057 A75-26712
- Geothermal energy --- technology assessment 06 p0060 A75-27826
- Novel materials for power systems. Part 3: Selective emitters for energy conversion [AD-784449] 05 p0026 N75-10608
- Chemical to electromagnetic energy conversion techniques --- explosive flux compression technology [AD-783901] 05 p0026 N75-10609
- Utilization of plasma exhaust energy for fuel production [COO-3028-7] 05 p0028 N75-11465
- Review of direct energy conversion of ion beams: Experimental results and reactor applications [UCRL-75600] 05 p0028 N75-11466
- MHD energy conversion [AD-785419] 05 p0032 N75-12807
- Efficiencies in power generation [PB-234160/0] 05 p0034 N75-13398
- Continued development of energy transmission and conversion systems --- applied to operation of mechanical hearts
[PB-236181/4] 05 p0037 N75-14278
- DART: A simulation code for a direct energy converter for fusion reactors [UCRL-51557] 05 p0043 N75-15462
- Development of advanced fuel cell system, phase 2 [NASA-CR-134721] 06 p0067 N75-16084
- Energy conversion from coal utilizing CPU-400 technology [PB-235817/4] 06 p0068 N75-16093
- Photochemical conversion of solar energy [PB-235503/0] 06 p0070 N75-16106

- Chemical vapor deposition research for fabrication of solar energy convertors
[PB-236189/7] 06 p0072 N75-16119
- Low to high temperature energy conversion system --- using ammonia
[NASA-CASE-NPO-13510-1] 06 p0074 N75-16972
- 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
[PB-236632/6] 06 p0078 N75-17007
- 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
[PB-236633/4] 06 p0078 N75-17008
- Energy conversion. 1: Non-propulsive aspects --- fuels and pyrotechnics
[AD-A000077] 06 p0079 N75-17454
- First Joint Soviet-American Colloquium on the Problems of MHD Energy Conversion
[JPRS-63794] 06 p0081 N75-17790
- Prospects for magnetohydrodynamic electric power plants in power engineering 06 p0081 N75-17791
- Some developments of industrial magnetohydrodynamic electric power plants
06 p0081 N75-17792
- Workshop in Gas-Phase Molecular Interactions and the Nation's Energy Problem
[PB-236712/6] 06 p0086 N75-18718
- Status and outlook for energy conversion via fuel cells
[CONF-740462-1] 06 p0087 N75-18729
- Study of potential problems and optimum opportunities in retrofitting industrial processes to low and intermediate energy gas from coal
[PB-237116/9] 06 p0088 N75-18739
- In situ oil shale conversion and recovery
[SLA-74-0162] 06 p0093 N75-19825
- Evaluation of pollution control in fossil fuel conversion processes. Gasification, section 1: Synthane process
[PB-237113/6] 06 p0095 N75-19879
- Evaluation of pollution control in fossil fuel conversion processes: Gasification. Section 1: Lurgi process
[PB-237694/5] 06 p0096 N75-19880
- Energy recovery from solid waste. Volume 1: Summary report
[NASA-CR-2525] 06 p0098 N75-20830
- Fuel cells: Direct conversion of electrochemical energy into electricity
[SAND-74-0125] 06 p0103 N75-20869
- Energy and fixed nitrogen from agricultural residues
[BNWL-SA-5070] 06 p0103 N75-20874
- ENERGY CONVERSION EFFICIENCY**
- MHD energy conversion systems
[AIAA PAPER 74-1071] 05 p0001 A75-10263
- Solar farms utilizing low-pressure closed-cycle gas turbines 05 p0003 A75-10514
- The hot deeps of the Red Sea as a potential heat source for thermoelectric power generation 05 p0004 A75-10516
- A planning methodology for the analysis and design of wind-power systems 05 p0004 A75-10517
- A wind energy conversion system based on the tracked-vehicle airfoil concept 05 p0004 A75-10518
- Economics analyses of solar energy utilization 05 p0004 A75-10520
- A prototype solar powered, Rankine Cycle system providing residential air conditioning and electricity 05 p0004 A75-10523
- Solar augmented home heating heat pump system 05 p0004 A75-10524
- Independent energy systems for better efficiency 05 p0006 A75-10549
- Fuel energy systems - Conversion and transport efficiencies 05 p0007 A75-10554
- Advanced betavoltaic power sources 05 p0007 A75-10563
- Metal hydride fuel cell power source 05 p0008 A75-10564
- Electrically rechargeable redox flow cells 05 p0008 A75-10573
- Feasibility demonstration of a road vehicle fueled with hydrogen-enriched gasoline 05 p0008 A75-10574
- Report on progress in achieving direct conversion of a major fraction of sonic flow kinetic power into electrical power by electrofluid dynamic /EPD/ processes 05 p0009 A75-10576
- The MHD power generation system with directly fired coal 05 p0009 A75-10577
- Development of a theoretical method for predicting the performance of hydrogen-oxygen MHD generators 05 p0009 A75-10578
- The Harwell thermo-mechanical generator 05 p0009 A75-10579
- Electrostatic voltage generation from flowing water 05 p0009 A75-10580
- Analysis of conversion efficiency of organic-semiconductor solar cells 05 p0010 A75-11146
- Power conversion of energy fluctuations 05 p0011 A75-11497
- II-VI photovoltaic heterojunctions for solar energy conversion 05 p0012 A75-12734
- Prospects and scientific problems of the utilization of methods of direct electric power generation from chemical fuels /fuel cells/ 05 p0012 A75-12911
- Progress in coal gasification 05 p0013 A75-12993
- High efficiency thermoelectric generator 05 p0014 A75-13067
- Solar thermal absorption heat pump breakeven coefficient of performance
[ASME PAPER 74-WA/ENER-2] 05 p0015 A75-16834
- Methods for low cost manufacture of silicon solar arrays
[ASME PAPER 74-WA/ENER-4] 05 p0016 A75-16836
- A comparison of methods for electric power generation from geothermal hot water deposits
[ASME PAPER 74-WA/ENER-10] 05 p0016 A75-16841
- Natural convection in enclosed spaces - A review of application to solar energy collection
[ASME PAPER 74-WA/HT-12] 05 p0017 A75-16860
- Performance of the thermal trap solar collector
[ASME PAPER 74-WA/SOL-5] 05 p0019 A75-16888
- Utilization of tubular thermoelectric modules in solar generators 05 p0020 A75-17067
- Determination of the temperature field in a tubular thermoelectric module 05 p0020 A75-17068
- Prospects for using dynamic thermocompression converter in solar power plants 05 p0020 A75-17076
- Effect of heat transfer from the lateral surfaces of semiconductor thermocouples on the energy characteristics of a thermoelectric generator 05 p0021 A75-18798
- Thermodynamic considerations of 'solid state engines' based on thermoelastic martensitic transformations and the shape memory effect 06 p0045 A75-19631
- Numerical simulation of direct energy conversion --- from fusion reactions 06 p0045 A75-19660
- Hydrogen fuel cells and motors --- new energy technology 06 p0046 A75-22042
- Stirling engines - Capabilities and prospects 06 p0048 A75-23237
- Radiation effects on high efficiency silicon-solar cells 06 p0051 A75-24197
- The effects of irradiation on high-efficiency silicon solar cells 06 p0051 A75-24199
- Optimisation of solar cell shielding for geostationary missions 06 p0051 A75-24203
- Improvements in analysis and technology of silicon solar cells with increased efficiency 06 p0051 A75-24216

- High efficiency silicon solar cells 06 p0052 A75-24217
- Development and space qualification of new high-efficiency silicon solar cells 06 p0052 A75-24218
- Development of very low cost solar cells for terrestrial power generation 06 p0052 A75-24226
- Performance of advanced silicon solar cells in a space environment 06 p0052 A75-24232
- Electron and proton irradiation of high-efficiency silicon solar cells 06 p0053 A75-24233
- The COMSAT non-reflective silicon solar cell - A second generation improved cell 06 p0053 A75-24245
- Power generation for the X4 spacecraft - A step in the development of a high power/mass ratio, hybrid solar array for applications spacecraft 06 p0053 A75-24251
- Review of central power magnetohydrodynamics. [AIAA PAPER 75-264] 06 p0055 A75-25005
- Epitaxial silicon solar cell 06 p0056 A75-25086
- A superconducting microwave engine 06 p0056 A75-25831
- A generalization of the Carnot theorem - The theorem of useful power 06 p0057 A75-26448
- High-efficiency graded band-gap Al_xGa_{1-x}As-GaAs solar cell 06 p0058 A75-27519
- GaAs concentrator solar cell 06 p0058 A75-27520
- Solar collector performance evaluated outdoors at NASA-Lewis Research Center 06 p0058 A75-27531
- Salt domes, pit craters, and dry steam fields - Heat pipe applications 06 p0060 A75-27789
- 100 MWe solar power plant design configuration and performance [AIAA PAPER 75-623] 06 p0062 A75-28595
- Design study of the energy characteristics of thermionic electric power generating components and assemblies 06 p0064 A75-28893
- Ocean thermal energy conversion system evaluation [AIAA PAPER 75-616] 06 p0064 A75-29115
- Analytical description of the modern steam automobile [NASA-TM-X-72199] 05 p0035 N75-14134
- Photochemical conversion of solar energy [PB-236266/3] 05 p0037 N75-14281
- Utilizing fuel more efficiently in reheating and heat treatment furnaces [BLL-M-21957-(5828.4F)] 06 p0080 N75-17467
- ENERGY DISTRIBUTION**
- Study of energy distribution in the field of concentration of a solar power plant with a hyperboloid counterreflector 05 p0010 A75-11195
- Energy distribution in the concentration field of a solar installation with a hyperboloidal counter-reflector 06 p0049 A75-23407
- Energy transportation, distribution, and storage [WASH-1281-4] 05 p0024 N75-10595
- Solar energy --- and solar powered equipment [NASA-TT-F-16155] 06 p0081 N75-17787
- ENERGY POLICY**
- Combustion dynamics research for 'Project Independence' [AIAA PAPER 74-1069] 05 p0001 A75-10262
- Fuel outlook dictating technical transport research 05 p0011 A75-11427
- Fusion reactors as future energy sources 05 p0011 A75-11735
- Energy crisis - Fact or fiction 05 p0011 A75-12115
- International energy problems and environmental policy 05 p0014 A75-13597
- The energy perspective --- world fossil fuel reserves and alternate energy sources 05 p0019 A75-17000
- Energy. Volume 1 - Demands, resources, impact, technology, and policy --- Book 06 p0045 A75-20066
- Conceptual design of reduced energy transports [AIAA PAPER 75-303] 06 p0047 A75-22508
- Energy efficiency of current intercity passenger transportation modes [AIAA PAPER 75-314] 06 p0047 A75-22513
- The economics of nuclear power 06 p0047 A75-22734
- Energy systems - Modeling and policy analysis 06 p0055 A75-24750
- Mode shift strategies in intercity transportation and their effect on energy consumption [AIAA PAPER 75-315] 06 p0055 A75-25013
- Energy Delta: Supply vs. demand; Proceedings of the Energy Symposium, San Francisco, Calif., February 25-27, 1974 06 p0059 A75-27778
- Energy supply and demand challenges and some possible solutions 06 p0059 A75-27779
- Rationale for setting priorities for new energy technology research and development [UCRL-51511] 05 p0024 N75-10594
- Development of solar engineering in the USSR [AD-784708] 05 p0025 N75-10597
- Preliminary evaluation of underground coal gasification at Hanna, Wyoming [BM-TPR-82] 05 p0025 N75-10599
- Impact of motor gasoline lead additive regulations on petroleum refineries and energy resources, 1974-1980, phase 1 [PB-234185/7] 05 p0025 N75-10601
- Char oil energy development [PB-233263/3] 05 p0025 N75-10603
- Evaluation of coal conversion processes to provide clean fuels, part 2 [PB-234203/8] 05 p0025 N75-10604
- Novel materials for power systems. Part 3: Selective emitters for energy conversion [AD-784449] 05 p0026 N75-10608
- Effects of energy crisis on education, 1974 [GPO-27-765] 05 p0026 N75-10850
- National Crude Oil Refinery Development Act, part 2 [GPO-35-578] 05 p0027 N75-10860
- The National Coal Conversion Act and the National Crude Oil Refinery Development Act [GPO-28-964] 05 p0027 N75-10861
- Hydrogen future fuel: A literature survey issued quarterly, issue no. 6 --- bibliographies 05 p0027 N75-11110
- Oil shale development, part 2 [GPO-30-368] 05 p0027 N75-11455
- Solar Sea Power Plants (SSPP): A critical review and survey [NASA-TM-X-70783] 05 p0028 N75-11459
- Degasification of the Mary Lee coalbed near Oak Grove, Jefferson County, Alabama, by vertical borehole in advance of mining [BM-RI-7968] 05 p0028 N75-11462
- Bioconversion --- of solar energy and solid waste energy into useable fuels [GPO-37-403] 05 p0028 N75-11463
- Shallow solar pond energy conversion system: An analysis of a conceptual 10-MWe plant [UCRL-51533-REV-1] 05 p0028 N75-11467
- NSF-RANN energy abstracts. A monthly abstract journal of energy research, volume 2, no. 4 [ORNL-EIS-74-52-VOL-2-4] 05 p0029 N75-11469
- Project Independence 05 p0029 N75-12428
- Solar sea thermal energy [GPO-37-476] 05 p0030 N75-12430
- Energy and environmental standards --- environmental standards and energy policy [GPO-37-171] 05 p0030 N75-12431
- The approaching energy crisis: A call for action 05 p0030 N75-12432
- A survey of LNG technological needs in the USA: 1974 to beyond 2000 05 p0030 N75-12435
- Energy plantations: Should we grow trees for power plant fuel? [VP-X-129] 05 p0030 N75-12436
- Energy and the environment: Electric power 05 p0030 N75-12438

- Energy and security: Implications for American policy
[AD-785084] 05 p0032 N75-12857
- Energy required to develop power in the United States
05 p0032 N75-13378
- Solar photovoltaic energy
[GPO-39-576] 05 p0032 N75-13379
- Wind energy developments in the 20th century
[NASA-TM-X-71634] 05 p0033 N75-13380
- Wind energy
[GPO-37-390] 05 p0033 N75-13387
- Electricity conservation measures in the commercial sector: The Los Angeles experience
[R-1592-PEA] 05 p0034 N75-13388
- Prospects for solar energy utilization
[SAND-74-8604] 05 p0034 N75-13389
- Solar energy: Sandia's photovoltaic research program
[SLA-74-281] 05 p0034 N75-13392
- Evaluation of coal-gasification technology. Part 1: Pipeline-W quality gas
[PB-234036/2] 05 p0034 N75-13396
- Clean power generation from coal
[PB-234188/1] 05 p0035 N75-13401
- A review of the status of MHD power generation technology including suggestions for a Canadian MHD research program
[UTIAS-39] 05 p0035 N75-13641
- Transportation vehicle energy intensities. A joint DOT/NASA reference paper --- energy consumption of air and ground vehicles
[NASA-TM-X-62404] 05 p0035 N75-13690
- Evaluation of coal-gasification technology. Part 2: Low and intermediate BTU fuel gases
[PB-234042/0] 05 p0036 N75-14273
- Solar energy
[NASA-TT-P-16092] 05 p0038 N75-15149
- Development, growth, and state of the nuclear industry
[GPO-33-873] 05 p0038 N75-15150
- The prospects for gasoline availability: 1974
[GPO-34-969] 05 p0039 N75-15155
- Oversight: Mandatory petroleum allocation programs, part 1
[GPO-30-060] 05 p0039 N75-15158
- Oversight: Mandatory petroleum allocation programs, part 2
[GPO-31-519] 05 p0039 N75-15159
- Prototype oil shale leasing program
[GPO-28-686] 05 p0039 N75-15160
- Revised cost estimate for the LLL in situ coal gasification concept
[UCRL-51578] 05 p0039 N75-15166
- Wind and solar power engineering
[AD-786844] 05 p0039 N75-15168
- Development of a process for producing an ashless, low-sulfur fuel from coal. Volume 2: Laboratory studies. Part 1: Autoclave experiments
[PB-236305/9] 05 p0040 N75-15169
- Bureau of Mines research 1973. Summary of significant results in mining, metallurgy, and energy
[PB-234733/4] 05 p0040 N75-15171
- Char oil energy development
[PB-234018/0] 05 p0040 N75-15173
- Offshore investigation: Producing shut-in leases as of January 1974 (second phase)
[PB-234490/1] 05 p0040 N75-15174
- Program plan for environmental effects of energy
[PB-235115/3] 05 p0040 N75-15177
- Interfuel substitution in the consumption of energy in the United States. Part 1: Residential and commercial sector
[PB-234536/1] 05 p0040 N75-15178
- Caltech seminar series on energy consumption in private transportation: Administrative summary
[PB-235349/8] 05 p0041 N75-15184
- Chemical vapor deposition research for fabrication of solar energy convertors
[PB-235481/9] 05 p0041 N75-15185
- Feasibility study of alternative fuels for automotive transportation. Volume 1: Executive summary
[PB-235581/6] 05 p0041 N75-15187
- Feasibility study of alternative fuels for automotive transportation. Volume 2: Technical section
[PB-235582/4] 05 p0041 N75-15188
- Feasibility study of alternative fuels and automotive transportation. Volume 3: Appendices
[PB-235583/2] 05 p0041 N75-15189
- Solar heating and cooling of buildings, phase 0. Volume 2: Final report
[PB-235423/1] 05 p0042 N75-15190
- Solar heating and cooling of buildings, phase 0: Feasibility and planning study. Volume 3, book 1, appendix A, task 1: Development of requirements. Appendix B, task 2: Systems definition
[PB-235433/0] 05 p0042 N75-15191
- Solar heating and cooling of buildings. Phase 0: Final report, volume 1
[PB-235427/2] 05 p0042 N75-15192
- Solar heating and cooling of buildings. Phase 0: Final report. Volume 2: Appendices A-N
[PB-235428/0] 05 p0042 N75-15193
- Solar heating and cooling of buildings. Phase 0: Final report. Volume 3: Appendices O-Y
[PB-235429/8] 05 p0042 N75-15194
- A process for cleaning and removal of sulfur compounds from low Btu gases --- coal gasification
[PB-236522/9] 06 p0065 N75-15768
- An assessment and analysis of the energy emergency
[GPO-25-382] 06 p0066 N75-16076
- Market performance and competition in the petroleum industry, part 1
[GPO-28-503] 06 p0066 N75-16077
- Fuel availability and allocation in the United States
[GPO-31-711] 06 p0067 N75-16081
- Total energy supply and demand, volume 1, chapter 6 --- natural gas, economic analysis
06 p0067 N75-16082
- Test report SEPS solar array root section model
[NASA-CR-120606] 06 p0067 N75-16085
- Oslo's future power supply
[NP-20121] 06 p0067 N75-16087
- 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
[NP-20023] 06 p0067 N75-16088
- AEC in situ oil shale program
[UCID-16520] 06 p0068 N75-16090
- Beneficial uses of waste heat
[RT/PROT-(74)10] 06 p0068 N75-16091
- NSF-RANN energy abstracts
[ORNL-EIS-74-52-VOL-2-5] 06 p0068 N75-16092
- Guidelines to reduce energy consumption through transportation actions
[PB-235983/4] 06 p0068 N75-16094
- Proceedings of the Solar Heating and Cooling for Buildings Workshop. Part 2: Panel sessions, March 23
[PB-235483/5] 06 p0069 N75-16095
- Industrial energy studies of ground freight transportation, volume 1
[PB-236016/2] 06 p0069 N75-16099
- Industrial energy studies of ground freight transportation. Volume 2: Appendices
[PB-236017/0] 06 p0069 N75-16100
- Solar heating and cooling of buildings. Phase 0: Feasibility and planning study. Volume 1:
[PB-235431/4] 06 p0069 N75-16101
- Solar heating and cooling of buildings. Phase 0: Feasibility and planning study. Volume 2: Technical report
[PB-235432/2] 06 p0069 N75-16102
- Solar heating and cooling of buildings, phase 0. Volume 3: Appendices
[PB-235424/9] 06 p0070 N75-16103
- Energy use in the commercial and industrial sectors of the US economy, 1963
[PB-235487/6] 06 p0070 N75-16104
- A study of the demand for gasoline
[PB-235254/0] 06 p0070 N75-16105
- Photochemical conversion of solar energy
[PB-235503/0] 06 p0070 N75-16106
- Solar heating and cooling of buildings, phase 0. Volume 1: Executive summary
[PB-235422/3] 06 p0070 N75-16107

- The design and development of an interactive energy model
[PB-236144/2] 06 p0070 N75-16110
- Prospective regional markets for coal conversion plant products projected to 1980 and 1985. Volume 1: Market analysis
[PB-236631/8] 06 p0071 N75-16113
- Air-stable selective surfaces for solar energy collectors
[PB-236196/2] 06 p0071 N75-16116
- Photovoltaic conversion of solar energy for Terrestrial Applications. Volume 1: Working group and panel reports
[PB-236163/2] 06 p0072 N75-16121
- Transportation and the new energy policies: Truck sizes and weights, part 2
[GPO-29-802] 06 p0073 N75-16410
- Energy from the earth's depths
[BLL-M-23516-(5828.4F)] 06 p0074 N75-16968
- Air conditioning of office buildings with all-electric supply. Part 1: Technical conception
[OA-TRANS-938-PT-1] 06 p0074 N75-16970
- Development of oil and gas on the Continental Shelf
[GPO-31-891] 06 p0075 N75-16973
- Progress and problems in developing nuclear and other experimental techniques for recovering natural gas in the Rocky Mountain area
[B-164105] 06 p0075 N75-16975
- The 1974 AGARD Annual Meeting: The energy problem: Impacts on military research and development
06 p0075 N75-16977
- Development and performance of a miniature, high-voltage thermal battery
[SLA-74-5363] 06 p0076 N75-16988
- Solar energy program plan for heating and cooling buildings
[WASH-1337-5-DRAFT] 06 p0077 N75-16993
- Comparison of the environmental aspects of nuclear and fossil fueled power stations
[CONF-740555-1] 06 p0077 N75-16995
- Use of methanol in transportation --- coal liquefaction methods
[UCID-16528] 06 p0077 N75-16996
- Proceedings of the Workshop on Needs for Fundamental Research in Catalysis as Related to the Energy Problem
[PB-236683/9] 06 p0078 N75-17006
- 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
[PB-236632/6] 06 p0078 N75-17007
- 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
[PB-236633/4] 06 p0078 N75-17008
- Economic modeling and energy policy planning --- technology transfer, market research
06 p0079 N75-17210
- US energy R and D policy: The role of economics
[RFP-WORKING-PAPER-EN-4] 06 p0080 N75-17783
- Oversight: Mandatory petroleum allocation programs
[GPO-31-027] 06 p0081 N75-17806
- Solar total energy program
[SAND-74-0208] 06 p0081 N75-17810
- California energy workshop: Developing a plan of action to meet the energy crisis in California --- oil recovery, nuclear electric power generation, and offshore energy sources
[PB-237045/0] 06 p0082 N75-17822
- Design and construction of a residential solar heating and cooling system
[PB-237042/7] 06 p0082 N75-17823
- Economic and energy conservation relationship relevant to state of New York building design and contract awards
[PB-237006/2] 06 p0082 N75-17824
- Use of solar energy in buildings in New York state
[PB-236974/2] 06 p0083 N75-17825
- Intermediate-term energy programs to protect against crude-petroleum import interruptions: Feasible alternatives, program costs, and operational methods of funding
[PB-237209/2] 06 p0083 N75-17826
- Industrial energy study of selected food industries
[PB-237316/5] 06 p0083 N75-17827
- OCS oil and gas: An environmental assessment, Volume 1
06 p0083 N75-17837
- OCS oil and gas: An environmental assessment, Volume 2
06 p0084 N75-17838
- Nuclear system that burns its own wastes shows promise
[NASA-NEWS-RELEASE-75-44] 06 p0085 N75-18716
- Workshop in Gas-Phase Molecular Interactions and the Nation's Energy Problem
[PB-236712/6] 06 p0086 N75-18718
- Status and outlook for energy conversion via fuel cells
[CONF-740462-1] 06 p0087 N75-18729
- Natural gas in Alabama
[PB-236582/3] 06 p0088 N75-18737
- Assessment of the Rankine cycle for potential application to solar powered cooling of buildings
[PB-238069/9] 06 p0089 N75-18755
- Proceedings of the New York State Assembly/AISLE Conference on Energy and the Environment, Volume 1
[PB-237936/0] 06 p0091 N75-18801
- An economic analysis of oil shale operations featuring gas combustion retorting
[PB-237851/1] 06 p0093 N75-19813
- Intra industry capability to substitute fuels
[PB-237605/1] 06 p0093 N75-19814
- In situ oil shale conversion and recovery
[SLA-74-0162] 06 p0093 N75-19825
- LLL-SOHIO solar process heat project
[UCID-16630-74-1] 06 p0093 N75-19827
- Nuclear district-heating and nuclear long-distance energy
[JUL-1077] 06 p0093 N75-19828
- Energy systems analysis and technology assessment program
[BNL-18984] 06 p0094 N75-19831
- 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
[PB-237763/8] 06 p0095 N75-19839
- Development of a process for producing an ashless, low-sulfur fuel from coal. Volume 4. Product studies. Part 3 Products from coal minerals
[PB-237764/6] 06 p0095 N75-19840
- Development of a process for producing an ashless, low-sulfur fuel from coal. Volume 4. Product studies. Part 4. Sulfur removal from coal minerals
[PB-237765/3] 06 p0095 N75-19841
- 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
[PB-237766/1] 06 p0095 N75-19842
- Synthetic Liquid Fuel Research and Development Act of 1974 --- energy conservation and cost analyses
[GPO-44-818] 06 p0103 N75-20867
- Synthetic fuels for ground transportation with special emphasis on hydrogen
[NASA-TN-X-72652] 06 p0103 N75-20868
- Fuel cells: Direct conversion of electrochemical energy into electricity
[SAND-74-0125] 06 p0103 N75-20869
- Comparative performance characteristics of cylindrical parabolic focusing and flat plate solar energy collectors
[CONF-741104-3] 06 p0103 N75-20872
- Hydrogen storage and production in utility systems
[BNL-19249] 06 p0103 N75-20873
- Energy and fixed nitrogen from agricultural residues
[BNWL-SA-5070] 06 p0103 N75-20874
- Acoustic array methods for instrumentation of in situ coal gasification
[UCID-16591] 06 p0104 N75-20875
- Metal hydrides as a source of hydrogen fuel
[BNL-14804-R] 06 p0104 N75-20876
- Management of power plant waste heat in cold regions
[AD-A003217] 06 p0104 N75-20881
- Sulfur-based lithium-organic electrolyte secondary batteries
[AD-A003309] 06 p0104 N75-20882
- Technology for the conversion of solar energy to fuel gas
[PB-238103/6] 06 p0104 N75-20883

- Environmental aspects of cadmium sulfide usage in solar energy conversion. Part 1: Toxicological and environmental health considerations, a bibliography
[PB-238285/1] 06 p0105 N75-20884
- Wind power potential of Alaska. Part 1: Surface wind data from specific coastal sites
[PB-238507/8] 06 p0105 N75-20885
- Wisconsin superconductive energy storage project, volume 1
[PB-238082/2] 06 p0105 N75-20887
- Research on the application of solar energy to the food drying industry
[PB-238073/1] 06 p0105 N75-20888
- Synthetic fuels from fusion reactors
[BNL-19351] 06 p0106 N75-21098
- Synopsis of studies on synthetic fuels production by fusion reactors
[BNL-19336] 06 p0106 N75-21104
- ENERGY REQUIREMENTS**
- Nuclear energy requirements for hydrogen production from water
05 p0005 A75-10533
- The Energy Systems Optimization Computer Program /ESOP/ developed for Modular Integrated Utility Systems /MIUS/ analysis
05 p0006 A75-10551
- Mission applications of electric propulsion
[AIAA PAPER 74-1085] 05 p0010 A75-11284
- Rating aircraft on energy
05 p0015 A75-14346
- Laser compression of matter - Optical power and energy requirements
06 p0046 A75-22352
- Energy systems - Modeling and policy analysis
06 p0055 A75-24750
- Energy supply and demand challenges and some possible solutions
06 p0059 A75-27779
- Time factors in slowing down the rate of growth of demand for primary energy in the United States
06 p0059 A75-27780
- DCTR power supply and energy storage review meeting
[WASH-1310] 05 p0031 N75-12445
- Energy required to develop power in the United States
05 p0032 N75-13378
- MEGASTAR: The meaning of growth. An assessment of systems, technologies, and requirements --- methodology for display and analysis of energy production and consumption
[NASA-CR-120338] 05 p0033 N75-13381
- Oslo's future power supply
[NP-20121] 06 p0067 N75-16087
- Energy problems in a global context
06 p0075 N75-16978
- Energy resources and utilization
06 p0075 N75-16983
- Proceedings of the Workshop on Needs for Fundamental Research in Catalysis as Related to the Energy Problem
[PB-236683/9] 06 p0078 N75-17006
- Hydrogen economy: A utility perspective
[BNL-19267] 06 p0103 N75-20870
- ENERGY SOURCES**
- Energy carriers in space conditioning and automotive applications - A comparison of hydrogen, methane, methanol and electricity
05 p0005 A75-10540
- Energy from urban wastes
05 p0006 A75-10548
- Independent energy systems for better efficiency
05 p0006 A75-10549
- Metal hydride fuel cell power source
05 p0008 A75-10564
- Geothermics with special reference to application --- Book
05 p0011 A75-11576
- Energy development; Proceedings of the Energy Sources Conference, Anaheim, Calif., July 14-19, 1974
05 p0012 A75-12986
- U.S. energy resources - Outlook for the future
05 p0014 A75-12999
- A comparison of methods for electric power generation from geothermal hot water deposits
[ASME PAPER 74-WA/ENER-10] 05 p0016 A75-16841
- Energy Delta: Supply vs. demand; Proceedings of the Energy Symposium, San Francisco, Calif., February 25-27, 1974
06 p0059 A75-27778
- Solar/hydroelectric combined power systems
06 p0059 A75-27786
- Current worldwide utilization and ultimate potential of geothermal energy systems
06 p0060 A75-27787
- New technology challenges in exploration, exploitation and environmental impact of geothermal systems
06 p0060 A75-27788
- Hydrogen - A carrier of energy
06 p0060 A75-27791
- Urban waste energy resources
[AIAA PAPER 75-632] 06 p0062 A75-28598
- US energy flow charts for 1950, 1960, 1970, 1980, 1985, and 1990
[UCRL-51487] 05 p0024 N75-10593
- Advanced nuclear research
[GPO-41-253] 05 p0026 N75-10764
- Elimination of duty on methanol imported for certain uses
[H-REPT-93-998] 05 p0026 N75-10857
- Public works for water and power development and Atomic Energy Commission Appropriation Bill, 1975. Part 6: Tennessee Valley Authority
[GPO-32-403] 05 p0026 N75-10859
- Outlook for fusion energy sources: Remaining technological hurdles
[UCRL-75418] 05 p0029 N75-11745
- Solar sea thermal energy
[GPO-37-476] 05 p0030 N75-12430
- Oil for the free world in the 1970's --- demand and supply
[AD-779352] 05 p0031 N75-12448
- MEGASTAR: The meaning of growth. An assessment of systems, technologies, and requirements --- methodology for display and analysis of energy production and consumption
[NASA-CR-120338] 05 p0033 N75-13381
- A system utilizing solar energy
[NASA-TT-P-16089] 05 p0033 N75-13386
- Hydrogen as a fuel --- analysis of problems involved in generation, transportation, and utilization
[AD-787484] 06 p0066 N75-15818
- Energy from US and Canadian tar sands: Technical, environmental, economic, legislative, and policy aspects
[GPO-43-005] 06 p0067 N75-16083
- Geothermal energy: A new application of rock mechanics
[LA-UR-74-821] 06 p0068 N75-16089
- NSF-RANN energy abstracts
[ORNL-EIS-74-52-VOL-2-5] 06 p0068 N75-16092
- Workshop proceedings: Photovoltaic conversion of solar energy for terrestrial applications. Volume 1: Working group and panel reports
[NASA-CR-138209] 06 p0069 N75-16097
- Workshop proceedings: Photovoltaic conversion of solar energy for terrestrial applications. Volume 2: Invited papers
[NASA-CR-138193] 06 p0069 N75-16098
- Possibilities for lithium borohydride recycle --- using diborane intermediate
[ICP-1054] 06 p0074 N75-16651
- The 1974 AGARD Annual Meeting: The energy problem: Impacts on military research and development
06 p0075 N75-16977
- Energy problems in a global context
06 p0075 N75-16978
- Energy-related research and development in the United States Air Force
06 p0075 N75-16979
- Alternative fuels for aviation
06 p0075 N75-16980
- Energy resources and utilization
06 p0075 N75-16983
- Energy and cryoengineering
[LA-UR-74-741] 06 p0082 N75-17814
- Methanol from forestry, municipal, and agricultural organic residues
[BNWL-SA-5053] 06 p0085 N75-18702
- Steps into the future. Development of the power industry in the USSR
[BLL-M-23330-(5828.4F)] 06 p0085 N75-18714

- Pyrolysis system evaluation study
[NASA-CR-141664] 06 p0086 N75-18722
- Prospect for geothermal power
[LA-UR-74-1111] 06 p0086 N75-18723
- In situ oil shale: A cost sensitivity analysis
[SAND-74-0146] 06 p0087 N75-18727
- Conference proceedings: Power Generation-Clean Fuels Today
[PB-237661/4] 06 p0087 N75-18735
- Study of potential problems and optimum opportunities in retrofitting industrial processes to low and intermediate energy gas from coal
[PB-237116/9] 06 p0088 N75-18739
- Interesting possibilities of fusion-fission --- for thermonuclear power generation
[BNWL-SA-5069] 06 p0096 N75-20106
- The National Geothermal Energy Research Program
06 p0098 N75-20832
- Geothermal research and development program of the US Atomic Energy Commission
06 p0098 N75-20834
- Hydrogen economy: A utility perspective
[BNL-19267] 06 p0103 N75-20870
- United States transportation fuel economics (1975 - 1995)
[NASA-TM-X-3197] 06 p0107 N75-21154
- Scientific research seeks new sources of energy
06 p0107 N75-21216
- ENERGY STORAGE**
- Metal hydrides for thermal energy storage
05 p0004 A75-10522
- Energy storage for utilities via hydrogen systems
05 p0005 A75-10537
- Closed loop chemical systems for energy transmission, conversion and storage
05 p0005 A75-10538
- Thermal energy storage devices suitable for solar heating
05 p0007 A75-10553
- Electrically rechargeable redox flow cells
05 p0008 A75-10573
- Solar energy conversion and storage systems for the future
05 p0013 A75-12988
- Energy storage underground --- hydroelectric pumped-storage and combustion turbine facilities
05 p0013 A75-12989
- Pumped air storage for electric power generation
05 p0013 A75-12990
- The Hydrogen Economy - A utility perspective --- energy technology
05 p0014 A75-12998
- Potential for large-scale energy storage in electric utility systems
[ASME PAPER 74-WA/ENER-9] 05 p0016 A75-16840
- A hot liquid energy storage system utilizing natural circulation
[ASME PAPER 74-WA/HT-16] 05 p0017 A75-16862
- Solar energy storage within the absorption cycle
[ASME PAPER 74-WA/HT-18] 05 p0017 A75-16864
- Economics of a hydrogen storage peaking power plant
[ASME PAPER 74-WA/PWR-6] 05 p0018 A75-16880
- Optimising pumped storage with tidal power in an estuary
[ASME PAPER 74-WA/PWR-7] 05 p0018 A75-16881
- An analytical and experimental investigation of a laboratory solar pond model
[ASME PAPER 74-WA/SOL-3] 05 p0019 A75-16886
- Energy, hydrogen, and pollution --- energy technology
06 p0046 A75-22041
- Production of hydrogen by the electrolysis of water
06 p0046 A75-22044
- Metals and composites in superflywheel energy storage systems
06 p0047 A75-22523
- Energy transportation, distribution, and storage
[NASH-1281-4] 05 p0024 N75-10595
- Energy storage for the electric power industry
[LA-UR-74-918] 05 p0031 N75-12447
- Superconducting magnetic energy storage --- theta pinch thermonuclear fusion test reactor
[LA-UR-74-737] 05 p0032 N75-12814
- Methods of energy transfer from a magnetic energy storage system using a transfer capacitor and a superconducting switch
[LA-5631-MS] 05 p0032 N75-13164
- Development of advanced fuel cell system, phase 2
[NASA-CR-134721] 06 p0067 N75-16084
- Energy from the earth's depths
[BLL-M-23516-(5828.4F)] 06 p0074 N75-16968
- High energy battery program at Argonne National Laboratory
[ANL-8064] 06 p0076 N75-16984
- Energy storage for utilities via hydrogen systems
[BNL-19266] 06 p0086 N75-18725
- Economic and system aspects of a superconducting magnetic energy storage device and a dc superconducting transmission line
[LA-UR-74-1145] 06 p0091 N75-19080
- Hydrogen storage and production in utility systems
[BNL-18920] 06 p0097 N75-20580
- Hydrogen economy: A utility perspective
[BNL-19267] 06 p0103 N75-20870
- Hydrogen storage and production in utility systems
[BNL-19249] 06 p0103 N75-20873
- Wisconsin superconductive energy storage project, volume 1
[PB-238082/2] 06 p0105 N75-20887
- ENERGY TECHNOLOGY**
- Nuclear propulsion technology transfer to energy systems
[AIAA PAPER 74-1072] 05 p0001 A75-10264
- Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings
05 p0001 A75-10476
- Technology considerations for Organic Rankine Cycle Electric Power Systems
05 p0002 A75-10484
- NASA objectives for improved solar power plants
05 p0002 A75-10485
- RTG technology development - Where we are/where we are going --- radioisotope thermoelectric generator
05 p0002 A75-10496
- Economics analyses of solar energy utilization
05 p0004 A75-10520
- Status of JPL solar powered experiments for terrestrial applications
05 p0005 A75-10530
- Operating experiences with terrestrial solar battery systems in Japan
05 p0005 A75-10531
- Nuclear energy requirements for hydrogen production from water
05 p0005 A75-10533
- Hydrogen for the electric utilities - Long range possibilities
05 p0005 A75-10536
- Oxides of nitrogen control techniques for appliance conversion to hydrogen fuel
05 p0006 A75-10541
- Potential of Rankine engines to produce power from waste heat streams
05 p0006 A75-10547
- Energy from urban wastes
05 p0006 A75-10548
- A heat pump powered by natural thermal gradients
05 p0006 A75-10550
- A review of thermal battery technology
05 p0007 A75-10557
- Combustion R&D - Key to our energy future --- pollution reduction using hydrocarbon fuels
05 p0009 A75-10596
- Applications of plasma core reactors to terrestrial energy systems
[AIAA PAPER 74-1074] 05 p0010 A75-11281
- Coal-gas combustion in industrial gas turbines
[AIAA PAPER 74-1114] 05 p0010 A75-11286
- Power conversion of energy fluctuations
05 p0011 A75-11497
- An evaluation of discarded tires as a potential source of fuel
05 p0012 A75-12416
- Solar energy: Technology and applications --- Book
05 p0012 A75-12425
- Energy development; Proceedings of the Energy Sources Conference, Anaheim, Calif., July 14-19, 1974
05 p0012 A75-12986
- Utilization of solar energy today
05 p0012 A75-12987
- Solar energy conversion and storage systems for the future
05 p0013 A75-12988

- Pumped air storage for electric power generation
05 p0013 A75-12990
- The impact of advanced batteries on electric power generation
05 p0013 A75-12991
- The PCG-1 fuel cell powerplant for electric utility use
05 p0013 A75-12992
- Progress in coal gasification
05 p0013 A75-12993
- Tidal power and its integration into the electric system
05 p0013 A75-12994
- Fusion power research - Where do we stand
05 p0013 A75-12995
- Windpower - Look backward, then move forward confidently --- for electric power generation in rural areas
05 p0014 A75-12997
- The Hydrogen Economy - A utility perspective --- energy technology
05 p0014 A75-12998
- U.S. energy resources - Outlook for the future
05 p0014 A75-12999
- Advances in space power generation [IAF PAPER 74-086]
05 p0015 A75-13718
- Prospects for tapping solar energy on a large scale
05 p0015 A75-14014
- Solar cells - Operation, development and applications
05 p0015 A75-15201
- The use of hydrogen as an energy carrier
05 p0015 A75-15795
- Comparative performance characteristics of cylindrical parabolic and flat plate solar energy collectors
[ASME PAPER 74-WA/ENER-3] 05 p0016 A75-16835
- Progress in development of auxiliary MHD power plant components at Avco Everett Research Laboratory, Inc
[ASME PAPER 74-WA/ENER-6] 05 p0016 A75-16838
- Two-stage methane production from solid wastes
[ASME PAPER 74-WA/ENER-11] 05 p0017 A75-16842
- Solar selective surfaces made of semiconducting powders
[ASME PAPER 74-WA/HT-13] 05 p0017 A75-16857
- Solar radiation heat transfer to high temperature heat carriers
[ASME PAPER 74-WA/HT-14] 05 p0017 A75-16861
- Performance of heat pumps using cold-side energy storage and unconventional heat sources
[ASME PAPER 74-WA/HT-17] 05 p0017 A75-16863
- Power from ocean waves
[ASME PAPER 74-WA/PWR-5] 05 p0018 A75-16879
- Gasification of solid wastes in fixed beds
[ASME PAPER 74-WA/PWR-10] 05 p0018 A75-16882
- Coal gasification by Atomics International's Rockgas process
[ASME PAPER 74-WA/PWR-11] 05 p0018 A75-16883
- A case study - Utilization of solar energy in residential dwellings
[ASME PAPER 74-WA/SOL-2] 05 p0018 A75-16885
- Performance of the thermal trap solar collector
[ASME PAPER 74-WA/SOL-5] 05 p0019 A75-16888
- Assessment of Rankine cycle for potential application to solar-powered cooling of buildings
[ASME PAPER 74-WA/SOL-7] 05 p0019 A75-16890
- Dynamic simulation for performance analysis of solar heated and cooled buildings
[ASME PAPER 74-WA/SOL-8] 05 p0019 A75-16891
- The energy perspective --- world fossil fuel reserves and alternate energy sources
05 p0019 A75-17000
- Energy problems - Solar energy and manure gas
05 p0020 A75-17024
- Design of a tubular heat collector for a solar power installation with a parabolocylindric concentrator
05 p0020 A75-17069
- Some generalizations of sample water-supply calculations for solar-powered pumping plants
05 p0020 A75-17077
- Effectiveness of using semiconductor heat pumps under the conditions of the Turkmen SSR
05 p0020 A75-17083
- Wind energy developments in the 20th century
05 p0020 A75-17503
- Concepts for central solar electric power generation
05 p0021 A75-17504
- Fusion power - Prospects and impact
05 p0021 A75-18080
- Compact solar energy concentrator
05 p0021 A75-19050
- Energy. Volume 1 - Demands, resources, impact, technology, and policy --- Book
06 p0045 A75-20066
- Energy, hydrogen, and pollution --- energy technology
06 p0046 A75-22041
- Hydrogen fuel cells and motors --- new energy technology
06 p0046 A75-22042
- Production of hydrogen by the electrolysis of water
06 p0046 A75-22044
- Material considerations involved in solar energy conversion
06 p0047 A75-22522
- Liquid hydrogen as an automotive fuel
06 p0048 A75-23238
- Nonconventional energy systems; Meeting, Duesseldorf, West Germany, June 20, 21, 1974, Reports
06 p0049 A75-23501
- The production of gaseous energy carriers from fossil fuels
06 p0049 A75-23502
- Energy supply in a closed cycle --- nuclear energy for nonelectrical use
06 p0049 A75-23503
- Hydrogen as energy carrier in industry and household
06 p0049 A75-23505
- Methanol as fuel for vehicle engines
06 p0050 A75-23506
- Methane gas engines for commercial vehicles and busses
06 p0050 A75-23507
- Hydrogen as fuel for internal-combustion engines
06 p0050 A75-23508
- Considerations regarding a utilization of solar energy --- thermal, electric and wind energy systems
06 p0050 A75-23510
- The introduction of the principles of biological energy supply in future technical systems
06 p0050 A75-23511
- Other primary energy resources --- geothermal, tidal, wind, waterwave and glacier energy utilization
06 p0050 A75-23512
- Report on photovoltaics research and technology in the United States
06 p0051 A75-24214
- Historic development of photovoltaic power generation
06 p0051 A75-24215
- CdS-Cu₂S cells - An outlook for terrestrial applications
06 p0052 A75-24223
- Progress in the development of cadmium sulphide terrestrial solar batteries
06 p0052 A75-24224
- Solar one - The Delaware solar house and results obtained during the first year of operation
06 p0054 A75-24254
- Some aspects of a solar battery system and its use for irrigation in remote sun-rich regions
06 p0054 A75-24256
- Solar generators for terrestrial applications
06 p0054 A75-24257
- Terrestrial applications of PEP-encapsulated solar cell modules --- power systems using Fluorinated Ethylene Propylene encapsulation
06 p0054 A75-24258
- The Mitre solar energy demonstration system
06 p0055 A75-24676
- Application of thermodynamic and material- and energy-balance calculations to gasification processes
06 p0055 A75-24785
- Review of central power magnetohydrodynamics [AIAA PAPER 75-264]
06 p0055 A75-25005
- The Electric Power Research Institute's role in applying superconductivity to future utility systems
06 p0056 A75-25827
- Will superconducting magnetic energy storage be used on electric utility systems
06 p0056 A75-25832

- Theory of heat extraction from fractured hot dry rock
06 p0057 A75-26544
- Testing of a photoelectric generator in a mountainous region of the Azerbaidzhan SSR
06 p0057 A75-26714
- Solar cells - Present state and perspectives on terrestrial applications
06 p0058 A75-27716
- The future of silicon solar cells for terrestrial use
06 p0058 A75-27717
- Thermoelectric generators --- using semiconductor thermocouples
06 p0058 A75-27718
- Energy Delta: Supply vs. demand; Proceedings of the Energy Symposium, San Francisco, Calif., February 25-27, 1974
06 p0059 A75-27778
- Coal gasification - A review of status and technology
06 p0059 A75-27781
- The outlook for fusion energy sources - Remaining technological hurdles
06 p0059 A75-27782
- Solar heating and cooling of buildings
06 p0059 A75-27783
- Roles for solar thermal conversion systems in our energy economy
06 p0059 A75-27784
- The Solar Community - Energy for residential heating, cooling, and electrical power
06 p0059 A75-27785
- Solar/hydroelectric combined power systems
06 p0059 A75-27786
- Salt domes, pit craters, and dry steam fields - Heat pipe applications
06 p0060 A75-27789
- Ocean thermal power and windpower systems - Natural solar energy conversion for near-term impact on world energy markets
06 p0060 A75-27790
- Hydrogen - A carrier of energy
06 p0060 A75-27791
- Prospects of photosynthetic energy production
06 p0060 A75-27792
- Geothermal energy --- technology assessment
06 p0060 A75-27826
- Fundamental research on the selection of new electrochemical generators of medium power
06 p0060 A75-27827
- Cryogenics safety in a hydrogen fuel society
06 p0061 A75-27973
- SIMSHAC - A simulation program for solar heating and cooling of buildings
06 p0061 A75-28093
- Characteristics of a rocking wave power device --- for waterwave energy conversion
06 p0062 A75-28450
- The solution of information-deficiency problems of electroenergy technology --- optimal decision making
06 p0062 A75-28508
- Systems aspects of ocean thermal energy conversion
[AIAA PAPER 75-615] 06 p0062 A75-28593
- Site limitations on Solar Sea Power Plants
[AIAA PAPER 75-618] 06 p0062 A75-28594
- 100 MWe solar power plant design configuration and performance
[AIAA PAPER 75-623] 06 p0062 A75-28595
- A central receiver solar power plant in a hybrid mode of operation --- solar/fossil-fueled steam power plant
[AIAA PAPER 75-624] 06 p0062 A75-28596
- Solar electric and thermal conversion system in close proximity to the consumer --- solar panels on house roofs
[AIAA PAPER 75-628] 06 p0062 A75-28597
- The oceanic biomass energy plantation --- seaweed harvesting for food and fuel
[AIAA PAPER 75-635] 06 p0063 A75-28599
- The satellite solar power station - An option for energy production on earth
[AIAA PAPER 75-637] 06 p0063 A75-28600
- Gulf stream based ocean thermal power plants
[AIAA PAPER 75-643] 06 p0063 A75-28603
- Ocean thermal energy conversion system evaluation
[AIAA PAPER 75-616] 06 p0064 A75-29115
- Tropical ocean thermal power plants and potential products
[AIAA PAPER 75-617] 06 p0064 A75-29116
- Solar thermal conversion mission analysis
[AIAA PAPER 75-619] 06 p0064 A75-29117
- Derivation of a total satellite energy system --- solar power station for terrestrial consumption
[AIAA PAPER 75-640] 06 p0064 A75-29118
- Rationale for setting priorities for new energy technology research and development
[UCRL-51511] 05 p0024 N75-10594
- Application of technology from the Rover program and related developments --- to energy needs
[LA-5558] 05 p0028 N75-11468
- NSF-RANN energy abstracts. A monthly abstract
Journal of energy research, volume 2, no. 4
[ORNL-EIS-74-52-VOL-2-4] 05 p0029 N75-11469
- Technological and commercial possibilities which result by using a high temperature reactor for the future supply of mineral oil in the FRG
[JUL-1017-RG] 05 p0029 N75-11470
- Outlook for fusion energy sources: Remaining technological hurdles
[UCRL-75418] 05 p0029 N75-11745
- Our prodigal sun --- solar energy technology
[NASA-EP-118] 05 p0032 N75-12885
- Wind energy developments in the 20th century
[NASA-TM-X-71634] 05 p0033 N75-13380
- MEGASTAR: The meaning of growth. An assessment of systems, technologies, and requirements --- methodology for display and analysis of energy production and consumption
[NASA-CR-120338] 05 p0033 N75-13381
- A system utilizing solar energy
[NASA-TT-F-16089] 05 p0033 N75-13386
- Efficiencies in power generation
[PB-234160/0] 05 p0034 N75-13398
- Report of the Wind Power Committee --- a feasibility analysis of the use of wind for a major energy source
[NASA-TT-F-16062] 05 p0039 N75-15154
- Energy from US and Canadian tar sands: Technical, environmental, economic, legislative, and policy aspects
[GPO-43-005] 06 p0067 N75-16083
- Energy problems in a global context
06 p0075 N75-16978
- Energy-related research and development in the United States Air Force
06 p0075 N75-16979
- Alternative fuels for aviation
06 p0075 N75-16980
- Energy resources and utilization
06 p0075 N75-16983
- Assessment of the technology required to develop photovoltaic power system for large scale national energy applications
[NSF/RA/N-74-072] 06 p0080 N75-17785
- First Joint Soviet-American Colloquium on the Problems of MHD Energy Conversion
[JPRS-63794] 06 p0081 N75-17790
- Solar total energy program
[SAND-74-0208] 06 p0081 N75-17810
- Energy and cryoengineering
[LA-UR-74-741] 06 p0082 N75-17814
- Report of the Interagency Working Group on health and environmental effects of energy use
[PB-237937/8] 06 p0084 N75-17858
- Survey of hydrogen compatibility problems in energy storage and energy transmission applications
[SAND-74-8219] 06 p0087 N75-18726
- In situ oil shale: A cost sensitivity analysis
[SAND-74-0146] 06 p0087 N75-18727
- Data base for the industrial energy study of the industrial chemicals group
[PB-237845/3] 06 p0087 N75-18732
- Conference proceedings: Power Generation-Clean Fuels Today
[PB-237661/4] 06 p0087 N75-18735
- Study of potential problems and optimum opportunities in retrofitting industrial processes to low and intermediate energy gas from coal
[PB-237116/9] 06 p0088 N75-18739
- Advanced coal gasification system for electric power generation
[PB-236971/8] 06 p0089 N75-18747

- The MHD generator: A step toward the energy supply of tomorrow --- development of magnetohydrodynamic generators [AD-A000087] 06 p0089 N75-18749
- Energy systems analysis and technology assessment program [BNL-18984] 06 p0094 N75-19831
- Research and technology operating plan summary: Fiscal year 1975 research and technology program --- space programs, energy technology, and aerospace sciences [NASA-TM-X-70410] 06 p0096 N75-20155
- Proceedings of the Conference on Research for the Development of Geothermal Energy Resources [NASA-CR-142556] 06 p0098 N75-20831
- The NSF/RANN FY 1975 program for geothermal resources research and technology 06 p0098 N75-20833
- Geothermal research and development program of the US Atomic Energy Commission 06 p0098 N75-20834
- Geophysical, geochemical, and geological investigations of the Dunes geothermal system, Imperial Valley, California [IGPP-UCR-74-31] 06 p0098 N75-20836
- The Colorado School of Mines Nevada geothermal study 06 p0099 N75-20837
- Heat flow and geothermal potential of the East Mesa KGRA, Imperial Valley, California 06 p0099 N75-20838
- A brief description of geological and geophysical exploration of the Marysville geothermal area 06 p0099 N75-20839
- Institutional and environmental problems in geothermal resource development 06 p0100 N75-20843
- The total flow concept for geothermal energy conversion 06 p0100 N75-20846
- San Diego Gas and Electric Company Imperial Valley geothermal activities 06 p0100 N75-20847
- The Marysville, Montana Geothermal Project 06 p0100 N75-20849
- Preliminary results of geothermal desalting operations at the East Mesa test site Imperial Valley, California 06 p0101 N75-20850
- Rock melting technology and geothermal drilling 06 p0101 N75-20851
- Geothermal reservoir simulation 06 p0101 N75-20852
- Geothermal reservoir engineering research 06 p0101 N75-20853
- Geothermal down well pumping system 06 p0101 N75-20854
- Helical rotary screw expander power system 06 p0101 N75-20856
- Combining total energy and energy industrial center concepts to increase utilization efficiency of geothermal energy 06 p0102 N75-20860
- A city invests in its future 06 p0102 N75-20862
- Hydrogen economy: A utility perspective [BNL-19267] 06 p0103 N75-20870
- Scientific research seeks new sources of energy 06 p0107 N75-21216
- Problems of the future and potentialities of system engineering --- metallic materials, plastics, traffic and energy supplies [ESRO-TT-110] 06 p0107 N75-21218
- ENERGY TRANSFER**
- The nature of the sunspot phenomenon. III - Energy consumption and energy transport. IV - The intrinsic instability of the magnetic configuration 06 p0064 A75-29137
- Solar energy absorber [NASA-CASE-MPS-22743-1] 05 p0024 N75-10585
- Methods of energy transfer from a magnetic energy storage system using a transfer capacitor and a superconducting switch [LA-5631-MS] 05 p0032 N75-13164
- Continued development of energy transmission and conversion systems --- applied to operation of mechanical hearts [PB-236181/4] 05 p0037 N75-14278
- Energy recovery from solid waste --- production engineering model 06 p0079 N75-17200
- Magnetic Energy Transfer and Storage (NETS) program schedules for a Fusion Test Reactor (PTR) [LA-5748-MS] 06 p0106 N75-21097
- ENGINE CONTROL**
- Powerplant energy management --- transport aircraft engine thrust control [AIAA PAPER 74-1066] 05 p0001 A75-10259
- ENGINE DESIGN**
- The Harwell thermo-mechanical generator 05 p0009 A75-10579
- An engine project engineer's view of advanced secondary power systems [SAE PAPER 740884] 05 p0019 A75-16925
- Stirling engines - Capabilities and prospects 06 p0048 A75-23237
- Part load specific fuel consumption of gas turbines 06 p0063 A75-28650
- Impact of future fuels on military aero-engines 06 p0075 N75-16981
- Preliminary study of advanced turbofans for low energy consumption [NASA-TM-X-71663] 06 p0084 N75-18241
- ENGINE PARTS**
- Study of the costs and benefits of composite materials in advanced turbofan engines [NASA-CR-134696] 06 p0073 N75-16637
- ENVIRONMENT EFFECTS**
- Process environment effects on heat pipes for fluid-bed gasification of coal [LA-OR-74-984] 05 p0029 N75-12252
- Energy and the environment: Electric power 05 p0030 N75-12438
- Energy and the environment in Baden-Wuerttemberg [KFK-1966-UF] 05 p0030 N75-12439
- Program plan for environmental effects of energy [PB-235115/3] 05 p0040 N75-15177
- Comparison of the environmental aspects of nuclear and fossil fueled power stations [CONF-740555-1] 06 p0077 N75-16995
- OCS oil and gas: An environmental assessment, Volume 1 06 p0083 N75-17837
- Pollutional problems and research needs for an oil shale industry [PB-236608/6] 06 p0084 N75-17848
- Environmental aspects of methanol as vehicular fuel: Health and environmental effects [UCRL-76076] 06 p0095 N75-19867
- Environmental aspects of cadmium sulfide usage in solar energy conversion. Part 1: Toxicological and environmental health considerations, a bibliography [PB-238285/1] 06 p0105 N75-20884
- ENVIRONMENT MANAGEMENT**
- The solution of information-deficiency problems of electroenergy technology --- optimal decision making 06 p0062 A75-28508
- ENVIRONMENT POLLUTION**
- Environmental impact of a geothermal power plant 06 p0049 A75-23291
- Limit lead in gasoline [GPO-29-660] 05 p0023 N75-10259
- Report of the Interagency Working Group on health and environmental effects of energy use [PB-237937/8] 06 p0084 N75-17858
- ENVIRONMENT PROTECTION**
- Energy crisis - Fact or fiction 05 p0011 A75-12115
- International energy problems and environmental policy 05 p0014 A75-13597
- Impact of motor gasoline lead additive regulations on petroleum refineries and energy resources, 1974-1980, phase 1 [PB-234185/7] 05 p0025 N75-10601
- Public works for water and power development and Atomic Energy Commission Appropriation Bill, 1975. Part 6: Tennessee Valley Authority [GPO-32-403] 05 p0026 N75-10859
- The Environmental protection agency industrial technology transfer program 06 p0078 N75-17193

- The action of EDF in the prevention of atmospheric pollution --- by expanding nuclear electric power generation
[BLL-CE-TRANS-6500-(9022.09)] 06 p0083 N75-17833
- Proceedings of the New York State Assembly/AISLE Conference on Energy and the Environment, Volume 1 [PB-237936/0] 06 p0091 N75-18801
- Geothermal reservoir simulation 06 p0101 N75-20852
- ENVIRONMENTAL CONTROL**
Solar heating and cooling of buildings. Phase 0: Final report. Executive summary [PB-235426/4] 05 p0042 N75-15195
- ENVIRONMENTAL MONITORING**
Institutional and environmental problems in geothermal resource development 06 p0100 N75-20843
- ENVIRONMENTAL QUALITY**
Energy and environmental standards --- environmental standards and energy policy [GPO-37-171] 05 p0030 N75-12431
- OCS oil and gas: An environmental assessment, Volume 2 06 p0084 N75-17838
- OCS oil and gas: An environmental assessment, volume 4 06 p0084 N75-17839
- OCS oil and gas: An environmental assessment, volume 5 06 p0084 N75-17840
- ENVIRONMENTAL SURVEYS**
The bioenvironmental impact of air pollution from fossil-fuel power plants [PB-237720/8] 06 p0090 N75-18782
- Imperial Valley's proposal to develop a guide for geothermal development within its county 06 p0100 N75-20844
- EPITAXY**
Epitaxial silicon solar cell 06 p0056 A75-25086
- EQUIPMENT SPECIFICATIONS**
Design installation and operation of a 25 ton-a-day coal gasification process development unit for the agglomerating burner-gasification [PB-237625/9] 06 p0087 N75-18734
- ESTIMATES**
Methane in the Pittsburgh coalbed, Washington County, Pennsylvania [PB-237848/7] 06 p0089 N75-18760
- ESTUARIES**
Optimising pumped storage with tidal power in an estuary [ASME PAPER 74-WA/PWR-7] 05 p0018 A75-16881
- EVAPORATORS**
Hot side heat exchanger for an ocean thermal difference power plant 05 p0004 A75-10527
- EXCAVATION**
The initiatives of the Los Alamos Scientific Laboratory in the transfer of a new excavation technology 06 p0079 N75-17203
- EXHAUST GASES**
Utilization of plasma exhaust energy for fuel production [COO-3028-7] 05 p0028 N75-11465
- Project Clean Air 1972, LNG conversion of GM-71 series diesel engine --- considering automobile exhaust gases control [PB-236585/6] 06 p0090 N75-18783
- Inspection and maintenance of light-duty gasoline powered motor vehicles: A guide for implementation --- emissions inspection program [PB-236587/2] 06 p0090 N75-18784
- EXPERIMENTAL DESIGN**
State of the art and prospects for electric vehicles [BLL-OA-TRANS-1250-(6196.3)] 06 p0074 N75-16712
- EXTERNAL COMBUSTION ENGINES**
Stirling engines - Capabilities and prospects 06 p0048 A75-23237
- F**
- F-15 AIRCRAFT**
F-15 secondary power systems [SAE PAPER 740885] 06 p0048 A75-22948
- FABRICATION**
Process development for low cost integrated solar arrays 06 p0054 A75-24259
- FABRY-PEROT INTERFEROMETERS**
Interferometric tuning of a 15-atm CO2 laser 06 p0058 A75-27518
- FARM CROPS**
The effect of recent energy price increases on field crop production costs [PB-238659/7] 06 p0107 N75-21155
- FAST NUCLEAR REACTORS**
Clinch River Breeder Reactor: A combined power and fuel source [CONF-740609-4] 05 p0038 N75-14593
- FEASIBILITY ANALYSIS**
Potential for large-scale energy storage in electric utility systems [ASME PAPER 74-WA/ENER-9] 05 p0016 A75-16840
- Power from ocean waves [ASME PAPER 74-WA/PWR-5] 05 p0018 A75-16879
- Lighter than air - A look at the past, a look at the possibilities 06 p0056 A75-25995
- Report of the Wind Power Committee --- a feasibility analysis of the use of wind for a major energy source [NASA-TT-F-16062] 05 p0039 N75-15154
- Solar heating and cooling of buildings. Phase 0. Feasibility and planning study. Volume 3, book 2, appendix C, task 3: Assessment of capture potential. Appendix d, task 4: Social and environmental study [PB-235434/8] 06 p0070 N75-16108
- Pollution-free electrochemical power generation from low grade coal [PB-236162/4] 06 p0070 N75-16109
- Sixty minute thermal battery: A feasibility study [SLA-73-5888] 06 p0077 N75-16994
- Solar thermal power systems based on optical transmission [PB-237005/4] 06 p0088 N75-18742
- Electric power generation using geothermal brine resources for a proof of concept facility 06 p0101 N75-20857
- FEDERAL BUDGETS**
Public works for water and power development and Atomic Energy Commission Appropriation Bill, 1975. Part 6: Tennessee Valley Authority [GPO-32-403] 05 p0026 N75-10859
- FERMENTATION**
Energy problems - Solar energy and manure gas 05 p0020 A75-17024
- Biological conversion of organic refuse to methane [PB-235468/6] 05 p0041 N75-15183
- FERTILIZERS**
Energy and fixed nitrogen from agricultural residues [BNWL-SA-5070] 06 p0103 N75-20874
- FIGURE OF MERIT**
Heat mirrors for solar-energy collection and radiation insulation 05 p0004 A75-10525
- FINLAND**
Technology and community development materials processing, and electrical and nuclear technology --- technical research center of Finland 05 p0031 N75-12695
- FISSION**
Interesting possibilities of fusion-fission --- for thermonuclear power generation [BNWL-SA-5069] 06 p0096 N75-20106
- FLAMES**
Energy conversion. 1: Non-propulsive aspects --- fuels and pyrotechnics [AD-A000077] 06 p0079 N75-17454
- FLAT PLATES**
Status of the NASA-Lewis flat-plate collector tests with a solar simulator 06 p0058 A75-27533
- FLEXIBLE BODIES**
Investigations and selection of components and materials for flexible solar generator 06 p0050 A75-24182
- FLIGHT CHARACTERISTICS**
Impact on aerodynamic design 06 p0075 N75-16982

FLIGHT OPTIMIZATION

Certain problems of fuel consumption in air transport

05 p0011 A75-11372

Extended energy management methods for flight performance optimization

[AIAA PAPER 75-30] 05 p0021 A75-18269

FLOW CHARTS

US energy flow charts for 1950, 1960, 1970, 1980, 1985, and 1990

[UCRL-51487] 05 p0024 N75-10593

FLUIDIZED BED PROCESSORS

Small coal burning gas turbine for modular integrated utility systems

05 p0006 A75-10546

Use of low grade solid fuels in gas turbines

[ASME PAPER 74-WA/ENER-5] 05 p0016 A75-16837

Development of coal fired fluidized-bed boilers

[PB-235899/2] 06 p0065 N75-15668

Development of coal fired fluidized-bed boilers

[PB-235898/4] 06 p0065 N75-15669

Pressurized fluidized bed combustion --- combustion physics, gas turbines

[PB-236498/2] 06 p0065 N75-15769

Pressurized fluidized bed combustion

[PB-235591/5] 06 p0065 N75-15772

Reduction of atmospheric pollution by the application of fluidized-bed combustion

[PB-235840/6] 06 p0072 N75-16151

Energy conversion from coal utilizing CPU-400 technology

[PB-237028/6] 06 p0083 N75-17828

FLUIDS

Solar energy trap

[NASA-CASE-MFS-22744-1] 05 p0024 N75-10586

FLYWHEELS

Metals and composites in superflywheel energy storage systems

06 p0047 A75-22523

The multirim superflywheel

[AD-A001081] 06 p0085 N75-18594

FOCUSING

New applications for optical components - High energy focusing

05 p0015 A75-16525

FOLDING STRUCTURES

Latest developments of the circular solar array

--- with deployment structure for central antenna communication satellite

06 p0053 A75-24246

FOOD

Industrial energy study of selected food industries

[PB-237316/5] 06 p0083 N75-17827

FORECASTING

The design and development of an interactive energy model

[PB-236144/2] 06 p0070 N75-16110

FOREIGN POLICY

Energy and security: Implications for American policy

[AD-785084] 05 p0032 N75-12857

FOSSIL FUELS

The production of gaseous energy carriers from fossil fuels

06 p0049 A75-23502

An econometric analysis of fuel selection for power generation

06 p0055 A75-24751

A central receiver solar power plant in a hybrid mode of operation --- solar/fossil-fueled steam power plant

[AIAA PAPER 75-624] 06 p0062 A75-28596

Technological and commercial possibilities which result by using a high temperature reactor for the future supply of mineral oil in the FRG

[JUL-1017-RG] 05 p0029 N75-11470

Bureau of Mines research 1973. Summary of significant results in mining, metallurgy, and energy

[PB-234733/4] 05 p0040 N75-15171

Comparison of the environmental aspects of nuclear and fossil fueled power stations

[CONF-740555-1] 06 p0077 N75-16995

Summary report of workshop on Energy Related Basic Combustion Research

[PB-236714/2] 06 p0079 N75-17456

Operational, maintenance, and environmental problems associated with a fossil fuel-fired potassium steam binary vapor cycle

[ORNL-NSF-EP-30] 06 p0090 N75-18769

The bioenvironmental impact of air pollution from fossil-fuel power plants

[PB-237720/8] 06 p0090 N75-18782

The collaborative study of EPA methods, 5, 6, and 7 in fossil fuel-fired steam generators

[PB-237695/2] 06 p0091 N75-18788

Evaluation of pollution control in fossil fuel conversion processes: Gasification. Section 1: Lurgi process

[PB-237694/5] 06 p0096 N75-19880

FRACTURE MECHANICS

A practical model law for chemical explosive fracture of oil shale

06 p0078 N75-17023

FRACTURING

Fracture-induced permeability: Present situation and prospects for coal

[UCID-16593] 06 p0094 N75-19830

FRANCE

Wind power projects of the French electrical authority

[NASA-TT-F-16057] 05 p0033 N75-13384

FREE CONVECTION

Steady state free convection in an unconfined geothermal reservoir

05 p0009 A75-11069

Natural convection in enclosed spaces - A review of application to solar energy collection

[ASME PAPER 74-WA/HT-12] 05 p0017 A75-16860

FUEL CAPSULES

Soil burial of radioisotopic-fuel capsules

06 p0046 A75-21274

FUEL CELLS

Metal hydride fuel cell power source

05 p0008 A75-10564

Milliwatt fuel cell system for sensors

05 p0008 A75-10565

Methanol/air acidic fuel cell system

05 p0008 A75-10566

60 watt hydride-air fuel cell system

05 p0008 A75-10567

Prospects and scientific problems of the utilization of methods of direct electric power generation from chemical fuels /fuel cells/

05 p0012 A75-12911

The FCG-1 fuel cell powerplant for electric utility use

05 p0013 A75-12992

Hydrogen fuel cells and motors --- new energy technology

06 p0046 A75-22042

Corrosion and related problems in high-temperature cells

06 p0055 A75-24377

An intercell heat pipe for fuel cell and battery cooling

[AD-782888] 05 p0027 N75-11226

Evaluation of an ion exchange membrane fuel cell for space power

[AD-786888] 05 p0037 N75-14274

Status and outlook for energy conversion via fuel cells

[CONF-740462-1] 06 p0087 N75-18729

Fuel cells: Direct conversion of electrochemical energy into electricity

[SAND-74-0125] 06 p0103 N75-20869

FUEL COMBUSTION

Combustion dynamics research for 'Project Independence'

[AIAA PAPER 74-1069] 05 p0001 A75-10262

Combustion R&D - Key to our energy future --- pollution reduction using hydrocarbon fuels

05 p0009 A75-10596

Coal-gas combustion in industrial gas turbines

[AIAA PAPER 74-1114] 05 p0010 A75-11286

The Stirling engine for vehicle propulsion

06 p0050 A75-23509

Compilation of air pollutant emission factors, second edition, supplement no. 3 --- fuel combustion and consumption

[PB-235736/6] 06 p0073 N75-16152

FUEL CONSUMPTION

Powerplant energy management --- transport aircraft engine thrust control

[AIAA PAPER 74-1066] 05 p0001 A75-10259

Energy from urban wastes 05 p0006 A75-10548

Certain problems of fuel consumption in air transport 05 p0011 A75-11372

Next generation transports will emphasize fuel savings 05 p0011 A75-11426

Fuel outlook dictating technical transport research 05 p0011 A75-11427

Rating aircraft on energy 05 p0015 A75-14346

Effectiveness of using semiconductor heat pumps under the conditions of the Turkmen SSR 05 p0020 A75-17083

Extended energy management methods for flight performance optimization [AIAA PAPER 75-30] 05 p0021 A75-18269

Conceptual design of reduced energy transports [AIAA PAPER 75-303] 06 p0047 A75-22508

Future long-range transports - Prospects for improved fuel efficiency [AIAA PAPER 75-316] 06 p0047 A75-22514

Air transportation energy consumption - Yesterday, today, and tomorrow [AIAA PAPER 75-319] 06 p0047 A75-22515

An econometric analysis of fuel selection for power generation 06 p0055 A75-24751

Part load specific fuel consumption of gas turbines 06 p0063 A75-28650

Total energy use for commercial aviation in the US [ORNL-NSF-EP-68] 05 p0023 N75-10039

Transportation vehicle energy intensities. A joint DOT/NASA reference paper --- energy consumption of air and ground vehicles [NASA-TM-X-62404] 05 p0035 N75-13690

The prospects for gasoline availability: 1974 [GPO-34-969] 05 p0039 N75-15155

Fuel conservation capability and effort by commercial air carriers [NASA-CR-137624] 05 p0039 N75-15157

Interfuel substitution in the consumption of energy in the United States. Part 1: Residential and commercial sector [PB-234536/1] 05 p0040 N75-15178

Caltech seminar series on energy consumption in private transportation [PB-235348/0] 05 p0040 N75-15179

Caltech seminar series on energy consumption in private transportation: Administrative summary [PB-235349/8] 05 p0041 N75-15184

Engine development program for the APL remotely piloted vehicle [AD-787507] 06 p0065 N75-15658

Fuel availability and allocation in the United States [GPO-31-711] 06 p0067 N75-16081

The design and development of an interactive energy model [PB-236144/2] 06 p0070 N75-16110

Compilation of air pollutant emission factors, second edition, supplement no. 3 --- fuel combustion and consumption [PB-235736/6] 06 p0073 N75-16152

Evaluation of advanced lift concepts and potential fuel conservation for short-haul aircraft [NASA-CR-2502] 06 p0073 N75-16557

Future long-range transports: Prospects for improved fuel efficiency [NASA-TM-X-72659] 06 p0079 N75-17339

Intermediate-term energy programs to protect against crude-petroleum import interruptions: Feasible alternatives, program costs, and operational methods of funding [PB-237209/2] 06 p0083 N75-17826

Proceedings of the New York State Assembly/AISLE Conference on Energy and the Environment, Volume 1 [PB-237936/0] 06 p0091 N75-18801

Fuel conservation possibilities for terminal area compatible aircraft [NASA-CR-132608] 06 p0091 N75-19224

Evaluation of advanced lift concepts and fuel conservative short-haul aircraft, volume 1 [NASA-CR-137525] 06 p0096 N75-20291

Evaluation of advanced lift concepts and fuel conservative short-haul aircraft, volume 2 [NASA-CR-137526] 06 p0097 N75-20292

FUEL CONTROL

Fuel energy systems - Conversion and transport efficiencies 05 p0007 A75-10554

FUEL OILS

Char oil energy development [PB-233263/3] 05 p0025 N75-10603

The approaching energy crisis: A call for action 05 p0030 N75-12432

FUEL SYSTEMS

Energy carriers in space conditioning and automotive applications - A comparison of hydrogen, methane, methanol and electricity 05 p0005 A75-10540

Oxides of nitrogen control techniques for appliance conversion to hydrogen fuel 05 p0006 A75-10541

Some LNG vehicle developments --- for automotive conversion systems and fueling stations 06 p0048 A75-23236

FUEL TANKS

Hydrogen as fuel for internal-combustion engines 06 p0050 A75-23508

FUELS

An evaluation of discarded tires as a potential source of fuel 05 p0012 A75-12416

Effective utilization of solar energy to produce clean fuel [PB-233956/2] 05 p0026 N75-10605

Iron titanium hydride as a source of hydrogen fuel for stationary and automotive applications [BNL-18651] 05 p0030 N75-12441

Energy conversion. 1: Non-propulsive aspects --- fuels and pyrotechnics [AD-A000077] 06 p0079 N75-17454

Fuel gas production from solid waste [PB-238068/1] 06 p0095 N75-19843

FURNACES

Utilizing fuel more efficiently in reheating and heat treatment furnaces [BLL-M-21957-(5828.4F)] 06 p0080 N75-17467

Survey of gas and oil burners for use with NSF/RANN-ORNL potassium boiler [ORNL-NSF-EP-45] 06 p0087 N75-18728

G

GALLIUM ARSENIIDES

High-efficiency graded band-gap Al_xGa_{1-x}As-GaAs solar cell 06 p0058 A75-27519

GaAs concentrator solar cell 06 p0058 A75-27520

GALLIUM PHOSPHIDES

GaP p-n junctions and possibilities for their application in the conversion of solar energy into electric 05 p0011 A75-12198

GAS COOLED REACTORS

Nuclear propulsion technology transfer to energy systems [AIAA PAPER 74-1072] 05 p0001 A75-10264

GAS DISCHARGES

Energy characteristics of coaxial plasma source [AD-787419] 06 p0073 N75-16368

GAS EVOLUTION

Project Rio Blanco data report: Production testing (RB-E-01), November 1973 and January - February 1974 [NVO-148] 06 p0094 N75-19833

GAS FLOW

Report on progress in achieving direct conversion of a major fraction of sonic flow kinetic power into electrical power by electrofluid dynamic /EPD/ processes 05 p0009 A75-10576

Thermal performance characteristics of heat pipes 06 p0046 A75-21465

GAS GENERATORS

Energy problems - Solar energy and manure gas 05 p0020 A75-17024

Efficiencies of electrolytic and thermochemical hydrogen production 06 p0045 A75-20300

Hydrogen as a fuel --- analysis of problems involved in generation, transportation, and utilization [AD-787484] 06 p0066 N75-15818

- A SASOL type process for gasoline, methanol, SNG, and low-Btu gas from coal
[PB-237670/5] 06 p0095 N75-19838
- GAS POCKETS**
Natural gas fields, Cook Inlet Basin, Alaska
[PB-235767/1] 06 p0066 N75-16071
- GAS PRESSURE**
Procedure for preparation for shipment of natural gas storage vessel
[NASA-CR-141455] 05 p0036 N75-14135
- GAS TRANSPORT**
The Hydrogen Economy - A utility perspective --- energy technology 05 p0014 A75-12998
Energy supply in a closed cycle --- nuclear energy for nonelectrical use 06 p0049 A75-23503
- GAS TURBINE ENGINES**
Use of low grade solid fuels in gas turbines
[ASME PAPER 74-WA/ENER-5] 05 p0016 A75-16837
Part load specific fuel consumption of gas turbines 06 p0063 A75-28650
- GAS TURBINES**
Solar farms utilizing low-pressure closed-cycle gas turbines 05 p0003 A75-10514
Small coal burning gas turbine for modular integrated utility systems 05 p0006 A75-10546
Gas turbine engines - A state-of-the-art review 05 p0009 A75-10840
Coal-gas combustion in industrial gas turbines
[AIAA PAPER 74-1114] 05 p0010 A75-11286
Thermodynamic analysis of a solar energy system with a closed-cycle gas-turbine converter 06 p0049 A75-23402
Thermodynamics of multistage air-cooled gas turbine 06 p0050 A75-23817
Effect of gas turbine efficiency and fuel cost on cost of producing electric power
[PB-234159/2] 05 p0034 N75-13397
Pressurised fluidized bed combustion --- combustion physics, gas turbines
[PB-236498/2] 06 p0065 N75-15769
- GASEOUS FISSION REACTORS**
Physics and potentials of fissioning plasmas for space power and propulsion
[IAF PAPER 74-087] 05 p0015 A75-13719
- GASIFICATION**
Gasification of solid wastes in fixed beds
[ASME PAPER 74-WA/PWR-10] 05 p0018 A75-16882
Application of thermodynamic and material- and energy-balance calculations to gasification processes 06 p0055 A75-24785
- GASOLINE**
Feasibility demonstration of a road vehicle fueled with hydrogen-enriched gasoline 05 p0008 A75-10574
Limit lead in gasoline
[GPO-29-660] 05 p0023 N75-10259
Impact of motor gasoline lead additive regulations on petroleum refineries and energy resources, 1974-1980, phase 1
[PB-234185/7] 05 p0025 N75-10601
The prospects for gasoline availability: 1974
[GPO-34-969] 05 p0039 N75-15155
A study of the demand for gasoline
[PB-235254/0] 06 p0070 N75-16105
Effects of changing the proportions of automotive distillate and gasoline produced by petroleum refining
[PB-236900/7] 06 p0085 N75-18443
- GEODETTIC SURVEYS**
Hawaii geothermal project 06 p0099 N75-20840
Leasing of federal geothermal resources 06 p0099 N75-20841
Measuring ground movement in geothermal areas of Imperial Valley, California 06 p0099 N75-20842
Institutional and environmental problems in geothermal resource development 06 p0100 N75-20843
- GEOLOGICAL SURVEYS**
The geology and geophysics of geothermal energy 06 p0061 A75-28438
- Further development of scientific research in the field of geology and of the survey and exploration of petroleum and gas
[JPRS-63414] 05 p0027 N75-11410
Heat flow and geothermal potential of the East Mesa MGRA, Imperial Valley, California 06 p0099 N75-20838
The Lawrence Berkeley Laboratory geothermal program in northern Nevada 06 p0100 N75-20845
- GEOPHYSICS**
Geothermics with special reference to application --- Book 05 p0011 A75-11576
The geology and geophysics of geothermal energy 06 p0061 A75-28438
- GEOTHERMAL ENERGY CONVERSION**
Environmental impact of a geothermal power plant 06 p0049 A75-23291
Solar energy in earth processes --- review 06 p0061 A75-28437
The geology and geophysics of geothermal energy 06 p0061 A75-28438
Geothermal power station --- using heat pipes
[AD-785948] 05 p0037 N75-14275
Methodical approach to temperature and pressure measurements for in situ energy-recovery processes
[UCID-16631] 06 p0097 N75-20693
Proceedings of the Conference on Research for the Development of Geothermal Energy Resources
[NASA-CR-142556] 06 p0098 N75-20831
The National Geothermal Energy Research Program 06 p0098 N75-20832
The NSF/RANN FY 1975 program for geothermal resources research and technology 06 p0098 N75-20833
Overview of Reclamation's geothermal program in Imperial Valley, California 06 p0098 N75-20835
Progress of the LASL dry hot rock geothermal energy project 06 p0100 N75-20848
Rock melting technology and geothermal drilling 06 p0101 N75-20851
Geothermal reservoir simulation 06 p0101 N75-20852
Investment and operating costs of binary cycle geothermal power plants 06 p0101 N75-20855
Helical rotary screw expander power system 06 p0101 N75-20856
Electric power generation using geothermal brine resources for a proof of concept facility 06 p0101 N75-20857
Phase 0 study for a geothermal superheated water proof of concept facility 06 p0102 N75-20858
Combining total energy and energy industrial center concepts to increase utilization efficiency of geothermal energy 06 p0102 N75-20860
A city invests in its future 06 p0102 N75-20862
Geothermal steam condensate reinjection 06 p0102 N75-20863
Utility company views of geothermal development 06 p0102 N75-20864
- GEOTHERMAL RESOURCES**
The hot depths of the Red Sea as a potential heat source for thermoelectric power generation 05 p0004 A75-10516
Steady state free convection in an unconfined geothermal reservoir 05 p0009 A75-11069
Geothermics with special reference to application --- Book 05 p0011 A75-11576
A comparison of methods for electric power generation from geothermal hot water deposits
[ASME PAPER 74-WA/ENER-10] 05 p0016 A75-16841
Other primary energy resources --- geothermal, tidal, wind, waterwave and glacier energy utilization 06 p0050 A75-23512
Theory of heat extraction from fractured hot dry rock 06 p0057 A75-26544

- Current worldwide utilization and ultimate potential of geothermal energy systems
06 p0060 A75-27787
- New technology challenges in exploration, exploitation and environmental impact of geothermal systems
06 p0060 A75-27788
- Salt domes, pit craters, and dry steam fields - Heat pipe applications
06 p0060 A75-27789
- Geothermal energy --- technology assessment
06 p0060 A75-27826
- The geology and geophysics of geothermal energy
06 p0061 A75-28438
- Idaho geothermal R and D project report for period 16 December 1973 - 15 March 1974
[ANCR-1155] 06 p0076 N75-16985
- Recommended research program in geothermal chemistry
[WASH-1344] 06 p0077 N75-16997
- Materials screening program for the LLL geothermal project
[UCRL-75353] 06 p0082 N75-17815
- Prospect for geothermal power
[LA-UR-74-1111] 06 p0086 N75-18723
- Proceedings of the Conference on Research for the Development of Geothermal Energy Resources
[NASA-CR-142556] 06 p0098 N75-20831
- The National Geothermal Energy Research Program
06 p0098 N75-20832
- The NSF/RANN FY 1975 program for geothermal resources research and technology
06 p0098 N75-20833
- Geothermal research and development program of the US Atomic Energy Commission
06 p0098 N75-20834
- Overview of Reclamation's geothermal program in Imperial Valley, California
06 p0098 N75-20835
- Geophysical, geochemical, and geological investigations of the Dunes geothermal system, Imperial Valley, California
[IGPP-UCR-74-31] 06 p0098 N75-20836
- The Colorado School of Mines Nevada geothermal study
06 p0099 N75-20837
- Heat flow and geothermal potential of the East Mesa KGRA, Imperial Valley, California
06 p0099 N75-20838
- A brief description of geological and geophysical exploration of the Marysville geothermal area
06 p0099 N75-20839
- Hawaii geothermal project
06 p0099 N75-20840
- Leasing of federal geothermal resources
06 p0099 N75-20841
- Measuring ground movement in geothermal areas of Imperial Valley, California
06 p0099 N75-20842
- Institutional and environmental problems in geothermal resource development
06 p0100 N75-20843
- Imperial Valley's proposal to develop a guide for geothermal development within its county
06 p0100 N75-20844
- The Lawrence Berkeley Laboratory geothermal program in northern Nevada
06 p0100 N75-20845
- The total flow concept for geothermal energy conversion
06 p0100 N75-20846
- San Diego Gas and Electric Company Imperial Valley geothermal activities
06 p0100 N75-20847
- Progress of the LASL dry hot rock geothermal energy project
06 p0100 N75-20848
- The Marysville, Montana Geothermal Project
06 p0100 N75-20849
- Preliminary results of geothermal desalting operations at the East Mesa test site Imperial Valley, California
06 p0101 N75-20850
- Rock melting technology and geothermal drilling
06 p0101 N75-20851
- Geothermal reservoir simulation
06 p0101 N75-20852
- Geothermal reservoir engineering research
06 p0101 N75-20853
- Geothermal down well pumping system
06 p0101 N75-20854
- Investment and operating costs of binary cycle geothermal power plants
06 p0101 N75-20855
- Helical rotary screw expander power system
06 p0101 N75-20856
- Electric power generation using geothermal brine resources for a proof of concept facility
06 p0101 N75-20857
- Phase 0 study for a geothermal superheated water proof of concept facility
06 p0102 N75-20858
- The hydrogen sulfide emissions abatement program at the Geysers Geothermal Power Plant
06 p0102 N75-20859
- Combining total energy and energy industrial center concepts to increase utilization efficiency of geothermal energy
06 p0102 N75-20860
- Cooperative efforts by industry and government to develop geothermal resources
06 p0102 N75-20861
- A city invests in its future
06 p0102 N75-20862
- Geothermal steam condensate reinjection
06 p0102 N75-20863
- Utility company views of geothermal development
06 p0102 N75-20864
- GERMANY**
- Energy and the environment in Baden-Wuerttemberg
[KPK-1966-UF] 05 p0030 N75-12439
- Mission and organization of the DFVLR: Two years of integrated society of German aeronautical and space flight research
[NASA-TT-F-16086] 05 p0035 N75-13882
- GLACIERS**
- Other primary energy resources --- geothermal, tidal, wind, waterwave and glacier energy utilization
06 p0050 A75-23512
- GLASS FIBERS**
- An investigation of heat-pipe wick characteristics
05 p0012 A75-12914
- 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
[PB-237763/8] 06 p0095 N75-19839
- GOVERNMENT PROCUREMENT**
- Leasing of federal geothermal resources
06 p0099 N75-20841
- GOVERNMENT/INDUSTRY RELATIONS**
- Energy crisis - Fact or fiction
05 p0011 A75-12115
- Energy systems - Modeling and policy analysis
06 p0055 A75-24750
- Proceedings of the first 1974 Technology Transfer Conference
[NASA-CR-142119] 06 p0078 N75-17188
- The Environmental protection agency industrial technology transfer program
06 p0078 N75-17193
- Transfer of space technology to industry
06 p0078 N75-17195
- Cooperative efforts by industry and government to develop geothermal resources
06 p0102 N75-20861
- GREENHOUSE EFFECT**
- Method for calculating solar radiation for semicylindrical collectors
06 p0057 A75-26718
- GROUND STATIONS**
- Development of very low cost solar cells for terrestrial power generation
06 p0052 A75-24226
- GROUND SUPPORT EQUIPMENT**
- Multi-hundred watt radioisotope thermoelectric generator program, part 1 --- ground support equipment and safety management
[GESP-7107-PT-1] 06 p0092 N75-19354
- Multi-hundred watt radioisotope thermoelectric generator program, part 2 --- ground support equipment
[GESP-7107-PT-2] 06 p0092 N75-19355
- GULF STREAM**
- Gulf stream based ocean thermal power plants
[AIAA PAPER 75-643] 06 p0063 A75-28603

Technical and economic feasibility of the ocean thermal differences process as a solar-driven energy process
[PB-236422/2] 06 p0077 N75-17003

H

HABITATS

Prospects for utilization of underwater houses and chambers in development of marine oil deposits
05 p0029 N75-11606

HEART FUNCTION

Continued development of energy transmission and conversion systems --- applied to operation of mechanical hearts
[PB-236181/4] 05 p0037 N75-14278

HEAT BALANCE

Application of thermodynamic and material- and energy-balance calculations to gasification processes
06 p0055 A75-24785

Changes in the global energy balance --- atmospheric composition and the effect of air pollution
[PB-238075/6] 06 p0106 N75-20936

HEAT EXCHANGERS

Hot side heat exchanger for an ocean thermal difference power plant
05 p0004 A75-10527

Closed loop chemical systems for energy transmission, conversion and storage
05 p0005 A75-10538

Thermal energy storage devices suitable for solar heating
05 p0007 A75-10553

A hot liquid energy storage system utilizing natural circulation
[ASME PAPER 74-WA/HT-16] 05 p0017 A75-16862

Progress in heat pipe and porous heat exchanger technology
06 p0045 A75-20686

Ocean thermal energy conversion system evaluation
[AIAA PAPER 75-616] 06 p0064 A75-29115

Solar sea power
[PB-235469/4] 05 p0038 N75-14284

Evaluation of a fossil fuel fired ceramic regenerative heat exchanger
[PB-236346/3] 06 p0092 N75-19599

HEAT FLUX

Solar radiation heat transfer to high temperature heat carriers
[ASME PAPER 74-WA/HT-14] 05 p0017 A75-16861

HEAT GENERATION

Solar energy program plan for heating and cooling buildings
[WASH-1337-5-DRAFT] 06 p0077 N75-16993

HEAT PIPES

Nuclear propulsion technology transfer to energy systems
[AIAA PAPER 74-1072] 05 p0001 A75-10264

Operational testing of the high performance thermoelectric generator /HPG-02/
05 p0003 A75-10505

A 10% efficient economic RTG design --- radioisotope thermoelectric generator
05 p0003 A75-10506

A design parameter for assessing wicking capabilities of heat pipes
[AIAA PAPER 74-1266] 05 p0010 A75-11107

Controlled heat pipes
05 p0012 A75-12912

An investigation of heat-pipe wick characteristics
05 p0012 A75-12914

The heat pipe - Its development, and its aerospace applications
05 p0015 A75-15054

Performance of a laser mirror heat pipe
[ASME PAPER 74-WA/HT-61] 05 p0018 A75-16869

Progress in heat pipe and porous heat exchanger technology
06 p0045 A75-20686

Thermal performance characteristics of heat pipes
06 p0046 A75-21465

Material considerations involved in solar energy conversion
06 p0047 A75-22522

Salt domes, pit craters, and dry steam fields - Heat pipe applications
06 p0060 A75-27789

Heat pipe manufacturing study
[NASA-CR-139140] 05 p0023 N75-10347

An intercell heat pipe for fuel cell and battery cooling
[AD-782888] 05 p0027 N75-11226

Heat Pipe Symposium/Workshop
[PB-236008/9] 05 p0035 N75-14094

Geothermal power station --- using heat pipes
[AD-785948] 05 p0037 N75-14275

Conceptual design of a heat pipe methanator --- conversion of synthesis coal gas to methane
[LA-5596] 06 p0074 N75-16774

Solar collector thermal power system. Volume 2: Development, fabrication, and testing of fifteen foot heat pipes
[AD-A000941] 06 p0091 N75-19340

HEAT PUMPS

Solar augmented home heating heat pump system
05 p0004 A75-10524

A heat pump powered by natural thermal gradients
05 p0006 A75-10550

Solar thermal absorption heat pump breakeven coefficient of performance
[ASME PAPER 74-WA/ENER-2] 05 p0015 A75-16834

Performance of heat pumps using cold-side energy storage and unconventional heat sources
[ASME PAPER 74-WA/HT-17] 05 p0017 A75-16863

Effectiveness of using semiconductor heat pumps under the conditions of the Turken SSR
05 p0020 A75-17083

Convergence and speed of calculations for thermoelectric heat pump
05 p0020 A75-17084

Solar one - The Delaware solar house and results obtained during the first year of operation
06 p0054 A75-24254

Ocean thermal energy conversion system evaluation
[AIAA PAPER 75-616] 06 p0064 A75-29115

Heat pumps in large buildings --- a refrigerating unit for heating and cooling
[OA-TRANS-939] 06 p0078 N75-17184

HEAT SINKS

Study of active cooling for supersonic transports
[NASA-CR-132573] 06 p0079 N75-17336

HEAT SOURCES

A modular heat source for curium-244 and plutonium-238
05 p0002 A75-10497

The hot depths of the Red Sea as a potential heat source for thermoelectric power generation
05 p0004 A75-10516

Potential of Rankine engines to produce power from waste heat streams
05 p0006 A75-10547

Geothermics with special reference to application --- Book
05 p0011 A75-11576

Advanced heat source concepts --- module design for space electric power generation
[MLH-2134] 05 p0024 N75-10591

Preliminary results of geothermal desalting operations at the East Mesa test site Imperial Valley, California
06 p0101 N75-20850

Geothermal down well pumping system
06 p0101 N75-20854

Geothermal steam condensate reinjection
06 p0102 N75-20863

HEAT STORAGE

Performance of heat pumps using cold-side energy storage and unconventional heat sources
[ASME PAPER 74-WA/HT-17] 05 p0017 A75-16863

Solar energy storage within the absorption cycle
[ASME PAPER 74-WA/HT-18] 05 p0017 A75-16864

Sizing of solar energy storage systems using local weather records
[ASME PAPER 74-WA/HT-20] 05 p0017 A75-16865

Dynamic response of solar heat storage systems
[ASME PAPER 74-WA/HT-22] 05 p0018 A75-16867

Sensible heat storage in liquids --- solar energy applications
[SLL-73-0263] 06 p0074 N75-16773

Latent heat and sensible heat storage for solar heating systems
[PB-236190/5] 06 p0077 N75-17005

Solar thermal conversion program. Central receiver POCE project, subsystem specifications studies
[PB-238002/0] 06 p0087 N75-18733

HEAT TRANSFER

- Controlled heat pipes 05 p0012 A75-12912
- The heat pipe - Its development, and its aerospace applications 05 p0015 A75-15054
- A generalization of the Carnot theorem - The theorem of useful power 06 p0057 A75-26448
- Theory of heat extraction from fractured hot dry rock 06 p0057 A75-26544
- Heat Pipe Symposium/Workshop [PB-236008/9] 05 p0035 N75-14094
- Solar thermal conversion program. Central receiver POCE project, subsystem specifications studies [PB-238002/0] 06 p0087 N75-18733
- Heat transfer design and proof tests of a radioisotope thermoelectric generator [AD-A002218] 06 p0092 N75-19608
- Electrochemical power sources --- heat and mass transfer in porous media [AD-A001610] 06 p0094 N75-19836
- HEAT TRANSFER COEFFICIENTS**
- Solar radiation heat transfer to high temperature heat carriers [ASME PAPER 74-WA/HT-14] 05 p0017 A75-16861
- Design of a tubular heat collector for a solar power installation with a parabolocylindric concentrator 05 p0020 A75-17069
- Convergence and speed of calculations for thermoelectric heat pump 05 p0020 A75-17084
- Effect of heat transfer from the lateral surfaces of semiconductor thermocouples on the energy characteristics of a thermoelectric generator 05 p0021 A75-18798
- HEAT TRANSMISSION**
- Closed loop chemical systems for energy transmission, conversion and storage 05 p0005 A75-10538
- Process environment effects on heat pipes for fluid-bed gasification of coal [LA-UR-74-984] 05 p0029 N75-12252
- Heat Pipe Symposium/Workshop [PB-236008/9] 05 p0035 N75-14094
- HEATING EQUIPMENT**
- Study of channel-type systems for solar-energy radiative heat transport 05 p0010 A75-11196
- Dynamic simulation for performance analysis of solar heated and cooled buildings [ASME PAPER 74-WA/SOL-8] 05 p0019 A75-16891
- A study of channel systems for radiative solar-heat transfer 06 p0049 A75-23408
- Time factors in slowing down the rate of growth of demand for primary energy in the United States 06 p0059 A75-27780
- Cooling by solar heat --- heating and cooling system for buildings [AIAA PAPER 75-609] 06 p0062 A75-28590
- HELICOPTER PERFORMANCE**
- Documenting helicopter operations from an energy standpoint [NASA-CR-132578] 06 p0084 N75-18220
- HELICOPTERS**
- Documenting helicopter operations from an energy standpoint [NASA-CR-132578] 06 p0084 N75-18220
- HIGH STRENGTH STEELS**
- Metals and composites in superflywheel energy storage systems 06 p0047 A75-22523
- HIGH TEMPERATURE**
- Low to high temperature energy conversion system --- using ammonia [NASA-CASE-NPO-13510-1] 06 p0074 N75-16972
- HIGH TEMPERATURE NUCLEAR REACTORS**
- Thermolysis of water for the generation of hydrogen 06 p0049 A75-23504
- Technological and commercial possibilities which result by using a high temperature reactor for the future supply of mineral oil in the FRG [JUL-1017-RG] 05 p0029 N75-11470

HIGH VOLTAGES

- Development and performance of a miniature, high-voltage thermal battery 05 p0007 A75-10559

HYDRAZINES

- The introduction of the principles of biological energy supply in future technical systems 06 p0050 A75-23511

HYDRIDES

- Iron titanium hydride as a source of hydrogen fuel for stationary and automotive applications [BNL-18651] 05 p0030 N75-12441

HYDROCARBON COMBUSTION

- Combustion R&D - Key to our energy future --- pollution reduction using hydrocarbon fuels 05 p0009 A75-10596

HYDROCARBON FUELS

- MHD energy conversion systems [AIAA PAPER 74-1071] 05 p0001 A75-10263
- Urban waste energy resources [AIAA PAPER 75-632] 06 p0062 A75-28598
- Exploration for fossil and nuclear fuels from orbital altitudes --- results of ERTS program for oil exploration [NASA-TM-X-70781] 05 p0027 N75-11413
- Evaluation of coal-gassification technology. Part 2: Low and intermediate BTU fuel gases [PB-234042/0] 05 p0036 N75-14273
- Alternative fuels for aviation 06 p0075 N75-16980
- Technology for the conversion of solar energy to fuel gas [PB-238103/6] 06 p0104 N75-20883

HYDROCARBON POISONING

- The effect of Alaskan crude oil and selected hydrocarbon compounds on embryonic development of the Pacific oyster, Crassostrea gigas 06 p0090 N75-18764

HYDROELECTRIC POWER STATIONS

- Energy storage underground --- hydroelectric pumped-storage and combustion turbine facilities 05 p0013 A75-12989
- Solar/hydroelectric combined power systems 06 p0059 A75-27786
- Gulf stream based ocean thermal power plants [AIAA PAPER 75-643] 06 p0063 A75-28603
- Solar power system and component research program [PB-236159/0] 05 p0037 N75-14280

HYDROGEN

- Feasibility demonstration of a road vehicle fueled with hydrogen-enriched gasoline 05 p0008 A75-10574
- Efficiencies of electrolytic and thermochemical hydrogen production 06 p0045 A75-20300
- Metal hydrides as hydrogen storage media [BNL-18887] 05 p0030 N75-12440
- Iron titanium hydride as a source of hydrogen fuel for stationary and automotive applications [BNL-18651] 05 p0030 N75-12441
- Proceedings of the Workshop on Bio-Solar Conversion [PB-236142/6] 06 p0069 N75-16096
- Energy storage for utilities via hydrogen systems [BNL-19266] 06 p0086 N75-18725
- Hydrogen storage and production in utility systems [BNL-18920] 06 p0097 N75-20580
- Hydrogen economy: A utility perspective [BNL-19267] 06 p0103 N75-20870

HYDROGEN FUELS

- Oxides of nitrogen control techniques for appliance conversion to hydrogen fuel 05 p0006 A75-10541
- The use of hydrogen in commercial aircraft - An assessment 05 p0006 A75-10542
- 60 watt hydride-air fuel cell system 05 p0008 A75-10567
- Liquid hydrogen as an automotive fuel 06 p0048 A75-23238
- Hydrogen as fuel for internal-combustion engines 06 p0050 A75-23508
- Cryogenics safety in a hydrogen fuel society 06 p0061 A75-27973
- Hydrogen as a fuel --- analysis of problems involved in generation, transportation, and utilization [AD-787484] 06 p0066 N75-15818

- possibilities for lithium borohydride recycle ---
using diborane intermediate
[ICP-1054] 06 p0074 N75-16651
- Study of active cooling for supersonic transports
[NASA-CR-132573] 06 p0079 N75-17336
- Survey of hydrogen compatibility problems in
energy storage and energy transmission
applications
[SAND-74-8219] 06 p0087 N75-18726
- Synthetic fuels for ground transportation with
special emphasis on hydrogen
[NASA-TM-X-72652] 06 p0103 N75-20868
- Metal hydrides as a source of hydrogen fuel
[BNL-14804-R] 06 p0104 N75-20876
- HYDROGEN OXYGEN FUEL CELLS**
Electrical power generation subsystem for Space
Shuttle Orbiter 05 p0002 A75-10477
- Development of a theoretical method for predicting
the performance of hydrogen-oxygen MHD generators
05 p0009 A75-10578
- Development of advanced fuel cell system, phase 2
[NASA-CR-134721] 06 p0067 N75-16084
- HYDROGEN SULFIDE**
The hydrogen sulfide emissions abatement program
at the Geysers Geothermal Power Plant
06 p0102 N75-20859
- HYDROGEN-BASED ENERGY**
The generation of hydrogen by the thermal
decomposition of water 05 p0005 A75-10532
- Nuclear energy requirements for hydrogen
production from water 05 p0005 A75-10533
- Hydrogen cycle peak-shaving for electric utilities
05 p0005 A75-10535
- Hydrogen for the electric utilities - Long range
possibilities 05 p0005 A75-10536
- Energy storage for utilities via hydrogen systems
05 p0005 A75-10537
- The Hydrogen Economy - A utility perspective ---
energy technology 05 p0014 A75-12998
- The use of hydrogen as an energy carrier
05 p0015 A75-15795
- Economics of a hydrogen storage peaking power plant
[ASME PAPER 74-WA/PWR-6] 05 p0018 A75-16880
- Energy, hydrogen, and pollution --- energy
technology 06 p0046 A75-22041
- Hydrogen fuel cells and motors --- new energy
technology 06 p0046 A75-22042
- Liquid hydrogen --- liquefaction, storage,
transportation, applications 06 p0046 A75-22043
- Production of hydrogen by the electrolysis of water
06 p0046 A75-22044
- Energy supply in a closed cycle --- nuclear energy
for nonelectrical use 06 p0049 A75-23503
- Thermolysis of water for the generation of hydrogen
06 p0049 A75-23504
- Hydrogen as energy carrier in industry and household
06 p0049 A75-23505
- Hydrogen - A carrier of energy 06 p0060 A75-27791
- Hydrogen future fuel: A literature survey issued
quarterly, issue no. 6 --- bibliographies
05 p0027 N75-11110
- Production of hydrogen from water using nuclear
energy. A review --- for hydrogen-based energy
[JAERI-M-5642] 06 p0093 N75-19824
- Synthetic fuels for ground transportation with
special emphasis on hydrogen
[NASA-TM-X-72652] 06 p0103 N75-20868
- Hydrogen storage and production in utility systems
[BNL-19249] 06 p0103 N75-20873
- HYDROGENATION**
Synthetic oil from coal
[PB-234460/4] 05 p0040 N75-15176
- IDAHO**
Idaho geothermal R and D project report for period
16 December 1973 - 15 March 1974
[ANCR-1155] 06 p0076 N75-16985
- IMAGING TECHNIQUES**
Oil exploration needs for digital processing of
imagery 05 p0001 A75-10437
- IMPERIAL VALLEY (CA)**
Overview of Reclamation's geothermal program in
Imperial Valley, California 06 p0098 N75-20835
- IMPREGNATING**
High energy density sintered plate type
nickel-cadmium battery cells. II -
Electrochemical impregnation methods to produce
nickel oxide electrodes 05 p0008 A75-10570
- INCIDENT RADIATION**
Method for calculating solar radiation for
semicylindrical collectors 06 p0057 A75-26718
- Solar incidence factor and other geometric
considerations of solar energy collection
[SAND-74-26] 05 p0034 N75-13390
- INCINERATORS**
Survey of gas and oil burners for use with
NSP/RANN-ORNL potassium boiler
[ORNL-NSF-EP-45] 06 p0087 N75-18728
- INDUSTRIAL ENERGY**
The National Coal Conversion Act and the National
Crude Oil Refinery Development Act
[GPO-28-964] 05 p0027 N75-10861
- Bureau of Mines research programs on recycling and
disposal of mineral, metal, and energy-based
wastes [PB-227476/9] 05 p0042 N75-15203
- Energy use in the commercial and industrial
sectors of the US economy, 1963
[PB-235487/6] 06 p0070 N75-16104
- Energy problems in a global context 06 p0075 N75-16978
- Some developments of industrial
magnetohydrodynamic electric power plants
06 p0081 N75-17792
- Study of industrial uses of energy relative to
environmental effects [PB-237215/9] 06 p0084 N75-17853
- Industrial energy study of the hydraulic cement
industry [PB-237142/5] 06 p0087 N75-18730
- Data base for the industrial energy study of the
industrial chemicals group [PB-237845/3] 06 p0087 N75-18732
- Fuel and energy consumption in the coal industries
[PB-237151/6] 06 p0088 N75-18744
- INDUSTRIAL MANAGEMENT**
Industrial energy study of selected food industries
[PB-237316/5] 06 p0083 N75-17827
- INDUSTRIAL PLANTS**
Industrial energy study of the Industrial
chemicals group [PB-236322/4] 06 p0071 N75-16111
- Applications of aerospace technology in the
electric power industry 06 p0079 N75-17197
- Background information for standards of
performance: Coal preparation plants. Volume
2: Summary and test data [PB-237696/0] 06 p0091 N75-18797
- INDUSTRIAL WASTES**
Study of industrial uses of energy relative to
environmental effects [PB-237215/9] 06 p0084 N75-17853
- INDUSTRIES**
Economic impact of the oil shale industry in
western Colorado [GPO-28-608] 05 p0024 N75-10588
- Energy consumption by industries in support of
national defense: An energy demand model
[AD-784964] 05 p0031 N75-12449
- Study of potential problems and optimum
opportunities in retrofitting industrial
processes to low and intermediate energy gas
from coal [PB-237116/9] 06 p0088 N75-18739
- INFORMATION DISSEMINATION**
The initiatives of the Los Alamos Scientific
Laboratory in the transfer of a new excavation
technology 06 p0079 N75-17203

INFORMATION MANAGEMENT

The solution of information-deficiency problems of electroenergy technology --- optimal decision making

06 p0062 A75-28508

INFORMATION SYSTEMS

The Environmental protection agency industrial technology transfer program

06 p0078 N75-17193

INFRARED RADIATION

Heat mirrors for solar-energy collection and radiation insulation

05 p0004 A75-10525

INFRARED REFLECTION

Transparent heat-mirror films of TiO₂/Ag/TiO₂ for solar energy collection and radiation insulation

05 p0015 A75-16378

INTERNAL COMBUSTION ENGINES

Feasibility demonstration of a road vehicle fueled with hydrogen-enriched gasoline

05 p0008 A75-10574

Hydrogen fuel cells and motors --- new energy technology

06 p0046 A75-22042

Liquid hydrogen as an automotive fuel

06 p0048 A75-23238

Methanol as fuel for vehicle engines

06 p0050 A75-23506

Hydrogen as fuel for internal-combustion engines

06 p0050 A75-23508

Engine development program for the APL remotely piloted vehicle

[AD-787507] 06 p0065 N75-15658

Hydrogen as a fuel --- analysis of problems involved in generation, transportation, and utilization

[AD-787484] 06 p0066 N75-15818

INTERNATIONAL COOPERATION

International energy problems and environmental policy

05 p0014 A75-13597

Man-made sun. Thermonuclear engineering developments

[BLL-M-23333-(5828.4F)] 06 p0091 N75-19014

The USA: The scientific and technical revolution and trends in foreign policy

[NASA-TT-F-16102] 06 p0096 N75-20160

INTERNATIONAL RELATIONS

The USA: The scientific and technical revolution and trends in foreign policy

[NASA-TT-F-16102] 06 p0096 N75-20160

Economic impact on the free world of the oil crisis, October 1973 - March 1974

[AD-A003136] 06 p0107 N75-21156

INTERNATIONAL TRADE

The approaching energy crisis: A call for action

05 p0030 N75-12432

Dependence of the United States on essential imported materials, year 2000; volume 1

[AD-A000842] 06 p0096 N75-20157

Dependence of the United States on essential imported materials, year 2000. Volume 2: Appendices

[AD-A000843] 06 p0096 N75-20158

INTERPLANETARY SPACECRAFT

Interplanetary spacecraft design using solar electric propulsion

[AIAA PAPER 74-1084] 05 p0010 A75-11283

ION BEAMS

Review of direct energy conversion of ion beams: Experimental results and reactor applications

[UCRL-75600] 05 p0028 N75-11466

ION EXCHANGE MEMBRANE ELECTROLYTES

Evaluation of an ion exchange membrane fuel cell for space power

[AD-786888] 05 p0037 N75-14274

IRON

Photochemical conversion of solar energy --- study of iron-thionine photogalvanic cells

[PB-235474/4] 05 p0038 N75-14282

IRON ALLOYS

Cryogenic properties of Fe-Mn and Fe-Mn-Cr alloys

[LBL-2764] 06 p0066 N75-15781

IRON COMPOUNDS

Iron titanium hydride as a source of hydrogen fuel for stationary and automotive applications

[BNL-18651] 05 p0030 N75-12441

IRRIGATION

Some aspects of a solar battery system and its use for irrigation in remote sun-rich regions

06 p0054 A75-24256

J

JAPAN

Japanese/United States Symposium on Solar Energy systems. Volume 1: Summary of proceedings

[NTR-6284-VOL-1] 05 p0036 N75-14264

JET ENGINE FUELS

Future long-range transports: Prospects for improved fuel efficiency

[NASA-TM-X-72659] 06 p0079 N75-17339

JET PROPULSION

On the future of jet propulsion in subsonic transport aviation

06 p0058 A75-27777

K

KANSAS

Statistical estimation of wildcat well outcome probabilities by visual analysis of structure contour maps of Stafford County, Kansas

06 p0092 N75-19778

KINETIC ENERGY

Report on progress in achieving direct conversion of a major fraction of sonic flow kinetic power into electrical power by electrofluid dynamic /EFD/ processes

05 p0009 A75-10576

L

LAND USE

Economic impact of the oil shale industry in western Colorado

[GPO-28-608] 05 p0024 N75-10588

Leasing of federal geothermal resources

06 p0099 N75-20841

LANDSAT SATELLITES

Exploration for fossil and nuclear fuels from orbital altitudes --- results of ERTS program for oil exploration

[NASA-TM-X-70781] 05 p0027 N75-11413

LASER APPLICATIONS

Laser induced luminescence signatures of refined and virgin crude petroleum - Their composition and remote sensing implications

06 p0050 A75-23790

Lasers investigated for space propulsion

06 p0061 A75-28439

LASER CAVITIES

Interferometric tuning of a 15-atm CO₂ laser

06 p0058 A75-27518

LASER HEATING

Conceptual design of a series of laser-fusion power plants of 100 to 3000 MW/e/

05 p0007 A75-10562

New applications for optical components - High energy focusing

05 p0015 A75-16525

Performance of a laser mirror heat pipe

[ASME PAPER 74-WA/HT-61] 05 p0018 A75-16869

LASER OUTPUTS

New applications for optical components - High energy focusing

05 p0015 A75-16525

Laser compression of matter - Optical power and energy requirements

06 p0046 A75-22352

LASERS

Review of the prospects for laser induced thermonuclear fusion

[AECL-4840] 06 p0106 N75-21099

LAW (JURISPRUDENCE)

Institutional and environmental problems in geothermal resource development

06 p0100 N75-20843

LEAD (METAL)

Impact of motor gasoline lead additive regulations on petroleum refineries and energy resources, 1974-1980, phase 1

[PB-234185/7] 05 p0025 N75-10601

LEAD COMPOUNDS

Limit lead in gasoline

[GPO-29-660] 05 p0023 N75-10259

LIFT AUGMENTATION

- Evaluation of advanced lift concepts and fuel conservative short-haul aircraft, volume 1 [NASA-CR-137525] 06 p0096 N75-20291
- Evaluation of advanced lift concepts and fuel conservative short-haul aircraft, volume 2 [NASA-CR-137526] 06 p0097 N75-20292

LIFT DEVICES

- Evaluation of advanced lift concepts and potential fuel conservation for short-haul aircraft [NASA-CR-2502] 06 p0073 N75-16557

LIGHT TRANSMISSION

- Lasers investigated for space propulsion 06 p0061 A75-28439
- Solar thermal power systems based on optical transmission [PB-237005/4] 06 p0088 N75-18742

LIGHT WATER BREEDER REACTORS

- The economics of nuclear power 06 p0047 A75-22734

LIGHTING EQUIPMENT

- The use of solar cells in the lighthouse service 06 p0054 A75-24255

LIQUEFACTION

- Liquid hydrogen --- liquefaction, storage, transportation, applications 06 p0046 A75-22043
- Evaluation of coal conversion processes to provide clean fuels, part 2 [PB-234203/8] 05 p0025 N75-10604

LIQUEFIED GASES

- Some LNG vehicle developments --- for automotive conversion systems and fueling stations 06 p0048 A75-23236
- Project Clean Air 1972, LNG conversion of GM-71 series diesel engine --- considering automobile exhaust gases control [PB-236585/6] 06 p0090 N75-18783

LIQUEFIED NATURAL GAS

- Methanol as fuel for vehicle engines 06 p0050 A75-23506
- Methane gas engines for commercial vehicles and busses 06 p0050 A75-23507
- A survey of LNG technological needs in the USA: 1974 to beyond 2000 05 p0030 N75-12435
- On the potentialities of polyphenylene oxide (PPO) as a wet-insulation material for cargo tanks of LNG-carriers [REPT-194-M] 05 p0035 N75-14002

LIQUID COOLING

- Performance of a laser mirror heat pipe [ASME PAPER 74-WA/HT-61] 05 p0018 A75-16869

LIQUID HYDROGEN

- The use of hydrogen in commercial aircraft - An assessment 05 p0006 A75-10542
- Liquid hydrogen --- liquefaction, storage, transportation, applications 06 p0046 A75-22043
- Liquid hydrogen as an automotive fuel 06 p0048 A75-23238
- Cryogenics safety in a hydrogen fuel society 06 p0061 A75-27973
- Alternative fuels for aviation 06 p0075 N75-16980

LITHIUM

- Investigation of the technology and performance of lithium doped solar cells --- feasibility study for mass production 06 p0052 A75-24219

LITHIUM BORATES

- Possibilities for lithium borohydride recycle --- using diborane intermediate [ICP-1054] 06 p0074 N75-16651

LITHIUM HYDRIDES

- Possibilities for lithium borohydride recycle --- using diborane intermediate [ICP-1054] 06 p0074 N75-16651

LITHIUM SULFATES

- Development of lithium/sulfur cells for application to electric automobiles [CONF-740805-7] 06 p0094 N75-19829

LOW COST

- Development of very low cost solar cells for terrestrial power generation 06 p0052 A75-24226

LOW DENSITY RESEARCH

- Status and objective of Tokamak systems for fusion research [WASH-1295] 05 p0035 N75-13644

LOW TEMPERATURE

- Low to high temperature energy conversion system --- using ammonia [NASA-CASE-NPO-13510-1] 06 p0074 N75-16972

LOW TEMPERATURE ENVIRONMENTS

- Development of a thermal battery for emergency radio power under arctic conditions 05 p0007 A75-10560

LUBRICATING OILS

- Waste lubricating oil research. A comparison of bench-test properties of re-refined and virgin lubricating oils --- materials recovery [PB-238124/2] 06 p0097 N75-20746

M**MAGNETIC CIRCUITS**

- Methods of energy transfer from a magnetic energy storage system using a transfer capacitor and a superconducting switch [LA-5631-MS] 05 p0032 N75-13164

MAGNETIC STORAGE

- Magnetic Energy Transfer and Storage (METS) program schedules for a Fusion Test Reactor (FTR) [LA-5748-MS] 06 p0106 N75-21097

MAGNETOHYDRODYNAMIC GENERATORS

- MHD energy conversion systems [AIAA PAPER 74-1071] 05 p0001 A75-10263
- The MHD power generation system with directly fired coal 05 p0009 A75-10577

- Development of a theoretical method for predicting the performance of hydrogen-oxygen MHD generators 05 p0009 A75-10578

- Applications of plasma core reactors to terrestrial energy systems [AIAA PAPER 74-1074] 05 p0010 A75-11281

- Progress in development of auxiliary MHD power plant components at Avco Everett Research Laboratory, Inc [ASME PAPER 74-WA/ENER-6] 05 p0016 A75-16838

- Recent MHD generator testing at Avco Everett Research Laboratory, Inc [ASME PAPER 74-WA/ENER-7] 05 p0016 A75-16839

- Possible development of acoustical instability in a system consisting of a combustion chamber and a subsonic MHD generator 06 p0045 A75-19959

- Corrosion studies of materials for auxiliary equipment in MHD power plants 06 p0055 A75-24384

- Review of central power magnetohydrodynamics [AIAA PAPER 75-264] 06 p0055 A75-25005

- MHD energy conversion [AD-785419] 05 p0032 N75-12807

- A review of the status of MHD power generation technology including suggestions for a Canadian MHD research program [UTIAS-39] 05 p0035 N75-13641

- First Joint Soviet-American Colloquium on the Problems of MHD Energy Conversion [JPRS-63794] 06 p0081 N75-17790

- Prospects for magnetohydrodynamic electric power plants in power engineering 06 p0081 N75-17791

- Some developments of industrial magnetohydrodynamic electric power plants 06 p0081 N75-17792

- Experience in the first step of the mastery of the U-25 device 06 p0081 N75-17793

- Electronic model of the U-25 device 06 p0081 N75-17794

- The MHD generator: A step toward the energy supply of tomorrow --- development of magnetohydrodynamic generators [AD-A000087] 06 p0089 N75-18749

- The generator of the future --- development of the magnetohydrodynamic generators [AD-A001515] 06 p0089 N75-18754

MAGNETOHYDRODYNAMICS

- MHD energy conversion [AD-785419] 05 p0032 N75-12807

MANAGEMENT METHODS

SUBJECT INDEX

MANAGEMENT METHODS

Extended energy management methods for flight performance optimization
[AIAA PAPER 75-30] 05 p0021 A75-18269
Energy utilization by households and technology assessment as a way to increase its effectiveness
--- management methods and family decision making 06 p0097 N75-20829

MANAGEMENT PLANNING

Project Independence 05 p0029 N75-12428
Imperial Valley's proposal to develop a guide for geothermal development within its county 06 p0100 N75-20844
The Lawrence Berkeley Laboratory geothermal program in northern Nevada 06 p0100 N75-20845
The total flow concept for geothermal energy conversion 06 p0100 N75-20846
San Diego Gas and Electric Company Imperial Valley geothermal activities 06 p0100 N75-20847

MANGANESE ALLOYS

Cryogenic properties of Fe-Mn and Fe-Mn-Cr alloys [LBL-2764] 06 p0066 N75-15781

MANUFACTURING

Heat pipe manufacturing study [NASA-CR-139140] 05 p0023 N75-10347
Solar kine: Answer to the agricultural energy challenge of our time 06 p0086 N75-18721
A SASOL type process for gasoline, methanol, SNG, and low-Btu gas from coal [PB-237670/5] 06 p0095 N75-19838

MARINE BIOLOGY

The effect of Alaskan crude oil and selected hydrocarbon compounds on embryonic development of the Pacific oyster, *Crassostrea gigas* 06 p0090 N75-18764

MARINE ENVIRONMENTS

Prospects for utilization of underwater houses and chambers in development of marine oil deposits 05 p0029 N75-11606

MARINE RESOURCES

Ocean thermal energy conversion system evaluation [AIAA PAPER 75-616] 06 p0064 A75-29115
Tropical ocean thermal power plants and potential products [AIAA PAPER 75-617] 06 p0064 A75-29116

MARKET RESEARCH

Technology utilization - Incentives and solar energy 06 p0048 A75-22913
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 [PB-236632/6] 06 p0078 N75-17007
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 [PB-236633/4] 06 p0078 N75-17008
Economic modeling and energy policy planning --- technology transfer, market research 06 p0079 N75-17210

MARTENSITE

Thermodynamic considerations of 'solid state engines' based on thermoelastic martensitic transformations and the shape memory effect 06 p0045 A75-19631

MASS RATIOS

Power generation for the X4 spacecraft - A step in the development of a high power/mass ratio, hybrid solar array for applications spacecraft 06 p0053 A75-24251

MASS TRANSFER

Controlled heat pipes 05 p0012 A75-12912
Electrochemical power sources --- heat and mass transfer in porous media [AD-A001610] 06 p0094 N75-19836

MATERIAL BALANCE

Application of thermodynamic and material- and energy-balance calculations to gasification processes 06 p0055 A75-24785

MATERIALS HANDLING

Fuel energy systems - Conversion and transport efficiencies 05 p0007 A75-10554
Technology and community development materials processing, and electrical and nuclear technology --- technical research center of Finland 05 p0031 N75-12695

MATERIALS RECOVERY

Synthetic oil from coal [PB-234460/4] 05 p0040 N75-15176
Waste lubricating oil research. A comparison of bench-test properties of re-refined and virgin lubricating oils --- materials recovery [PB-238124/2] 06 p0097 N75-20746

MATERIALS TESTS

Radioisotope space power generator [GA-A-12848] 05 p0038 N75-14832

MATHEMATICAL MODELS

A wind energy conversion system based on the tracked-vehicle airfoil concept 05 p0004 A75-10518
An analytical and experimental investigation of a laboratory solar pond model [ASME PAPER 74-WA/SOL-3] 05 p0019 A75-16886
Energy systems - Modeling and policy analysis 06 p0055 A75-24750

MECHANICAL PROPERTIES

Mechanical properties of oil shale from Anvil Point under conditions of uniaxial compression [SAND-74-0035] 06 p0092 N75-19390

MEGALOPOLISES

Mode shift strategies in intercity transportation and their effect on energy consumption [AIAA PAPER 75-315] 06 p0055 A75-25013

MELTING

Coal gasification by Atomics International's Rockgas process [ASME PAPER 74-WA/PWR-11] 05 p0018 A75-16883

METAL FILMS

Transparent heat-mirror films of TiO2/Ag/TiO2 for solar energy collection and radiation insulation 05 p0015 A75-16378

METAL HYDRIDES

Metal hydrides for thermal energy storage 05 p0004 A75-10522
Metal hydride fuel cell power source 05 p0008 A75-10564
60 watt hydride-air fuel cell system 05 p0008 A75-10567
Predicted energy densities for nickel-hydrogen and silver-hydrogen cells embodying metallic hydrides for hydrogen storage 05 p0008 A75-10572
Production of hydrogen by the electrolysis of water 06 p0046 A75-22044
Metal hydrides as hydrogen storage media [BNL-18887] 05 p0030 N75-12440
Energy storage for utilities via hydrogen systems [BNL-19266] 06 p0086 N75-18725
Hydrogen economy: A utility perspective [BNL-19267] 06 p0103 N75-20870
Metal hydrides as a source of hydrogen fuel [BNL-14804-R] 06 p0104 N75-20876

METAL SURFACES

Use of flexible reflective surfaces for solar energy concentration 06 p0056 A75-25678

METAL-GAS SYSTEMS

Predicted energy densities for nickel-hydrogen and silver-hydrogen cells embodying metallic hydrides for hydrogen storage 05 p0008 A75-10572

METALS

Bureau of Mines research programs on recycling and disposal of mineral, metal, and energy-based wastes [PB-227476/9] 05 p0042 N75-15203
Problems of the future and potentialities of system engineering --- metallic materials, plastics, traffic and energy supplies [ESRO-TT-110] 06 p0107 N75-21218

METEOROLOGICAL PARAMETERS

Meteorological factors and dispersion of pollutants in the atmosphere - A preliminary study about a large power plant 06 p0045 A75-21150

METHANE

- Two-stage methane production from solid wastes
[ASME PAPER 74-WA/ENER-11] 05 p0017 A75-16842
- Methane gas engines for commercial vehicles and
busses 06 p0050 A75-23507
- Urban waste energy resources
[AIAA PAPER 75-632] 06 p0062 A75-28598
- Methane in the Pittsburgh coalbed, Washington
County, Pennsylvania
[PB-237848/7] 06 p0089 N75-18760
- Fuel gas production from solid waste
[PB-238068/1] 06 p0095 N75-19843
- Environmental aspects of methanol as vehicular
fuel: Health and environmental effects
[UCRL-76076] 06 p0095 N75-19867
- Technology for the conversion of solar energy to
fuel gas
[PB-238103/6] 06 p0104 N75-20883

METHYL ALCOHOLS

- Methanol as fuel for vehicle engines
06 p0050 A75-23506
- Elimination of duty on methanol imported for
certain uses
[H-REPT-93-998] 05 p0026 N75-10857
- Use of methanol in transportation --- coal
liquefaction methods
[UCID-16528] 06 p0077 N75-16996
- Methanol from forestry, municipal, and
agricultural organic residues
[BNWL-SA-5053] 06 p0085 N75-18702

MICROMETEOROLOGY

- Meteorological factors and dispersion of
pollutants in the atmosphere - A preliminary
study about a large power plant 06 p0045 A75-21150

MICROPOROSITY

- An investigation of heat-pipe wick characteristics
05 p0012 A75-12914

MICROWAVE TRANSMISSION

- The satellite solar power station - An option for
energy production on earth
[AIAA PAPER 75-637] 06 p0063 A75-28600
- The adaptation of free space power transmission
technology to the SSPS concept --- Satellite
Solar Power Stations
[AIAA PAPER 75-642] 06 p0063 A75-28602

MICROWAVES

- A superconducting microwave engine
06 p0056 A75-25831

MILITARY AIRCRAFT

- Energy-related research and development in the
United States Air Force
06 p0075 N75-16979

MILITARY SPACECRAFT

- Solar cell and array standardization for Air Force
spacecraft
05 p0002 A75-10486

MILITARY TECHNOLOGY

- The 1974 AGARD Annual Meeting: The energy
problem: Impacts on military research and
development
06 p0075 N75-16977

MILITARY VEHICLES

- Energy-related research and development in the
United States Air Force
06 p0075 N75-16979

MINERAL DEPOSITS

- Bureau of Mines research 1973. Summary of
significant results in mining, metallurgy, and
energy
[PB-234733/4] 05 p0040 N75-15171

MINERAL OILS

- Technological and commercial possibilities which
result by using a high temperature reactor for
the future supply of mineral oil in the FRG
[JUL-1017-RG] 05 p0029 N75-11470

MINES (EXCAVATIONS)

- Degasification of the Mary Lee coalbed near Oak
Grove, Jefferson County, Alabama, by vertical
borehole in advance of mining
[BM-RV-7968] 05 p0028 N75-11462

MINIATURIZATION

- Development and performance of a miniature,
high-voltage thermal battery
05 p0007 A75-10559

MINIMAX TECHNIQUE

- The solution of information-deficiency problems of
electroenergy technology --- optimal decision
making
06 p0062 A75-28508

MINING

- Bureau of Mines research 1973. Summary of
significant results in mining, metallurgy, and
energy
[PB-234733/4] 05 p0040 N75-15171
- Fuel and energy consumption in the coal industries
[PB-237151/6] 06 p0088 N75-18744
- Regional economics: A subset of simulation of the
effects of coal-fired power development in the
four corners region
06 p0107 N75-21153

MIRRORS

- Performance of a laser mirror heat pipe
[ASME PAPER 74-WA/HT-61] 05 p0018 A75-16869
- Use of flexible reflective surfaces for solar
energy concentration
06 p0056 A75-25678

MISSION PLANNING

- Mission applications of electric propulsion
[AIAA PAPER 74-1085] 05 p0010 A75-11284

MODULES

- Advanced heat source concepts --- module design
for space electric power generation
[MLM-2134] 05 p0024 N75-10591

MOLECULAR INTERACTIONS

- Workshop in Gas-Phase Molecular Interactions and
the Nation's Energy Problem
[PB-236712/6] 06 p0086 N75-18718

MULTISPECTRAL PHOTOGRAPHY

- Relationships of earth fracture systems to
productivity of a gas storage reservoir
[PB-237894/1] 06 p0089 N75-18759

N**NASA PROGRAMS**

- NASA objectives for improved solar power plants
05 p0002 A75-10485
- Mission applications of electric propulsion
[AIAA PAPER 74-1085] 05 p0010 A75-11284
- The application of aerospace technology in the
cryogenics field
06 p0048 A75-23239
- Proceedings of the first 1974 Technology Transfer
Conference
[NASA-CR-142119] 06 p0078 N75-17188
- Transfer of space technology to industry
06 p0078 N75-17195

NATURAL GAS

- Some LNG vehicle developments --- for automotive
conversion systems and fueling stations
06 p0048 A75-23236
- Further development of scientific research in the
field of geology and of the survey and
exploration of petroleum and gas
[JPRS-63414] 05 p0027 N75-11410
- Offshore investigation: Producing shut-in
leases, January 1974, phase 1 --- potentially
productive oil and gas wells
05 p0027 N75-11457
- Offshore investigation: Producing shut-in leases
as of January 1974, phase 2 --- an estimation of
natural gas reserves in offshore wells
05 p0027 N75-11458
- Evaluation of coal-gasification technology. Part
1: Pipeline-W quality gas
[PB-234036/2] 05 p0034 N75-13396
- Procedure for preparation for shipment of natural
gas storage vessel
[NASA-CR-141455] 05 p0036 N75-14135
- Natural gas fields, Cook Inlet Basin, Alaska
[PB-235767/1] 06 p0066 N75-16071
- Total energy supply and demand, volume 1, chapter 6
--- natural gas, economic analysis
06 p0067 N75-16082
- Radiological surveillance program for the project
Gasbuggy production test, 15 May - 6 November 1973
[NERC-LV-539-30] 06 p0073 N75-16337
- Progress and problems in developing nuclear and
other experimental techniques for recovering
natural gas in the Rocky Mountain area
[B-164105] 06 p0075 N75-16975

Utilizing fuel more efficiently in reheating and heat treatment furnaces
[BLL-M-21957-(5828.4R)] 06 p0080 N75-17467

Experience in the first step of the mastery of the U-25 device 06 p0081 N75-17793

OCS oil and gas: An environmental assessment, volume 3 --- effect of natural phenomena on OCS gas and oil development 06 p0083 N75-17836

OCS oil and gas: An environmental assessment, Volume 1 06 p0083 N75-17837

OCS oil and gas: An environmental assessment, Volume 2 06 p0084 N75-17838

OCS oil and gas: An environmental assessment, volume 4 06 p0084 N75-17839

OCS oil and gas: An environmental assessment, volume 5 06 p0084 N75-17840

Natural gas in Alabama [PB-236582/3] 06 p0088 N75-18737

Relationships of earth fracture systems to productivity of a gas storage reservoir [PB-237894/1] 06 p0089 N75-18759

NAVIGATION AIDS

The use of solar cells in the lighthouse service 06 p0054 A75-24255

NETHERLANDS

The economics of using wind power for electricity supply in the Netherlands and for water supply on Curacao [NASA-TT-F-15982] 05 p0024 N75-10587

NEUTRON EMISSION

An electron beam initiated fusion neutron generator 06 p0045 A75-19657

NEW YORK

Economic and energy conservation relationship relevant to state of New York building design and contract awards [PB-237006/2] 06 p0082 N75-17824

Use of solar energy in buildings in New York state [PB-236974/2] 06 p0083 N75-17825

NICKEL CADMIUM BATTERIES

Milliwatt fuel cell system for sensors 05 p0008 A75-10565

High energy density sintered plate type sealed nickel cadmium battery cells. I - The positive electrode/plaque relationships 05 p0008 A75-10569

High energy density sintered plate type nickel-cadmium battery cells. II - Electrochemical impregnation methods to produce nickel oxide electrodes 05 p0008 A75-10570

A novel negative-limited sealed nickel-cadmium cell 05 p0008 A75-10571

NITROGEN OXIDES

Oxides of nitrogen control techniques for appliance conversion to hydrogen fuel 05 p0006 A75-10541

NOISE REDUCTION

Organic Rankine cycle silent power plant 1.5 kW, 28 volts dc [AD-A000900] 06 p0088 N75-18745

NONCONDENSABLE GASES

Controlled heat pipes 05 p0012 A75-12912

NORWAY

Oslo's future power supply [NP-20121] 06 p0067 N75-16087

NUCLEAR ELECTRIC POWER GENERATION

Nuclear energy requirements for hydrogen production from water 05 p0005 A75-10533

California energy workshop: Developing a plan of action to meet the energy crisis in California --- oil recovery, nuclear electric power generation, and offshore energy sources [PB-237045/0] 06 p0082 N75-17822

The action of EDF in the prevention of atmospheric pollution --- by expanding nuclear electric power generation [BLL-CE-TRANS-6500-(9022.09)] 06 p0083 N75-17833

NUCLEAR ELECTRIC PROPULSION

SENSE 2: Space applications of nuclear power.
Volume 1: Commercial communications satellite
[AEC-SNS-3063-3-VOL-1] 06 p0065 N75-15742

NUCLEAR ENERGY

The economics of nuclear power 06 p0047 A75-22734

Advanced nuclear research [GPO-41-253] 05 p0026 N75-10764

Development, growth, and state of the nuclear industry [GPO-33-873] 05 p0038 N75-15150

Comparison of the environmental aspects of nuclear and fossil fueled power stations [CONF-740555-1] 06 p0077 N75-16995

Production of hydrogen from water using nuclear energy. A review --- for hydrogen-based energy [JAERI-M-5642] 06 p0093 N75-19824

NUCLEAR EXPLOSIONS

Project Rio Blanco data report: Production testing (RB-E-01), November 1973 and January - February 1974 [NVO-148] 06 p0094 N75-19833

NUCLEAR FISSION

Nuclear system that burns its own wastes shows promise [NASA-NEWS-RELEASE-75-44] 06 p0085 N75-18716

NUCLEAR FUELS

Exploration for fossil and nuclear fuels from orbital altitudes --- results of ERTS program for oil exploration [NASA-TM-X-70781] 05 p0027 N75-11413

NUCLEAR FUSION

Conceptual design of a series of laser-fusion power plants of 100 to 3000 MW/e/ 05 p0007 A75-10562

Current expectations for fusion power from toroidal machines 05 p0014 A75-12996

New applications for optical components - High energy focusing 05 p0015 A75-16525

The outlook for fusion energy sources - Remaining technological hurdles 06 p0059 A75-27782

Utilization of plasma exhaust energy for fuel production [COO-3028-7] 05 p0028 N75-11465

Applications of fusion power technology to the chemical industry [BNL-18815] 05 p0029 N75-11730

Outlook for fusion energy sources: Remaining technological hurdles [UCRL-75418] 05 p0029 N75-11745

Survey of applications of fusion power technology to the chemical and material processing industry [BNL-18866] 05 p0031 N75-12443

Fusion power by magnetic confinement [WASH-1290] 05 p0031 N75-12797

Status and objective of Tokamak systems for fusion research [WASH-1295] 05 p0035 N75-13644

Interesting possibilities of fusion-fission --- for thermonuclear power generation [BNWL-SA-5069] 06 p0096 N75-20106

Magnetic Energy Transfer and Storage (METS) program schedules for a Fusion Test Reactor (FTR) [LA-5748-MS] 06 p0106 N75-21097

Review of the prospects for laser induced thermonuclear fusion [AECL-4840] 06 p0106 N75-21099

MIT fusion technology program --- nuclear reactors and reactor materials [COO-2431-1] 06 p0106 N75-21101

Synopsis of studies on synthetic fuels production by fusion reactors [BNL-19336] 06 p0106 N75-21104

NUCLEAR HEAT

Nuclear district-heating and nuclear long-distance energy [JUL-1077] 06 p0093 N75-19828

NUCLEAR PHYSICS

Technology and community development materials processing, and electrical and nuclear technology --- technical research center of Finland 05 p0031 N75-12695

NUCLEAR POWER PLANTS

Fundamentals of automatic control of space nuclear power plants --- Russian book

Nuclear power growth, 1974 - 2000 --- forecasting future reactor technology
[WASH-1139-74] 05 p0031 N75-12723

Application study of a nuclear coal solution gasification process for Oklahoma coal, volume 1
[PB-236156/6] 05 p0037 N75-14279

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
[NP-20023] 06 p0067 N75-16088

Interesting possibilities of fusion-fission --- for thermonuclear power generation
[BNWL-SA-5069] 06 p0096 N75-20106

NUCLEAR POWER REACTORS

Space power systems - Retrospect and prospect
[IAF PAPER 74-082] 05 p0014 A75-13714

Fusion power by magnetic confinement
[WASH-1290] 05 p0031 N75-12797

NUCLEAR PROPULSION

Nuclear propulsion technology transfer to energy systems
[AIAA PAPER 74-1072] 05 p0001 A75-10264

Physics and potentials of fissioning plasmas for space power and propulsion
[IAF PAPER 74-087] 05 p0015 A75-13719

NUCLEAR REACTOR CONTROL

Fusion power by magnetic confinement
[WASH-1290] 05 p0031 N75-12797

NUCLEAR REACTORS

The production of gaseous energy carriers from fossil fuels
06 p0049 A75-23502

Energy supply in a closed cycle --- nuclear energy for nonelectrical use
06 p0049 A75-23503

MIT fusion technology program --- nuclear reactors and reactor materials
[COO-2431-1] 06 p0106 N75-21101

Synopsis of studies on synthetic fuels production by fusion reactors
[BNL-19336] 06 p0106 N75-21104

NUCLEAR RESEARCH

Fusion power research - Where do we stand
05 p0013 A75-12995

Advanced nuclear research
[GPO-41-253] 05 p0026 N75-10764

O**OCEAN CURRENTS**

Power from ocean waves
[ASME PAPER 74-WA/PWR-5] 05 p0018 A75-16879

Gulf stream based ocean thermal power plants
[AIAA PAPER 75-643] 06 p0063 A75-28603

OCEAN SURFACE

Ocean thermal power and windpower systems - Natural solar energy conversion for near-term impact on world energy markets
06 p0060 A75-27790

Characteristics of a rocking wave power device --- for waterwave energy conversion
06 p0062 A75-28450

Systems aspects of ocean thermal energy conversion
[AIAA PAPER 75-615] 06 p0062 A75-28593

Site limitations on Solar Sea Power Plants
[AIAA PAPER 75-618] 06 p0062 A75-28594

OCEANS

Solar sea thermal energy
[GPO-37-476] 05 p0030 N75-12430

OCTANES

Benthal decomposition of adsorbed octadecane --- impact of oil pollution, deoxygenation of waterways
06 p0106 N75-20891

OFFSHORE ENERGY SOURCES

Hot side heat exchanger for an ocean thermal difference power plant
05 p0004 A75-10527

Offshore investigation: Producing shut-in leases, January 1974, phase 1 --- potentially productive oil and gas wells
05 p0027 N75-11457

Offshore investigation: Producing shut-in leases as of January 1974, phase 2 --- an estimation of natural gas reserves in offshore wells
05 p0027 N75-11458

Offshore investigation: Producing shut-in leases as of January 1974 (second phase)
[PB-234490/1] 05 p0040 N75-15174

California energy workshop: Developing a plan of action to meet the energy crisis in California --- oil recovery, nuclear electric power generation, and offshore energy sources
[PB-237045/0] 06 p0082 N75-17822

OCS oil and gas: An environmental assessment, volume 3 --- effect of natural phenomena on OCS gas and oil development
06 p0083 N75-17836

OCS oil and gas: An environmental assessment, volume 1
06 p0083 N75-17837

OCS oil and gas: An environmental assessment, volume 4
06 p0084 N75-17839

OCS oil and gas: An environmental assessment, volume 5
06 p0084 N75-17840

OFFSHORE PLATFORMS

Solar Sea Power Plants (SSPP): A critical review and survey
[NASA-TM-X-70783] 05 p0028 N75-11459

OIL ADDITIVES

Dry oil
[BLL-M-23508-(5828.4F)] 06 p0074 N75-16969

OIL EXPLORATION

Oil exploration needs for digital processing of imagery
05 p0001 A75-10437

Laser induced luminescence signatures of refined and virgin crude petroleum - Their composition and remote sensing implications
06 p0050 A75-23790

Further development of scientific research in the field of geology and of the survey and exploration of petroleum and gas
[JPRS-63414] 05 p0027 N75-11410

Exploration for fossil and nuclear fuels from orbital altitudes --- results of ERTS program for oil exploration
[NASA-TM-X-70781] 05 p0027 N75-11413

Offshore investigation: Producing shut-in leases, January 1974, phase 1 --- potentially productive oil and gas wells
05 p0027 N75-11457

Bureau of Mines energy program, 1973 --- discovery and production of oil, gas, and fluid fuels
[PB-234682/3] 05 p0040 N75-15172

Offshore investigation: Producing shut-in leases as of January 1974 (second phase)
[PB-234490/1] 05 p0040 N75-15174

Development of oil and gas on the Continental Shelf
[GPO-31-891] 06 p0075 N75-16973

OCS oil and gas: An environmental assessment, volume 3 --- effect of natural phenomena on OCS gas and oil development
06 p0083 N75-17836

OCS oil and gas: An environmental assessment, volume 2
06 p0084 N75-17838

OCS oil and gas: An environmental assessment, volume 4
06 p0084 N75-17839

OCS oil and gas: An environmental assessment, volume 5
06 p0084 N75-17840

OIL FIELDS

Solvent stimulation tests in two California oilfields
[PB-237849/5] 06 p0090 N75-18761

OIL RECOVERY

Prototype oil shale leasing program
[GPO-28-686] 05 p0039 N75-15160

Char oil energy development
[PB-234018/0] 05 p0040 N75-15173

Basic research needs for tertiary oil recovery: Proceedings of a National Science Foundation Workshop
[PB-236726/6] 06 p0066 N75-16072

- Average oil yield tables for oil shale sequences in cores from the Uinta Basin, Utah, that average 15, 20, 25, 30, 35, and 40 gallons per ton [PB-236068/3] 06 p0072 N75-16124
- Dry oil [BLL-M-23508-(5828.4F)] 06 p0074 N75-16969
- California energy workshop: Developing a plan of action to meet the energy crisis in California --- oil recovery, nuclear electric power generation, and offshore energy sources [PB-237045/0] 06 p0082 N75-17822
- OCS oil and gas: An environmental assessment, Volume 1 06 p0083 N75-17837
- Pollutional problems and research needs for an oil shale industry [PB-236608/6] 06 p0084 N75-17848
- Profitability analysis of producing crude oil by waterflooding using a simulation technique [PB-237843/8] 06 p0088 N75-18738
- Solvent stimulation tests in two California oilfields [PB-237849/5] 06 p0090 N75-18761
- Evaluation of thermal methods for recovery of viscous oils in Missouri and Kansas [PB-237831/3] 06 p0090 N75-18762
- In situ oil shale conversion and recovery [SLA-74-0162] 06 p0093 N75-19825
- Methodical approach to temperature and pressure measurements for in situ energy-recovery processes [UCID-16631] 06 p0097 N75-20693
- OILS**
- Impact of motor gasoline lead additive regulations on petroleum refineries and energy resources, 1974-1980, phase 1 [PB-234185/7] 05 p0025 N75-10601
- Synthetic oil from coal [PB-234460/4] 05 p0040 N75-15176
- Collection and concentration of solar energy using Fresnel type lenses [NASA-CR-142194] 06 p0080 N75-17784
- OKLAHOMA**
- Application study of a nuclear coal solution gasification process for Oklahoma coal, volume 1 [PB-236156/6] 05 p0037 N75-14279
- OPERATIONAL PROBLEMS**
- Main problems met in the study of cryogenic generators 06 p0061 A75-27962
- OPTICAL DATA PROCESSING**
- Oil exploration needs for digital processing of imagery 05 p0001 A75-10437
- OPTICAL FILTERS**
- Collection and concentration of solar energy using Fresnel type lenses [NASA-CR-142194] 06 p0080 N75-17784
- OPTICAL PROPERTIES**
- Research on cadmium stannate selective optical films for solar energy applications [PB-236208/5] 06 p0071 N75-16117
- OPTICAL REFLECTION**
- The COMSAT non-reflective silicon solar cell - A second generation improved cell 06 p0053 A75-24245
- Use of flexible reflective surfaces for solar energy concentration 06 p0056 A75-25678
- OPTIMAL CONTROL**
- Powerplant energy management --- transport aircraft engine thrust control [AIAA PAPER 74-1066] 05 p0001 A75-10259
- Extended energy management methods for flight performance optimization [AIAA PAPER 75-30] 05 p0021 A75-18269
- Fundamentals of automatic control of space nuclear power plants --- Russian book 06 p0048 A75-23229
- OPTIMIZATION**
- The Energy Systems Optimization Computer Program /ESOP/ developed for Modular Integrated Utility Systems /MIUS/ analysis 05 p0006 A75-10551
- ORBITAL ASSEMBLY**
- Overcoming two significant hurdles to space power generation Transportation and assembly [AIAA PAPER 75-641] 06 p0063 A75-28601
- ORGANIC COMPOUNDS**
- Biological conversion of organic refuse to methane [PB-235468/6] 05 p0041 N75-15183
- ORGANIC LIQUIDS**
- Technology considerations for Organic Rankine Cycle Electric Power Systems 05 p0002 A75-10484
- ORGANIC MATERIALS**
- Two-stage methane production from solid wastes [ASME PAPER 74-WA/ENER-11] 05 p0017 A75-16842
- ORGANIC SEMICONDUCTORS**
- Analysis of conversion efficiency of organic-semiconductor solar cells 05 p0010 A75-11146
- OXIDATION**
- Electrically rechargeable redox flow cells 05 p0008 A75-10573
- OXIDE FILMS**
- Transparent heat-mirror films of TiO₂/Ag/TiO₂ for solar energy collection and radiation insulation 05 p0015 A75-16378
- P**
- P-N JUNCTIONS**
- GaP p-n junctions and possibilities for their application in the conversion of solar energy into electric 05 p0011 A75-12198
- II-VI photovoltaic heterojunctions for solar energy conversion 05 p0012 A75-12734
- Dynamic method for calculating the series resistance of a semiconductor photoelectric converter 06 p0057 A75-26713
- High-efficiency graded band-gap Al_x/Ga_{1-x}/As-GaAs solar cell 06 p0058 A75-27519
- PARABOLIC BODIES**
- Design of a tubular heat collector for a solar power installation with a parabolocylindric concentrator 05 p0020 A75-17069
- PARABOLIC REFLECTORS**
- Comparative performance characteristics of cylindrical parabolic focusing and flat plate solar energy collectors [CONF-741104-3] 06 p0103 N75-20872
- PARABOLOID MIRRORS**
- Compact solar energy concentrator 05 p0021 A75-19050
- PARTICULATE SAMPLING**
- The collaborative study of EPA methods, 5, 6, and 7 in fossil fuel-fired steam generators [PB-237695/2] 06 p0091 N75-18788
- PASSENGER AIRCRAFT**
- Energy efficiency of current intercity passenger transportation modes [AIAA PAPER 75-314] 06 p0047 A75-22513
- PELLETS**
- A review of thermal battery technology 05 p0007 A75-10557
- Laser compression of matter - Optical power and energy requirements 06 p0046 A75-22352
- Pellet type thermal battery [SAND-74-0007] 06 p0076 N75-16991
- PERFORMANCE PREDICTION**
- A 10% efficient economic RTG design --- radioisotope thermoelectric generator 05 p0003 A75-10506
- Solar augmented home heating heat pump system 05 p0004 A75-10524
- Development of a theoretical method for predicting the performance of hydrogen-oxygen MHD generators 05 p0009 A75-10578
- Electrostatic voltage generation from flowing water 05 p0009 A75-10580
- The analysis of the performance of a pancake absorber-heat exchanger for a solar concentrator [ASME PAPER 74-WA/SOL-1] 05 p0018 A75-16884
- Thermal performance characteristics of heat pipes 06 p0046 A75-21465
- A generalised analysis of the performance of a variety of drive systems for high Reynolds number, transonic wind tunnels [RAE-TR-73134] 06 p0073 N75-16572

- Electronic model of the U-25 device
06 p0081 N75-17794
- PERFORMANCE TESTS**
Performance testing of thermoelectric generators at JPL
05 p0002 A75-10503
Operational testing of the high performance thermoelectric generator /HPG-02/
05 p0003 A75-10505
Comparative performance characteristics of cylindrical parabolic and flat plate solar energy collectors
[ASME PAPER 74-WA/ENER-3] 05 p0016 A75-16835
Performance of a laser mirror heat pipe
[ASME PAPER 74-WA/HT-61] 05 p0018 A75-16869
Investigation of the technology and performance of lithium doped solar cells --- feasibility study for mass production
06 p0052 A75-24219
Performance of advanced silicon solar cells in a space environment
06 p0052 A75-24232
Solar collector performance evaluated outdoors at NASA-Lewis Research Center
06 p0058 A75-27531
Status of the NASA-Lewis flat-plate collector tests with a solar simulator
06 p0058 A75-27533
- PERIODIC VARIATIONS**
Experience in setting up solar-energy survey for Azerbaidzhan
05 p0020 A75-17081
- PERMEABILITY**
Fracture-induced permeability: Present situation and prospects for coal
[UCID-16593] 06 p0094 N75-19830
- PERTURBATION THEORY**
Extended energy management methods for flight performance optimization
[AIAA PAPER 75-30] 05 p0021 A75-18269
- PETROLOGY**
Coal petrography and petrology. A bibliography 1964 - 1973
[PB-236351/3] 06 p0072 N75-16123
- PHASE TRANSFORMATIONS**
Thermodynamic considerations of 'solid state engines' based on thermoelastic martensitic transformations and the shape memory effect
06 p0045 A75-19631
- PHOTOCHEMICAL REACTIONS**
Photochemical conversion of solar energy
[PB-236266/3] 05 p0037 N75-14281
Photochemical conversion of solar energy --- study of iron-thionine photogalvanic cells
[PB-235474/4] 05 p0038 N75-14282
Photochemical conversion of solar energy
[PB-235503/0] 06 p0070 N75-16106
- PHOTOELECTRIC CELLS**
Temperature sensor for photoelectric energy converters
06 p0057 A75-26712
Dynamic method for calculating the series resistance of a semiconductor photoelectric converter
06 p0057 A75-26713
- PHOTOELECTRIC GENERATORS**
GaP p-n junctions and possibilities for their application in the conversion of solar energy into electric
05 p0011 A75-12198
Testing of a photoelectric generator in a mountainous region of the Azerbaidzhan SSR
06 p0057 A75-26714
- PHOTOLUMINESCENCE**
Laser induced luminescence signatures of refined and virgin crude petroleum - Their composition and remote sensing implications
06 p0050 A75-23790
- PHOTOSYNTHESIS**
Prospects of photosynthetic energy production
06 p0060 A75-27792
Proceedings of the Workshop on Bio-Solar Conversion
[PB-236142/6] 06 p0069 N75-16096
- PHOTOVOLTAIC CELLS**
NASA objectives for improved solar power plants
05 p0002 A75-10485
Status of JPL solar powered experiments for terrestrial applications
05 p0005 A75-10530
- II-VI photovoltaic heterojunctions for solar energy conversion
05 p0012 A75-12734
Methods for low cost manufacture of silicon solar arrays
[ASME PAPER 74-WA/ENER-4] 05 p0016 A75-16836
Improvements in analysis and technology of silicon solar cells with increased efficiency
06 p0051 A75-24216
High efficiency silicon solar cells
06 p0052 A75-24217
CdS-Cu₂S cells - An outlook for terrestrial applications
06 p0052 A75-24223
Further progress in the technology of silk screened CdS solar cells
06 p0052 A75-24225
Process development for low cost integrated solar arrays
06 p0054 A75-24259
The Mitre solar energy demonstration system
06 p0055 A75-24676
Solar photovoltaic energy
[GPO-39-576] 05 p0032 N75-13379
Solar energy: Sandia's photovoltaic research program
[SLA-74-281] 05 p0034 N75-13392
Workshop proceedings: Photovoltaic conversion of solar energy for terrestrial applications. Volume 1: Working group and panel reports
[NASA-CR-138209] 06 p0069 N75-16097
Workshop proceedings: Photovoltaic conversion of solar energy for terrestrial applications. Volume 2: Invited papers
[NASA-CR-138193] 06 p0069 N75-16098
Photochemical conversion of solar energy
[PB-235503/0] 06 p0070 N75-16106
Terrestrial photovoltaic power systems with sunlight concentration
[PB-236180/6] 06 p0072 N75-16120
Photovoltaic conversion of solar energy for Terrestrial Applications. Volume 1: Working group and panel reports
[PB-236163/2] 06 p0072 N75-16121
Integration of photovoltaic and solar thermal energy conversion systems
[SAND-74-0093] 06 p0076 N75-16992
Report and recommendations of the Solar Energy Data Workshop
[PB-238066/5] 06 p0089 N75-18757
Terrestrial photovoltaic power systems with sunlight concentration
[PB-238582/1] 06 p0105 N75-20886
- PHOTOVOLTAIC CONVERSION**
Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974
06 p0051 A75-24213
Report on photovoltaics research and technology in the United States
06 p0051 A75-24214
Historic development of photovoltaic power generation
06 p0051 A75-24215
An analysis of photovoltaic power generation and thermal control interfaces --- for solar arrays
06 p0053 A75-24243
Photovoltaic conversion of solar energy for terrestrial applications. Volume 2: Invited papers
[PB-236164/0] 06 p0072 N75-16122
Assessment of the technology required to develop photovoltaic power system for large scale national energy applications
[NSF/RA/N-74-072] 06 p0080 N75-17785
- PIPE FLOW**
Controlled heat pipes
05 p0012 A75-12912
- PIPELINES**
Evaluation of coal-gasification technology. Part 1: Pipeline-W quality gas
[PB-234036/2] 05 p0034 N75-13396
Dry oil
[BLL-M-23508-(5828.4F)] 06 p0074 N75-16969
- PISTON ENGINES**
The Stirling engine for vehicle propulsion
06 p0050 A75-23509

PITCHING MOMENTS

- Unsteady aerodynamics of variable pitch vertical axis windmill
[AIAA PAPER 75-649] 06 p0063 A75-28604
- PLASMA CONTROL**
Fusion reactors as future energy sources
05 p0011 A75-11735
Current expectations for fusion power from toroidal machines
05 p0014 A75-12996
Numerical simulation of direct energy conversion --- from fusion reactions
06 p0045 A75-19660
The outlook for fusion energy sources - Remaining technological hurdles
06 p0059 A75-27782
Outlook for fusion energy sources: Remaining technological hurdles
[UCRL-75418] 05 p0029 N75-11745
- PLASMA ELECTRODES**
Empirical method of designing the current-voltage characteristics for the discharge mode of a thermionic converter
06 p0057 A75-26332
- PLASMA GENERATORS**
An electron beam initiated fusion neutron generator
06 p0045 A75-19657
- PLASMA HEATING**
The outlook for fusion energy sources - Remaining technological hurdles
06 p0059 A75-27782
- PLASMA PHYSICS**
Energy characteristics of coaxial plasma source
[AD-787419] 06 p0073 N75-16368
- PLASMA POTENTIALS**
Physics and potentials of fissioning plasmas for space power and propulsion
[IAF PAPER 74-087] 05 p0015 A75-13719
- PLASMA PROPULSION**
Physics and potentials of fissioning plasmas for space power and propulsion
[IAF PAPER 74-087] 05 p0015 A75-13719
- PLASTIC MEMORY**
Thermodynamic considerations of 'solid state engines' based on thermoelastic martensitic transformations and the shape memory effect
06 p0045 A75-19631
- PLASTICS**
Problems of the future and potentialities of system engineering --- metallic materials, plastics, traffic and energy supplies
[ESRO-TT-110] 06 p0107 N75-21218
- PLUTONIUM ISOTOPES**
Two-watt radioisotope power generators for underwater applications
05 p0007 A75-10556
- PLUTONIUM 238**
A modular heat source for curium-244 and plutonium-238
05 p0002 A75-10497
- POLITICS**
Oil for the free world in the 1970's --- demand and supply
[AD-779352] 05 p0031 N75-12448
The USA: The scientific and technical revolution and trends in foreign policy
[NASA-TT-F-16102] 06 p0096 N75-20160
- POLLUTION CONTROL**
Energy, hydrogen, and pollution --- energy technology
06 p0046 A75-22041
Pollution-free electrochemical power generation from low grade coal
[PB-236162/4] 06 p0070 N75-16109
Reduction of atmospheric pollution by the application of fluidized-bed combustion
[PB-235840/6] 06 p0072 N75-16151
Development of high specific energy batteries for electric vehicles
[ANL-8058] 06 p0076 N75-16990
Energy conversion from coal utilizing CPU-400 technology
[PB-237028/6] 06 p0083 N75-17828
Background information for standards of performance: Coal preparation plants. Volume 2: Summary and test data
[PB-237696/0] 06 p0091 N75-18797
- Evaluation of pollution control in fossil fuel conversion processes. Gasification, section 1: Synthane process
[PB-237113/6] 06 p0095 N75-19879
- Evaluation of pollution control in fossil fuel conversion processes: Gasification. Section 1: Lurgi process
[PB-237694/5] 06 p0096 N75-19880
- POLLUTION MONITORING**
Meteorological factors and dispersion of pollutants in the atmosphere - A preliminary study about a large power plant
06 p0045 A75-21150
Inspection and maintenance of light-duty gasoline powered motor vehicles: A guide for implementation --- emissions inspection program
[PB-236587/2] 06 p0090 N75-18784
Field surveillance and enforcement guide for petroleum refineries
[PB-236669/8] 06 p0090 N75-18786
- POLYPHENYL ETHER**
On the potentialities of polyphenylene oxide (PPO) as a wet-insulation material for cargo tanks of LNG-carriers
[REPT-194-M] 05 p0035 N75-14002
- PONDS**
An analytical and experimental investigation of a laboratory solar pond model
[ASME PAPER 74-WA/SOL-3] 05 p0019 A75-16886
- POROUS MATERIALS**
Electrochemical power sources --- heat and mass transfer in porous media
[AD-A001610] 06 p0094 N75-19836
- PORTABLE EQUIPMENT**
Manportable thermoelectric generator
[AD-A002042] 06 p0095 N75-19847
- POTASSIUM**
Operational, maintenance, and environmental problems associated with a fossil fuel-fired potassium steam binary vapor cycle
[ORNL-NSF-EP-30] 06 p0090 N75-18769
- POWDER (PARTICLES)**
Solar selective surfaces made of semiconducting powders
[ASME PAPER 74-WA/HT-13] 05 p0017 A75-16857
- POWER CONDITIONING**
Power conversion of energy fluctuations
05 p0011 A75-11497
- POWER EFFICIENCY**
Potential of Rankine engines to produce power from waste heat streams
05 p0006 A75-10547
Thermodynamics of multistage air-cooled gas turbine
06 p0050 A75-23817
An analysis of photovoltaic power generation and thermal control interfaces --- for solar arrays
06 p0053 A75-24243
Development of a flexible, fold-out solar array --- power to weight ratio for communication satellites
06 p0053 A75-24252
Remote platform power conserving system
[NASA-CASE-GSC-11182-1] 05 p0032 N75-13007
Effect of gas turbine efficiency and fuel cost on cost of producing electric power
[PB-234159/2] 05 p0034 N75-13397
- POWER PLANTS**
Evaluation of central solar tower power plant
05 p0003 A75-10515
Closed loop chemical systems for energy transmission, conversion and storage
05 p0005 A75-10538
Conceptual design of a series of laser-fusion power plants of 100 to 3000 MW/e/
05 p0007 A75-10562
Concepts for central solar electric power generation
05 p0021 A75-17504
An econometric analysis of fuel selection for power generation
06 p0055 A75-24751
Site limitations on Solar Sea Power Plants
[AIAA PAPER 75-618] 06 p0062 A75-28594
Thermal power plants --- German book
06 p0064 A75-28962
Tropical ocean thermal power plants and potential products
[AIAA PAPER 75-617] 06 p0064 A75-29116
Solar thermal subsystem specification study
[PB-238005/3] 06 p0083 N75-17829

POWER SUPPLIES

- Thermodynamic analysis of a solar energy system with a closed-cycle gas-turbine converter 06 p0049 A75-23402
- NSF-Rann energy abstracts: A monthly abstract journal of energy research [ORNL-EIS-74-52-VOL-2-NO-1] 05 p0024 N75-10592

POWER SUPPLY CIRCUITS

- Terrestrial applications of FEP-encapsulated solar cell modules --- power systems using Fluorinated Ethylene Propylene encapsulation 06 p0054 A75-24258

POWER TRANSMISSION

- Lasers investigated for space propulsion 06 p0061 A75-28439
- Derivation of a total satellite energy system --- solar power station for terrestrial consumption [AIAA PAPER 75-640] 06 p0064 A75-29118

PREDICTION ANALYSIS TECHNIQUES

- MEGASTAR: The Meaning of Energy Growth: An Assessment of Systems, Technologies, and Requirements [NASA-CR-120355] 05 p0023 N75-10584

PRESSURE CHAMBERS

- Prospects for utilization of underwater houses and chambers in development of marine oil deposits 05 p0029 N75-11606

PRESSURE MEASUREMENTS

- Methodical approach to temperature and pressure measurements for in situ energy-recovery processes [UCID-16631] 06 p0097 N75-20693

PRESSURE VESSELS

- Procedure for preparation for shipment of natural gas storage vessel [NASA-CR-141455] 05 p0036 N75-14135
- Survey of hydrogen compatibility problems in energy storage and energy transmission applications [SAND-74-8219] 06 p0087 N75-18726

PROBABILITY THEORY

- Statistical estimation of wildcat well outcome probabilities by visual analysis of structure contour maps of Stafford County, Kansas 06 p0092 N75-19778

PRODUCT DEVELOPMENT

- Heat pipe manufacturing study [NASA-CR-139140] 05 p0023 N75-10347
- Development of advanced fuel cell system, phase 2 [NASA-CR-134721] 06 p0067 N75-16084
- Fuel gas production from solid waste [PB-238068/1] 06 p0095 N75-19843

PRODUCTION ENGINEERING

- Investigation of the technology and performance of lithium doped solar cells --- feasibility study for mass production 06 p0052 A75-24219
- Heat pipe manufacturing study [NASA-CR-139140] 05 p0023 N75-10347
- Prospect for geothermal power [LA-UR-74-1111] 06 p0086 N75-18723

PRODUCTION MANAGEMENT

- Coal in Alabama [PB-236583/1] 06 p0088 N75-18736

PROJECT PLANNING

- Combustion dynamics research for 'Project Independence' [AIAA PAPER 74-1069] 05 p0001 A75-10262
- Program plan for environmental effects of energy [PB-235115/3] 05 p0040 N75-15177
- Research and technology operating plan summary: Fiscal year 1975 research and technology program --- space programs, energy technology, and aerospace sciences [NASA-TM-X-70410] 06 p0096 N75-20155

PROMETHIUM

- Advanced betavoltaic power sources 05 p0007 A75-10563

PROPELLANT TRANSFER

- How spacecraft are fueled --- technology of fueling spacecraft for flight [JPRS-63514] 05 p0027 N75-10983

PROPULSION SYSTEM CONFIGURATIONS

- On the future of jet propulsion in subsonic transport aviation 06 p0058 A75-27777
- Future long-range transports: Prospects for improved fuel efficiency [NASA-TM-X-72659] 06 p0079 N75-17339

PROPULSION SYSTEM PERFORMANCE

- Floating vs flying - A propulsion energy comparison 06 p0056 A75-25987
- Engine development program for the APL remotely piloted vehicle [AD-787507] 06 p0065 N75-15658
- Preliminary study of advanced turbofans for low energy consumption [NASA-TM-X-71663] 06 p0084 N75-18241
- PROPULSIVE EFFICIENCY**
- Future long-range transports - Prospects for improved fuel efficiency [AIAA PAPER 75-316] 06 p0047 A75-22514
- Floating vs flying - A propulsion energy comparison 06 p0056 A75-25987

PROTON IRRADIATION

- The effects of irradiation on high-efficiency silicon solar cells 06 p0051 A75-24199
- Electron and proton irradiation of high-efficiency silicon solar cells 06 p0053 A75-24233

PROTOTYPES

- A prototype solar powered, Rankine Cycle system providing residential air conditioning and electricity 05 p0004 A75-10523

PUBLIC HEALTH

- Report of the Interagency Working Group on health and environmental effects of energy use [PB-237937/8] 06 p0084 N75-17858

PUBLIC RELATIONS

- The energy crisis and decision making in the family [PB-238783/5] 06 p0106 N75-21028

PULSE GENERATORS

- Chemical to electromagnetic energy conversion techniques --- explosive flux compression technology [AD-783901] 05 p0026 N75-10609

PULSED LASERS

- Laser compression of matter - Optical power and energy requirements 06 p0046 A75-22352

PUMPING

- Optimising pumped storage with tidal power in an estuary [ASHE PAPER 74-WA/PWR-7] 05 p0018 A75-16881

PUMPS

- Some generalizations of sample water-supply calculations for solar-powered pumping plants 05 p0020 A75-17077

PYROLYSIS

- Thermolysis of water for the generation of hydrogen 06 p0049 A75-23504
- Retorting indexes for oil-shale pyrolyses from ethylene-ethane ratios of product gases [PB-234050/3] 05 p0034 N75-13399
- Pyrolysis system evaluation study [NASA-CR-141664] 06 p0086 N75-18722
- An economic analysis of oil shale operations featuring gas combustion retorting [PB-237851/1] 06 p0093 N75-19813

PYROMETALLURGY

- Bureau of Mines research 1973. Summary of significant results in mining, metallurgy, and energy [PB-234733/4] 05 p0040 N75-15171

PYROTECHNICS

- Energy conversion. 1: Non-propulsive aspects --- fuels and pyrotechnics [AD-A000077] 06 p0079 N75-17454

R**RADIANT FLUX DENSITY**

- Experience in setting up solar-energy survey for Azerbaidzhan 05 p0020 A75-17081
- Method for calculating solar radiation for semicylindrical collectors 06 p0057 A75-26718

RADIANT HEATING

- Solar energy trap [NASA-CASE-HFS-22744-1] 05 p0024 N75-10586

RADIATION DAMAGE

- Investigation of the technology and performance of lithium doped solar cells --- feasibility study for mass production 06 p0052 A75-24219

RADIATION EFFECTS

SUBJECT INDEX

- Electron and proton irradiation of high-efficiency silicon solar cells 06 p0053 A75-24233
- RADIATION EFFECTS**
Radiation effects on high efficiency silicon-solar cells 06 p0051 A75-24197
- The effects of irradiation on high-efficiency silicon solar cells 06 p0051 A75-24199
- RADIATION HAZARDS**
Soil burial of radioisotopic fuel capsules 06 p0046 A75-21274
- RADIATION SHIELDING**
Optimisation of solar cell shielding for geostationary missions 06 p0051 A75-24203
- RADIATIVE HEAT TRANSFER**
Study of channel-type systems for solar-energy radiative heat transport 05 p0010 A75-11196
- A study of channel systems for radiative solar-heat transfer 06 p0049 A75-23408
- Thermodynamic analysis and parameter optimization of a solar thermoelectric power unit with radiation heat dissipation [AD-A000211] 06 p0082 N75-17819
- RADIOACTIVE ISOTOPES**
SENSE 2: Space applications of nuclear power. Volume 1: Commercial communications satellite [AEC-SNS-3063-3-VOL-1] 06 p0065 N75-15742
- Multi-hundred watt radioisotope thermoelectric generator program, part 1 --- ground support equipment and safety management [GESP-7107-PT-1] 06 p0092 N75-19354
- Multi-hundred watt radioisotope thermoelectric generator program, part 2 --- ground support equipment [GESP-7107-PT-2] 06 p0092 N75-19355
- Heat transfer design and proof tests of a radioisotope thermoelectric generator [AD-A002218] 06 p0092 N75-19608
- RADIOACTIVE WASTES**
Soil burial of radioisotopic fuel capsules 06 p0046 A75-21274
- Nuclear system that burns its own wastes shows promise [NASA-NEWS-RELEASE-75-44] 06 p0085 N75-18716
- RADIOISOTOPE BATTERIES**
RTG technology development - Where we are/where we are going --- radioisotope thermoelectric generator 05 p0002 A75-10496
- A modular heat source for curium-244 and plutonium-238 05 p0002 A75-10497
- A 10% efficient economic RTG design --- radioisotope thermoelectric generator 05 p0003 A75-10506
- Cost effective designing for the economic RTG --- radioisotope thermoelectric generators 05 p0003 A75-10507
- Light-weight radioisotope thermoelectric generator design 05 p0003 A75-10508
- Two-watt radioisotope power generators for underwater applications 05 p0007 A75-10556
- Advanced betavoltaic power sources 05 p0007 A75-10563
- Soil burial of radioisotopic fuel capsules 06 p0046 A75-21274
- RTG electrical power for spacecraft --- Radioisotope Thermoelectric Generators 06 p0057 A75-26067
- Radioisotope space power generator [GA-A-12848] 05 p0038 N75-14832
- RAIL TRANSPORTATION**
Energy efficiency of current intercity passenger transportation modes [AIAA PAPER 75-314] 06 p0047 A75-22513
- Transportation vehicle energy intensities. A joint DOT/NASA reference paper --- energy consumption of air and ground vehicles [NASA-TM-X-62404] 05 p0035 N75-13690
- Industrial energy studies of ground freight transportation, volume 1 [PB-236016/2] 06 p0069 N75-16099
- Industrial energy studies of ground freight transportation. Volume 2: Appendices [PB-236017/0] 06 p0069 N75-16100
- RANKINE CYCLE**
Technology considerations for Organic Rankine Cycle Electric Power Systems 05 p0002 A75-10484
- A prototype solar powered, Rankine Cycle system providing residential air conditioning and electricity 05 p0004 A75-10523
- Potential of Rankine engines to produce power from waste heat streams 05 p0006 A75-10547
- Assessment of Rankine cycle for potential application to solar-powered cooling of buildings [ASME PAPER 74-WA/SOL-7] 05 p0019 A75-16890
- Organic Rankine cycle silent power plant 1.5 kW, 28 volts dc [AD-A000900] 06 p0088 N75-18745
- Assessment of the Rankine cycle for potential application to solar powered cooling of buildings [PB-238069/9] 06 p0089 N75-18755
- Sizing of focused solar collector fields with specified collector tube inlet temperature --- Rankine cycle [SLA-74-5288] 06 p0094 N75-19832
- RAPID TRANSIT SYSTEMS**
Caltech seminar series on energy consumption in private transportation [PB-235348/0] 05 p0040 N75-15179
- RATES (PER TIME)**
Time factors in slowing down the rate of growth of demand for primary energy in the United States 06 p0059 A75-27780
- REACTION KINETICS**
Retorting indexes for oil-shale pyrolyses from ethylene-ethane ratios of product gases [PB-234050/3] 05 p0034 N75-13399
- Summary report of workshop on Energy Related Basic Combustion Research [PB-236714/2] 06 p0079 N75-17456
- REACTOR CORES**
Applications of plasma core reactors to terrestrial energy systems [AIAA PAPER 74-1074] 05 p0010 A75-11281
- Physics and potentials of fissioning plasmas for space power and propulsion [IAP PAPER 74-087] 05 p0015 A75-13719
- REACTOR DESIGN**
Conceptual design of a series of laser-fusion power plants of 100 to 3000 MW/e/ 05 p0007 A75-10562
- Clinch River Breeder Reactor: A combined power and fuel source [CONF-740609-4] 05 p0038 N75-14593
- REACTOR MATERIALS**
Foreseeable thermal, mechanical, and materials engineering problems of fusion reactor power plants [SMRT PAPER A2/1] 06 p0046 A75-21713
- MIT fusion technology program --- nuclear reactors and reactor materials [COO-2431-1] 06 p0106 N75-21101
- REACTOR TECHNOLOGY**
Current expectations for fusion power from toroidal machines 05 p0014 A75-12996
- Foreseeable thermal, mechanical, and materials engineering problems of fusion reactor power plants [SMRT PAPER A2/1] 06 p0046 A75-21713
- The economics of nuclear power 06 p0047 A75-22734
- Review of direct energy conversion of ion beams: Experimental results and reactor applications [UCRL-75600] 05 p0028 N75-11466
- Survey of applications of fusion power technology to the chemical and material processing industry [BNL-18866] 05 p0031 N75-12443
- Nuclear power growth, 1974 - 2000 --- forecasting future reactor technology [WASH-1139-74] 05 p0031 N75-12723
- RECLAMATION**
Biological conversion of organic refuse to methane [PB-235468/6] 05 p0041 N75-15183

SUBJECT INDEX

RESEARCH PROJECTS

- RECYCLING**
Bureau of Mines research programs on recycling and disposal of mineral, metal, and energy-based wastes
[PB-227476/9] 05 p0042 N75-15203
- RED SEA**
The hot deeps of the Red Sea as a potential heat source for thermoelectric power generation
05 p0004 A75-10516
- REDUCTION (CHEMISTRY)**
Electrically rechargeable redox flow cells
05 p0008 A75-10573
- REFINING**
Impact of motor gasoline lead additive regulations on petroleum refineries and energy resources, 1974-1980, phase 1
[PB-234185/7] 05 p0025 N75-10601
National Crude Oil Refinery Development Act, part 2
[GPO-35-578] 05 p0027 N75-10860
The National Coal Conversion Act and the National Crude Oil Refinery Development Act
[GPO-28-964] 05 p0027 N75-10861
Retorting indexes for oil-shale pyrolyses from ethylene-ethane ratios of product gases
[PB-234050/3] 05 p0034 N75-13399
Effects of changing the proportions of automotive distillate and gasoline produced by petroleum refining
[PB-236900/7] 06 p0085 N75-18443
- REFRACTORY MATERIALS**
Aluminum nitride and silicon nitride for high-temperature vehicular gas turbine engines
05 p0011 A75-11362
Corrosion studies of materials for auxiliary equipment in MHD power plants
06 p0055 A75-24384
Materials screening program for the LLL geothermal project
[UCRL-75353] 06 p0082 N75-17815
- REFRIGERATING**
Power conversion of energy fluctuations
05 p0011 A75-11497
Solar energy storage within the absorption cycle
[ASME PAPER 74-WA/HT-18] 05 p0017 A75-16864
- REFRIGERATING MACHINERY**
Selection and evaluation of the University of Florida's solar powered absorption air conditioning system
[ASME PAPER 74-WA/SOL-6] 05 p0019 A75-16889
Cooling by solar heat --- heating and cooling system for buildings
[AIAA PAPER 75-609] 06 p0062 A75-28590
Heat pumps in large buildings --- a refrigerating unit for heating and cooling
[OA-TRANS-939] 06 p0078 N75-17184
- REGENERATION (ENGINEERING)**
Evaluation of a fossil fuel fired ceramic regenerative heat exchanger
[PB-236346/3] 06 p0092 N75-19599
- REGIONAL PLANNING**
Regional economics: A subset of simulation of the effects of coal-fired power development in the four corners region
06 p0107 N75-21153
- REGULATIONS**
Institutional and environmental problems in geothermal resource development
06 p0100 N75-20843
- RELIABILITY ANALYSIS**
Operating experiences with terrestrial solar battery systems in Japan
05 p0005 A75-10531
- RELIABILITY ENGINEERING**
Development of a thermal battery for emergency radio power under arctic conditions
05 p0007 A75-10560
- REMOTE REGIONS**
Some aspects of a solar battery system and its use for irrigation in remote sun-rich regions
06 p0054 A75-24256
Testing of a photoelectric generator in a mountainous region of the Azerbaidzhan SSR
06 p0057 A75-26714
- REMOTE SENSORS**
Milliwatt fuel cell system for sensors
05 p0008 A75-10565
- Laser induced luminescence signatures of refined and virgin crude petroleum - Their composition and remote sensing implications
06 p0050 A75-23790
- REMOTELY PILOTED VEHICLES**
Engine development program for the APL remotely piloted vehicle
[AD-787507] 06 p0065 N75-15658
- RENDEZVOUS TRAJECTORIES**
Solar electric propulsion spacecraft power subsystem for an Encke comet rendezvous mission
05 p0002 A75-10481
- REQUIREMENTS**
Energy-related research and development in the United States Air Force
06 p0075 N75-16979
- RESEARCH**
Radioisotope space power generator
[GA-A-12848] 05 p0038 N75-14832
- RESEARCH AND DEVELOPMENT**
Combustion dynamics research for 'Project Independence'
[AIAA PAPER 74-1069] 05 p0001 A75-10262
Combustion R&D - Key to our energy future --- pollution reduction using hydrocarbon fuels
05 p0009 A75-10596
Wind energy developments in the 20th century
05 p0020 A75-17503
Technology utilization - Incentives and solar energy
06 p0048 A75-22913
The application of aerospace technology in the cryogenics field
06 p0048 A75-23239
Report on photovoltaics research and technology in the United States
06 p0051 A75-24214
Progress in the development of cadmium sulphide terrestrial solar batteries
06 p0052 A75-24224
Development of a flexible, fold-out solar array --- power to weight ratio for communication satellites
06 p0053 A75-24252
The future of silicon solar cells for terrestrial use
06 p0058 A75-27717
Energy transportation, distribution, and storage
[WASH-1281-4] 05 p0024 N75-10595
A review of the status of MHD power generation technology including suggestions for a Canadian MHD research program
[UTIAS-39] 05 p0035 N75-13641
Bureau of Mines energy program, 1973 --- discovery and production of oil, gas, and fluid fuels
[PB-234682/3] 05 p0040 N75-15172
Idaho geothermal R and D project report for period 16 December 1973 - 15 March 1974
[ANCR-1155] 06 p0076 N75-16985
Recommended research program in geothermal chemistry
[WASH-1344] 06 p0077 N75-16997
US energy R and D policy: The role of economics
[RFF-WORKING-PAPER-EN-4] 06 p0080 N75-17783
Research and technology operating plan summary: Fiscal year 1975 research and technology program --- space programs, energy technology, and aerospace sciences
[NASA-TM-X-70410] 06 p0096 N75-20155
- RESEARCH FACILITIES**
Mission and organization of the DFVLR: Two years of integrated society of German aeronautical and space flight research
[NASA-TT-F-16086] 05 p0035 N75-13882
- RESEARCH MANAGEMENT**
Rationale for setting priorities for new energy technology research and development
[UCRL-51511] 05 p0024 N75-10594
- RESEARCH PROJECTS**
Roles for solar thermal conversion systems in our energy economy
06 p0059 A75-27784
The 1974 AGARD Annual Meeting: The energy problem: Impacts on military research and development
06 p0075 N75-16977
Geothermal reservoir engineering research
06 p0101 N75-20853
Phase 0 study for a geothermal superheated water proof of concept facility
06 p0102 N75-20858

RESERVES

SUBJECT INDEX

Scientific research seeks new sources of energy
06 p0107 N75-21216

RESERVES
The reserve base of bituminous coal and anthracite
for underground mining in the Eastern United
States
[PB-237815/6] 06 p0085 N75-18713

RESERVOIRS
Optimising pumped storage with tidal power in an
estuary
[ASME PAPER 74-WA/PWR-7] 05 p0018 A75-16881
Relationships of earth fracture systems to
productivity of a gas storage reservoir
[PB-237894/1] 06 p0089 N75-18759

RESIDENTIAL AREAS
A case study - Utilization of solar energy in
residential dwellings
[ASME PAPER 74-WA/SOL-2] 05 p0018 A75-16885
The Solar Community - Energy for residential
heating, cooling, and electrical power
06 p0059 A75-27785
Residential energy conservation
[TID-26534] 05 p0031 N75-12442
Design and construction of a residential solar
heating and cooling system
[PB-237042/7] 06 p0082 N75-17823

RESOURCE ALLOCATION
Oversight: Mandatory petroleum allocation programs
[GPO-31-027] 06 p0081 N75-17806

RESOURCES MANAGEMENT
U.S. energy resources - Outlook for the future
05 p0014 A75-12999
Energy. Volume 1 - Demands, resources, impact,
technology, and policy --- Book
06 p0045 A75-20066
Energy supply and demand challenges and some
possible solutions
06 p0059 A75-27779
Public works for water and power development and
Atomic Energy Commission Appropriation Bill,
1975. Part 6: Tennessee Valley Authority
[GPO-32-403] 05 p0026 N75-10859
Project Independence
05 p0029 N75-12428
Energy from US and Canadian tar sands: Technical,
environmental, economic, legislative, and policy
aspects
[GPO-43-005] 06 p0067 N75-16083
Energy resources and utilization
06 p0075 N75-16983
Intermediate-term energy programs to protect
against crude-petroleum import interruptions:
Feasible alternatives, program costs, and
operational methods of funding
[PB-237209/2] 06 p0083 N75-17826
Methanol from forestry, municipal, and
agricultural organic residues
[BNWL-SA-5053] 06 p0085 N75-18702
Overview of Reclamation's geothermal program in
Imperial Valley, California
06 p0098 N75-20835
Geophysical, geochemical, and geological
investigations of the Dunes geothermal system,
Imperial Valley, California
[IGPP-UCR-74-31] 06 p0098 N75-20836
The Colorado School of Mines Nevada geothermal study
06 p0099 N75-20837
Heat flow and geothermal potential of the East
Mesa KGRA, Imperial Valley, California
06 p0099 N75-20838
A brief description of geological and geophysical
exploration of the Marysville geothermal area
06 p0099 N75-20839
Hawaii geothermal project
06 p0099 N75-20840
Measuring ground movement in geothermal areas of
Imperial Valley, California
06 p0099 N75-20842
Imperial Valley's proposal to develop a guide for
geothermal development within its county
06 p0100 N75-20844
The Lawrence Berkeley Laboratory geothermal
program in northern Nevada
06 p0100 N75-20845
The total flow concept for geothermal energy
conversion
06 p0100 N75-20846

San Diego Gas and Electric Company Imperial Valley
geothermal activities
06 p0100 N75-20847
Progress of the LASL dry hot rock geothermal
energy project
06 p0100 N75-20848
The Marysville, Montana Geothermal Project
06 p0100 N75-20849
Preliminary results of geothermal desalting
operations at the East Mesa test site Imperial
Valley, California
06 p0101 N75-20850
Geothermal reservoir engineering research
06 p0101 N75-20853
Geothermal down well pumping system
06 p0101 N75-20854
Phase 0 study for a geothermal superheated water
proof of concept facility
06 p0102 N75-20858
Cooperative efforts by industry and government to
develop geothermal resources
06 p0102 N75-20861

ROCKET ENGINE DESIGN
Lasers investigated for space propulsion
06 p0061 A75-28439

ROCKS
Geothermal energy: A new application of rock
mechanics
[LA-UR-74-821] 06 p0068 N75-16089

ROCKY MOUNTAINS (NORTH AMERICA)
Progress and problems in developing nuclear and
other experimental techniques for recovering
natural gas in the Rocky Mountain area
[B-164105] 06 p0075 N75-16975

ROTATING ELECTRICAL MACHINES
A high-speed superconducting generator
06 p0060 A75-27960

ROTOR AERODYNAMICS
Unsteady aerodynamics of variable pitch vertical
axis windmill
[AIAA PAPER 75-649] 06 p0063 A75-28604

ROTOR BLADES (TURBOMACHINERY)
Structural analysis of wind turbine rotors for
NSF-NASA Mod-0 wind power system
[NASA-TM-X-3198] 06 p0080 N75-17712

ROVER PROJECT
Application of technology from the Rover program
and related developments --- to energy needs
[LA-5558] 05 p0028 N75-11468

RUBBER
An evaluation of discarded tires as a potential
source of fuel
05 p0012 A75-12416
An evaluation: The potential of discarded tires
as a source of fuel
[NASA-TM-X-58143] 05 p0038 N75-15153

S

SAFETY FACTORS
Procedure for preparation for shipment of natural
gas storage vessel
[NASA-CR-141455] 05 p0036 N75-14135

SAFETY MANAGEMENT
Cryogenics safety in a hydrogen fuel society
06 p0061 A75-27973
Operational, maintenance, and environmental
problems associated with a fossil fuel-fired
potassium steam binary vapor cycle
[ORNL-NSF-EP-30] 06 p0090 N75-18769
Multi-hundred watt radioisotope thermoelectric
generator program, part 1 --- ground support
equipment and safety management
[GESP-7107-PT-1] 06 p0092 N75-19354

SATELLITE ANTENNAS
Latest developments of the circular solar array
--- with deployment structure for central
antenna communication satellite
06 p0053 A75-24246

SATELLITE ATTITUDE CONTROL
Effect of attitude constraints on solar-electric
geocentric transfers
[AIAA PAPER 75-350] 06 p0055 A75-24957

SATELLITE DESIGN
The technology of the solar generator on the
Symphonie satellite
06 p0053 A75-24237

- Power generation for the X4 spacecraft - A step in the development of a high power/mass ratio, hybrid solar array for applications spacecraft
06 p0053 A75-24251
- SATELLITE POWER TRANSMISSION (TO EARTH)**
The satellite solar power station - An option for energy production on earth
[AIAA PAPER 75-637] 06 p0063 A75-28600
The adaptation of free space power transmission technology to the SSPS concept --- Satellite Solar Power Stations
[AIAA PAPER 75-642] 06 p0063 A75-28602
Solar power generating systems as sources of non-polluting energy (power generation in space and power generation on the ground)
[NASA-TT-F-16091] 05 p0033 N75-13383
- SATELLITE SOLAR ENERGY CONVERSION**
Analysis of different systems concerning the energy distribution on board a satellite
[IAF PAPER 74-084] 05 p0014 A75-13716
Solar power generating systems as sources of non-polluting energy (power generation in space and power generation on the ground)
[NASA-TT-F-16091] 05 p0033 N75-13383
- SATELLITE SOLAR POWER STATIONS**
The satellite solar power station - An option for energy production on earth
[AIAA PAPER 75-637] 06 p0063 A75-28600
Overcoming two significant hurdles to space power generation transportation and assembly
[AIAA PAPER 75-641] 06 p0063 A75-28601
The adaptation of free space power transmission technology to the SSPS concept --- Satellite Solar Power Stations
[AIAA PAPER 75-642] 06 p0063 A75-28602
Derivation of a total satellite energy system --- solar power station for terrestrial consumption
[AIAA PAPER 75-640] 06 p0064 A75-29118
Solar power generating systems as sources of non-polluting energy (power generation in space and power generation on the ground)
[NASA-TT-F-16091] 05 p0033 N75-13383
The modular solar energy satellite: Investigation on large solar cell surfaces in space for the purpose of earth power supply
[TLR-17-1974] 05 p0036 N75-14271
- SCALE MODELS**
Development of a flexible, fold-out solar array --- power to weight ratio for communication satellites
06 p0053 A75-24252
A practical model law for chemical explosive fracture of oil shale
06 p0078 N75-17023
- SCRAP**
Bureau of Mines research programs on recycling and disposal of mineral, metal, and energy-based wastes
[PB-227476/9] 05 p0042 N75-15203
- SEA GRASSES**
The oceanic biomass energy plantation --- seaweed harvesting for food and fuel
[AIAA PAPER 75-635] 06 p0063 A75-28599
- SEA WATER**
Steady state free convection in an unconfined geothermal reservoir
05 p0009 A75-11069
Solar sea power
[PB-235469/4] 05 p0038 N75-14284
Solar sea power --- axial flow pumps
[PB-236997/3] 06 p0082 N75-17821
- SECONDARY INJECTION**
Evaluation of thermal methods for recovery of viscous oils in Missouri and Kansas
[PB-237831/3] 06 p0090 N75-18762
- SECURITY**
Energy and security: Implications for American policy
[AD-785084] 05 p0032 N75-12857
- SEEBECK EFFECT**
High efficiency thermoelectric generator
05 p0014 A75-13067
- SEISMOLOGY**
Measuring ground movement in geothermal areas of Imperial Valley, California
06 p0099 N75-20842
- SELENIDES**
RTG technology development - Where we are/where we are going --- radioisotope thermoelectric generator
05 p0002 A75-10496
A 10% efficient economic RTG design --- radioisotope thermoelectric generator
05 p0003 A75-10506
RTG electrical power for spacecraft --- Radioisotope Thermoelectric Generators
06 p0057 A75-26067
- SEMICONDUCTING FILMS**
High efficiency thermoelectric generator
05 p0014 A75-13067
Dynamic method for calculating the series resistance of a semiconductor photoelectric converter
06 p0057 A75-26713
- SEMICONDUCTOR DEVICES**
Advanced betavoltaic power sources
05 p0007 A75-10563
Solar cells - Operation, development and applications
05 p0015 A75-15201
Effectiveness of using semiconductor heat pumps under the conditions of the Turkmen SSR
05 p0020 A75-17083
Effect of heat transfer from the lateral surfaces of semiconductor thermocouples on the energy characteristics of a thermoelectric generator
05 p0021 A75-18798
Devices based on thermoelectrical phenomena
[AD-783821] 05 p0026 N75-10836
Development of low cost thin film polycrystalline silicon solar cells for terrestrial applications
[PB-238505/2] 06 p0105 N75-20890
- SEMICONDUCTORS (MATERIALS)**
Solar selective surfaces made of semiconducting powders
[ASME PAPER 74-WA/HT-13] 05 p0017 A75-16857
- SERVICE LIFE**
Development of a thermal battery for emergency radio power under arctic conditions
05 p0007 A75-10560
A novel negative-limited sealed nickel-cadmium cell
05 p0008 A75-10571
Solar cell modules for lightweight solar arrays --- onboard communication satellites
06 p0057 A75-26068
- SHALE OIL**
Economic impact of the oil shale industry in western Colorado
[GPO-28-608] 05 p0024 N75-10588
Oil shale development, part 2
[GPO-30-368] 05 p0027 N75-11455
Retorting indexes for oil-shale pyrolyses from ethylene-ethane ratios of product gases
[PB-234050/3] 05 p0034 N75-13399
Primary data on economic activity and water use in prototype oil shale development areas of Colorado: An initial inquiry
[PB-236039/4] 05 p0037 N75-14277
Prototype oil shale leasing program
[GPO-28-686] 05 p0039 N75-15160
AEC in situ oil shale program
[UCID-16520] 06 p0068 N75-16090
Average oil yield tables for oil shale sequences in cores from the Uinta Basin, Utah, that average 15, 20, 25, 30, 35, and 40 gallons per ton
[PB-236068/3] 06 p0072 N75-16124
Pollutional problems and research needs for an oil shale industry
[PB-236608/6] 06 p0084 N75-17848
In situ oil shale: A cost sensitivity analysis
[SAND-74-0146] 06 p0087 N75-18727
- SHALES**
A practical model law for chemical explosive fracture of oil shale
06 p0078 N75-17023
Mechanical properties of oil shale from Anvil Point under conditions of uniaxial compression
[SAND-74-0035] 06 p0092 N75-19390
In situ oil shale conversion and recovery
[SLA-74-0162] 06 p0093 N75-19825
- SHORT HAUL AIRCRAFT**
Evaluation of advanced lift concepts and potential fuel conservation for short-haul aircraft
[NASA-CR-2502] 06 p0073 N75-16557

- Evaluation of advanced lift concepts and fuel conservative short-haul aircraft, volume 1
[NASA-CR-137525] 06 p0096 N75-20291
- Evaluation of advanced lift concepts and fuel conservative short-haul aircraft, volume 2
[NASA-CR-137526] 06 p0097 N75-20292
- SIBERIA**
- Improving the oil storage system of western Siberia
[AD-A002717] 06 p0092 N75-19705
- SILICON**
- Solar selective surfaces made of semiconducting powders
[ASME PAPER 74-WA/HT-13] 05 p0017 A75-16857
- Development of low cost thin film polycrystalline silicon solar cells for terrestrial applications
[PB-238505/2] 06 p0105 N75-20890
- SILICON FILMS**
- Methods for low cost manufacture of silicon solar arrays
[ASME PAPER 74-WA/ENER-4] 05 p0016 A75-16836
- SILICON JUNCTIONS**
- The effects of irradiation on high-efficiency silicon solar cells
06 p0051 A75-24199
- Improvements in analysis and technology of silicon solar cells with increased efficiency
06 p0051 A75-24216
- High efficiency silicon solar cells
06 p0052 A75-24217
- Development and space qualification of new high-efficiency silicon solar cells
06 p0052 A75-24218
- Investigation of the technology and performance of lithium doped solar cells --- feasibility study for mass production
06 p0052 A75-24219
- High-speed silicon processing for low cost solar cells - A comparative analysis
06 p0052 A75-24222
- Performance of advanced silicon solar cells in a space environment
06 p0052 A75-24232
- The future of silicon solar cells for terrestrial use
06 p0058 A75-27717
- SILICON NITRIDES**
- Aluminum nitride and silicon nitride for high-temperature vehicular gas turbine engines
05 p0011 A75-11362
- SILVER**
- Transparent heat-mirror films of TiO₂/Ag/TiO₂ for solar energy collection and radiation insulation
05 p0015 A75-16378
- SINTERING**
- High energy density sintered plate type sealed nickel cadmium battery cells. I - The positive electrode/plaque relationships
05 p0008 A75-10569
- High energy density sintered plate type nickel-cadmium battery cells. II - Electrochemical impregnation methods to produce nickel oxide electrodes
05 p0008 A75-10570
- SNAP 19**
- SNAP 19 Viking RTG flight configuration and integration testing --- Radioisotope Thermoelectric Generator
05 p0003 A75-10504
- SODIUM CARBONATES**
- Coal gasification by Atomics International's Rockgas process
[ASME PAPER 74-WA/PWR-11] 05 p0018 A75-16883
- SOLAR ARRAYS**
- NASA objectives for improved solar power plants
05 p0002 A75-10485
- Solar cell and array standardization for Air Force spacecraft
05 p0002 A75-10486
- Status of JPL solar powered experiments for terrestrial applications
05 p0005 A75-10530
- Methods for low cost manufacture of silicon solar arrays
[ASME PAPER 74-WA/ENER-4] 05 p0016 A75-16836
- Report on photovoltaics research and technology in the United States
06 p0051 A75-24214
- The technology of the solar generator on the Symphonie satellite
06 p0053 A75-24237
- An analysis of photovoltaic power generation and thermal control interfaces --- for solar arrays
06 p0053 A75-24243
- Latest developments of the circular solar array --- with deployment structure for central antenna communication satellite
06 p0053 A75-24246
- Design and qualification of the CTS solar cell blanket --- onboard Canadian Communications Technology Satellite
06 p0053 A75-24248
- Power generation for the X4 spacecraft - A step in the development of a high power/mass ratio, hybrid solar array for applications spacecraft
06 p0053 A75-24251
- Development of a flexible, fold-out solar array --- power to weight ratio for communication satellites
06 p0053 A75-24252
- Solar cell modules for lightweight solar arrays --- onboard communication satellites
06 p0057 A75-26068
- Test report SEPS solar array root section model
[NASA-CR-120606] 06 p0067 N75-16085
- Solar Power Array for the Concentration of Energy (SPACE)
[PB-236247/3] 06 p0071 N75-16114
- SOLAR CELLS**
- Solar cell and array standardization for Air Force spacecraft
05 p0002 A75-10486
- Analysis of conversion efficiency of organic-semiconductor solar cells
05 p0010 A75-11146
- Recent advances in components of space power systems
[IAF PAPER 74-083] 05 p0014 A75-13715
- Solar cells - Operation, development and applications
05 p0015 A75-15201
- Radiation effects on high efficiency silicon-solar cells
06 p0051 A75-24197
- The effects of irradiation on high-efficiency silicon solar cells
06 p0051 A75-24199
- Optimisation of solar cell shielding for geostationary missions
06 p0051 A75-24203
- Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974
06 p0051 A75-24213
- Improvements in analysis and technology of silicon solar cells with increased efficiency
06 p0051 A75-24216
- High efficiency silicon solar cells
06 p0052 A75-24217
- Development and space qualification of new high-efficiency silicon solar cells
06 p0052 A75-24218
- Investigation of the technology and performance of lithium doped solar cells --- feasibility study for mass production
06 p0052 A75-24219
- High-speed silicon processing for low cost solar cells - A comparative analysis
06 p0052 A75-24222
- CdS-Cu₂S cells - An outlook for terrestrial applications
06 p0052 A75-24223
- Progress in the development of cadmium sulphide terrestrial solar batteries
06 p0052 A75-24224
- Further progress in the technology of silk screened CdS solar cells
06 p0052 A75-24225
- Development of very low cost solar cells for terrestrial power generation
06 p0052 A75-24226
- Performance of advanced silicon solar cells in a space environment
06 p0052 A75-24232
- Electron and proton irradiation of high-efficiency silicon solar cells
06 p0053 A75-24233

- The COMSAT non-reflective silicon solar cell - A second generation improved cell
06 p0053 A75-24245
- Solar one - The Delaware solar house and results obtained during the first year of operation
06 p0054 A75-24254
- The use of solar cells in the lighthouse service
06 p0054 A75-24255
- Some aspects of a solar battery system and its use for irrigation in remote sun-rich regions
06 p0054 A75-24256
- Terrestrial applications of FEP-encapsulated solar cell modules --- power systems using Fluorinated Ethylene Propylene encapsulation
06 p0054 A75-24258
- Process development for low cost integrated solar arrays
06 p0054 A75-24259
- Epitaxial silicon solar cell
06 p0056 A75-25086
- Solar cell modules for lightweight solar arrays --- onboard communication satellites
06 p0057 A75-26068
- High-efficiency graded band-gap Al/x/Ga/1-x/As-GaAs solar cell
06 p0058 A75-27519
- GaAs concentrator solar cell
06 p0058 A75-27520
- Solar cells - Present state and perspectives on terrestrial applications
06 p0058 A75-27716
- The future of silicon solar cells for terrestrial use
06 p0058 A75-27717
- Solar electric and thermal conversion system in close proximity to the consumer --- solar panels on house roofs
[AIAA PAPER 75-628] 06 p0062 A75-28597
- The modular solar energy satellite: Investigation on large solar cell surfaces in space for the purpose of earth power supply
[ILR-17-1974] 05 p0036 N75-14271
- Direct solar energy conversion for large scale terrestrial use
[PB-236193/9] 06 p0071 N75-16115
- Development of low cost thin film polycrystalline silicon solar cells for terrestrial applications
[PB-238505/2] 06 p0105 N75-20890
- SOLAR COLLECTORS**
- Heat mirrors for solar-energy collection and radiation insulation
05 p0004 A75-10525
- Comparative performance characteristics of cylindrical parabolic and flat plate solar energy collectors
[ASME PAPER 74-WA/ENER-3] 05 p0016 A75-16835
- Solar selective surfaces made of semiconducting powders
[ASME PAPER 74-WA/HT-13] 05 p0017 A75-16857
- Natural convection in enclosed spaces - A review of application to solar energy collection
[ASME PAPER 74-WA/HT-12] 05 p0017 A75-16860
- Solar radiation heat transfer to high temperature heat carriers
[ASME PAPER 74-WA/HT-14] 05 p0017 A75-16861
- The analysis of the performance of a pancake absorber-heat exchanger for a solar concentrator
[ASME PAPER 74-WA/SOL-1] 05 p0018 A75-16884
- A case study - Utilization of solar energy in residential dwellings
[ASME PAPER 74-WA/SOL-2] 05 p0018 A75-16885
- An analytical and experimental investigation of a laboratory solar pond model
[ASME PAPER 74-WA/SOL-3] 05 p0019 A75-16886
- Performance of the thermal trap solar collector
[ASME PAPER 74-WA/SOL-5] 05 p0019 A75-16888
- Design of a tubular heat collector for a solar power installation with a parabolocylindric concentrator
05 p0020 A75-17069
- Simulation of a solar heating and cooling system --- for houses
06 p0048 A75-23018
- Some aspects of a solar battery system and its use for irrigation in remote sun-rich regions
06 p0054 A75-24256
- Method for calculating solar radiation for semicylindrical collectors
06 p0057 A75-26718
- GaAs concentrator solar cell
06 p0058 A75-27520
- Solar collector performance evaluated outdoors at NASA-Lewis Research Center
06 p0058 A75-27531
- Status of the NASA-Lewis flat-plate collector tests with a solar simulator
06 p0058 A75-27533
- Cooling by solar heat --- heating and cooling system for buildings
[AIAA PAPER 75-609] 06 p0062 A75-28590
- Solar incidence factor and other geometric considerations of solar energy collection
[SAND-74-26] 05 p0034 N75-13390
- Axial temperature differential analysis of linear focused collectors for solar power
[SLA-74-5078] 05 p0036 N75-14268
- Design analysis of asymmetric solar receivers
[SAND-74-0124] 06 p0076 N75-16986
- Collection and concentration of solar energy using Fresnel type lenses
[NASA-CR-142194] 06 p0080 N75-17784
- The evaluation of surface geometry modification to improve the directional selectivity of solar energy collectors
[PB-236412/3] 06 p0083 N75-17830
- Solar kine: Answer to the agricultural energy challenge of our time
06 p0086 N75-18721
- Solar thermal conversion program. Central receiver POCE project, subsystem specifications studies
[PB-238002/0] 06 p0087 N75-18733
- Summary of results of solar power arrays for the concentration of energy study
[PB-238003/8] 06 p0089 N75-18756
- Report and recommendations of the Solar Energy Data Workshop
[PB-238066/5] 06 p0089 N75-18757
- Solar collector thermal power system. Volume 1: Preliminary technology systems study
[AD-A000940] 06 p0091 N75-19339
- Solar collector thermal power system. Volume 2: Development, fabrication, and testing of fifteen foot heat pipes
[AD-A000941] 06 p0091 N75-19340
- Solar collector thermal power system. Volume 3: Basic study and experimental evaluation of thermal train components
[AD-A000942] 06 p0091 N75-19341
- Sizing of focused solar collector fields with specified collector tube inlet temperature --- Rankine cycle
[SLA-74-5288] 06 p0094 N75-19832
- Comparative performance characteristics of cylindrical parabolic focusing and flat plate solar energy collectors
[CONF-741104-3] 06 p0103 N75-20872
- Solar heating and cooling of buildings study conducted for department of the Army. Volume 1: Executive summary and implementation plans
[AD-A002576] 06 p0104 N75-20879
- Solar heating and cooling of buildings study conducted for Department of the Army. Volume 2: Technical report
[AD-A002563] 06 p0104 N75-20880
- Research on the application of solar energy to the food drying industry
[PB-238073/1] 06 p0105 N75-20888
- SOLAR ELECTRIC PROPULSION**
- Solar electric propulsion spacecraft power subsystem for an Encke comet rendezvous mission
05 p0002 A75-10481
- Interplanetary spacecraft design using solar electric propulsion
[AIAA PAPER 74-1084] 05 p0010 A75-11283
- Solar electric propulsion system thermal analysis
[NASA-CR-120622] 06 p0085 N75-18319
- SOLAR ENERGY**
- Prospects for tapping solar energy on a large scale
05 p0015 A75-14014
- A case study - Utilization of solar energy in residential dwellings
[ASME PAPER 74-WA/SOL-2] 05 p0018 A75-16885
- Some generalizations of sample water-supply calculations for solar-powered pumping plants
05 p0020 A75-17077

- Experience in setting up solar-energy survey for
Azerbaijan 05 p0020 A75-17081
- Technology utilization - Incentives and solar energy
06 p0048 A75-22913
- Simulation of a solar heating and cooling system
--- for houses 06 p0048 A75-23018
- Solar operation of ammonia-water multistage air
conditioning cycles in the tropics 06 p0048 A75-23021
- The Solar Community - Energy for residential
heating, cooling, and electrical power 06 p0059 A75-27785
- The nature of the sunspot phenomenon. III - Energy
consumption and energy transport. IV - The
intrinsic instability of the magnetic
configuration 06 p0064 A75-29137
- Effective utilization of solar energy to produce
clean fuel [PB-233956/2] 05 p0026 A75-10605
- Our prodigal sun --- solar energy technology
[NASA-EP-118] 05 p0032 A75-12885
- Utilization of solar energy --- an assessment of
present technology [NASA-TT-F-16090] 05 p0033 A75-13382
- Prospects for solar energy utilization
[SAND-74-8604] 05 p0034 A75-13389
- Solar incidence factor and other geometric
considerations of solar energy collection
[SAND-74-26] 05 p0034 A75-13390
- Solar energy: Sandia's photovoltaic research
program [SLA-74-281] 05 p0034 A75-13392
- Axial temperature differential analysis of linear
focused collectors for solar power [SLA-74-5078] 05 p0036 A75-14268
- Photochemical conversion of solar
energy [PB-236266/3] 05 p0037 A75-14281
- Photochemical conversion of solar energy --- study
of iron-thionine photogalvanic cells [PB-235474/4] 05 p0038 A75-14282
- Solar sea power [PB-235469/4] 05 p0038 A75-14284
- Solar energy [NASA-TT-F-16092] 05 p0038 A75-15149
- Research applied to solar-thermal power systems:
Chemical vapor deposition research for
fabrication of solar energy converters [PB-234565/0] 05 p0041 A75-15186
- Photochemical conversion of solar
energy [PB-235503/0] 06 p0070 A75-16106
- Air-stable selective surfaces for solar energy
collectors [PB-236196/2] 06 p0071 A75-16116
- Research on cadmium stannate selective optical
films for solar energy applications [PB-236208/5] 06 p0071 A75-16117
- Solar thermal electric power systems [PB-236368/7] 06 p0071 A75-16118
- Chemical vapor deposition research for fabrication
of solar energy converters [PB-236189/7] 06 p0072 A75-16119
- Terrestrial photovoltaic power systems with
sunlight concentration [PB-236180/6] 06 p0072 A75-16120
- Photovoltaic conversion of solar energy for
terrestrial applications. Volume 2: Invited
papers [PB-236164/0] 06 p0072 A75-16122
- Sensible heat storage in liquids --- solar energy
applications [SLL-73-0263] 06 p0074 A75-16773
- Solar energy program plan for heating and cooling
buildings [WASH-1337-5-DRAFT] 06 p0077 A75-16993
- Solar total energy program [SAND-74-0208] 06 p0081 A75-17810
- Use of solar energy in buildings in New York state
[PB-236974/2] 06 p0083 A75-17825
- Solar thermal subsystem specification study
[PB-238005/3] 06 p0083 A75-17829
- Solar energy concentrator system for crystal
growth and zone refining in space [NASA-CR-120623] 06 p0086 A75-18719
- Summary of results of solar power arrays for the
concentration of energy study [PB-238003/8] 06 p0089 A75-18756
- LLL-SOHIO solar process heat project
[UCID-16630-74-1] 06 p0093 A75-19827
- Solar energy: A bibliography [TID-3351] 06 p0103 A75-20871
- Comparative performance characteristics of
cylindrical parabolic focusing and flat plate
solar energy collectors [CONF-741104-3] 06 p0103 A75-20872
- Research on the application of solar energy to the
food drying industry [PB-238073/1] 06 p0105 A75-20888
- SOLAR ENERGY ABSORBERS**
- Solar farms utilizing low-pressure closed-cycle
gas turbines 05 p0003 A75-10514
- Operating experiences with terrestrial solar
battery systems in Japan 05 p0005 A75-10531
- Solar thermal absorption heat pump breakeven
coefficient of performance [ASME PAPER 74-WA/ENER-2] 05 p0015 A75-16834
- Solar energy storage within the absorption cycle
[ASME PAPER 74-WA/HT-18] 05 p0017 A75-16864
- The analysis of the performance of a pancake
absorber-heat exchanger for a solar concentrator
[ASME PAPER 74-WA/SOL-1] 05 p0018 A75-16884
- Thin film coatings in solar-thermal power systems 06 p0056 A75-25679
- Solar energy absorber [NASA-CASE-MFS-22743-1] 05 p0024 A75-10585
- Solar energy trap [NASA-CASE-MFS-22744-1] 05 p0024 A75-10586
- The evaluation of surface geometry modification to
improve the directional selectivity of solar
energy collectors [PB-236412/3] 06 p0083 A75-17830
- Solar thermal conversion program. Central
receiver POCE project, subsystem specifications
studies [PB-238002/0] 06 p0087 A75-18733
- Solar thermal power systems based on optical
transmission [PB-237005/4] 06 p0088 A75-18742
- Reflector-absorber systems for solar thermionic
converters [ESRO-TT-123] 06 p0104 A75-20878
- Terrestrial photovoltaic power systems with
sunlight concentration [PB-238582/1] 06 p0105 A75-20886
- SOLAR ENERGY CONVERSION**
- Evaluation of central solar tower power plant 05 p0003 A75-10515
- Economics analyses of solar energy utilization 05 p0004 A75-10520
- Metal hydrides for thermal energy storage 05 p0004 A75-10522
- A prototype solar powered, Rankine Cycle system
providing residential air conditioning and
electricity 05 p0004 A75-10523
- Solar augmented home heating heat pump system 05 p0004 A75-10524
- Heat mirrors for solar-energy collection and
radiation insulation 05 p0004 A75-10525
- Analysis of conversion efficiency of
organic-semiconductor solar cells 05 p0010 A75-11146
- Study of channel-type systems for solar-energy
radiative heat transport 05 p0010 A75-11196
- GaP p-n junctions and possibilities for their
application in the conversion of solar energy
into electric 05 p0011 A75-12198
- Solar energy: Technology and applications --- Book 05 p0012 A75-12425
- II-VI photovoltaic heterojunctions for solar
energy conversion 05 p0012 A75-12734
- Utilization of solar energy today 05 p0012 A75-12987
- Solar energy conversion and storage systems for
the future 05 p0013 A75-12988
- Solar cells - Operation, development and
applications 05 p0015 A75-15201

- Transparent heat-mirror films of $\text{TiO}_2/\text{Ag}/\text{TiO}_2$ for solar energy collection and radiation insulation
05 p0015 A75-16378
- Methods for low cost manufacture of silicon solar arrays
[ASME PAPER 74-WA/ENER-4] 05 p0016 A75-16836
- Natural convection in enclosed spaces - A review of application to solar energy collection
[ASME PAPER 74-WA/HT-12] 05 p0017 A75-16860
- Sizing of solar energy storage systems using local weather records
[ASME PAPER 74-WA/HT-20] 05 p0017 A75-16865
- Dynamic response of solar heat storage systems
[ASME PAPER 74-WA/HT-22] 05 p0018 A75-16867
- Performance of the thermal trap solar collector
[ASME PAPER 74-WA/SOL-5] 05 p0019 A75-16888
- Selection and evaluation of the University of Florida's solar powered absorption air conditioning system
[ASME PAPER 74-WA/SOL-6] 05 p0019 A75-16889
- Assessment of Rankine cycle for potential application to solar-powered cooling of buildings
[ASME PAPER 74-WA/SOL-7] 05 p0019 A75-16890
- Dynamic simulation for performance analysis of solar heated and cooled buildings
[ASME PAPER 74-WA/SOL-8] 05 p0019 A75-16891
- Energy problems - Solar energy and manure gas
05 p0020 A75-17024
- Concepts for central solar electric power generation
05 p0021 A75-17504
- Compact solar energy concentrator
05 p0021 A75-19050
- Material considerations involved in solar energy conversion
06 p0047 A75-22522
- Thermodynamic analysis of a solar energy system with a closed-cycle gas-turbine converter
06 p0049 A75-23402
- A study of channel systems for radiative solar-heat transfer
06 p0049 A75-23408
- Considerations regarding a utilization of solar energy --- thermal, electric and wind energy systems
06 p0050 A75-23510
- The introduction of the principles of biological energy supply in future technical systems
06 p0050 A75-23511
- Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974
06 p0051 A75-24213
- Report on photovoltaics research and technology in the United States
06 p0051 A75-24214
- Historic development of photovoltaic power generation
06 p0051 A75-24215
- Solar one - The Delaware solar house and results obtained during the first year of operation
06 p0054 A75-24254
- Effect of attitude constraints on solar-electric geocentric transfers
[AIAA PAPER 75-350] 06 p0055 A75-24957
- Use of flexible reflective surfaces for solar energy concentration
06 p0056 A75-25678
- Dynamic method for calculating the series resistance of a semiconductor photoelectric converter
06 p0057 A75-26713
- Roles for solar thermal conversion systems in our energy economy
06 p0059 A75-27784
- Solar/hydroelectric combined power systems
06 p0059 A75-27786
- Ocean thermal power and windpower systems - Natural solar energy conversion for near-term impact on world energy markets
06 p0060 A75-27790
- Prospects of photosynthetic energy production
06 p0060 A75-27792
- SIMSHAC - A simulation program for solar heating and cooling of buildings
06 p0061 A75-28093
- Solar energy in earth processes --- review
06 p0061 A75-28437
- Solar energy and energy conservation in a state-assisted housing for the elderly project
[AIAA PAPER 75-611] 06 p0062 A75-28591
- Systems aspects of ocean thermal energy conversion
[AIAA PAPER 75-615] 06 p0062 A75-28593
- Site limitations on Solar Sea Power Plants
[AIAA PAPER 75-618] 06 p0062 A75-28594
- 100 MWe solar power plant design configuration and performance
[AIAA PAPER 75-623] 06 p0062 A75-28595
- A central receiver solar power plant in a hybrid mode of operation --- solar/fossil-fueled steam power plant
[AIAA PAPER 75-624] 06 p0062 A75-28596
- The oceanic biomass energy plantation --- seaweed harvesting for food and fuel
[AIAA PAPER 75-635] 06 p0063 A75-28599
- The satellite solar power station - An option for energy production on earth
[AIAA PAPER 75-637] 06 p0063 A75-28600
- Overcoming two significant hurdles to space power generation Transportation and assembly
[AIAA PAPER 75-641] 06 p0063 A75-28601
- Tropical ocean thermal power plants and potential products
[AIAA PAPER 75-617] 06 p0064 A75-29116
- Solar thermal conversion mission analysis
[AIAA PAPER 75-619] 06 p0064 A75-29117
- Development of solar engineering in the USSR
[AD-784708] 05 p0025 N75-10597
- Solar Sea Power Plants (SSPP): A critical review and survey
[NASA-TM-X-70783] 05 p0028 N75-11459
- Bioconversion --- of solar energy and solid waste energy into useable fuels
[GPO-37-403] 05 p0028 N75-11463
- Shallow solar pond energy conversion system: An analysis of a conceptual 10-MWe plant
[UCRL-51533-REV-1] 05 p0028 N75-11467
- Solar photovoltaic energy
[GPO-39-576] 05 p0032 N75-13379
- A system utilizing solar energy
[NASA-TT-F-16089] 05 p0033 N75-13386
- Japanese/United States Symposium on Solar Energy systems. Volume 1: Summary of proceedings
[NTR-6284-VOL-1] 05 p0036 N75-14264
- Wind and solar power engineering
[AD-786844] 05 p0039 N75-15168
- Solar heating and cooling of buildings, phase O. Volume 2: Final report
[PB-235423/1] 05 p0042 N75-15190
- Solar heating and cooling of buildings, phase O: Feasibility and planning study. Volume 3, book 1, appendix A, task 1: Development of requirements. Appendix B, task 2: Systems definition
[PB-235433/0] 05 p0042 N75-15191
- Solar heating and cooling of buildings. Phase O: Final report, volume 1
[PB-235427/2] 05 p0042 N75-15192
- Solar heating and cooling of buildings. Phase O: Final report. Volume 2: Appendices A-N
[PB-235428/0] 05 p0042 N75-15193
- Solar heating and cooling of buildings. Phase O: Final report. Volume 3: Appendices O-Y
[PB-235429/8] 05 p0042 N75-15194
- Dynamic conversion of solar generated heat to electricity
[NASA-CR-134724] 06 p0066 N75-16079
- Test report SEPS solar array root section model
[NASA-CR-120606] 06 p0067 N75-16085
- Proceedings of the Solar Heating and Cooling for Buildings Workshop. Part 2: Panel sessions, March 23
[PB-235483/5] 06 p0069 N75-16095
- Proceedings of the Workshop on Bio-Solar Conversion
[PB-236142/6] 06 p0069 N75-16096
- Workshop proceedings: Photovoltaic conversion of solar energy for terrestrial applications. Volume 1: Working group and panel reports
[NASA-CR-138209] 06 p0069 N75-16097
- Workshop proceedings: Photovoltaic conversion of solar energy for terrestrial applications. Volume 2: Invited papers
[NASA-CR-138193] 06 p0069 N75-16098
- Solar heating and cooling of buildings. Phase O: Feasibility and planning study. Volume 1:
[PB-235431/4] 06 p0069 N75-16101

- Solar heating and cooling of buildings. Phase 0:
Feasibility and planning study. Volume 2:
Technical report
[PB-235432/2] 06 p0069 N75-16102
- Solar heating and cooling of buildings, phase 0.
Volume 3: Appendices
[PB-235424/9] 06 p0070 N75-16103
- Solar heating and cooling of buildings, phase 0.
Volume 1: Executive summary
[PB-235422/3] 06 p0070 N75-16107
- Solar Power Array for the Concentration of Energy
(SPACE)
[PB-236247/3] 06 p0071 N75-16114
- Direct solar energy conversion for large scale
terrestrial use
[PB-236193/9] 06 p0071 N75-16115
- Photovoltaic conversion of solar energy for
Terrestrial Applications. Volume 1: Working
group and panel reports
[PB-236163/2] 06 p0072 N75-16121
- Integration of photovoltaic and solar thermal
energy conversion systems
[SAND-74-0093] 06 p0076 N75-16992
- Control system design and simulation for solar
heated structures
[LA-UR-74-1085] 06 p0082 N75-17813
- Thermodynamic analysis and parameter optimization
of a solar thermoelectric power unit with
radiation heat dissipation
[AD-A000211] 06 p0082 N75-17819
- Solar kine: Answer to the agricultural energy
challenge of our time
06 p0086 N75-18721
- Sizing of focused solar collector fields with
specified collector tube inlet temperature ---
Rankine cycle
[SLA-74-5288] 06 p0094 N75-19832
- Reflector-absorber systems for solar thermionic
converters
[ESRO-TT-123] 06 p0104 N75-20878
- Technology for the conversion of solar energy to
fuel gas
[PB-238103/6] 06 p0104 N75-20883
- Environmental aspects of cadmium sulfide usage in
solar energy conversion. Part 1: Toxicological
and environmental health considerations, a
bibliography
[PB-238285/1] 06 p0105 N75-20884
- SOLAR FLUX DENSITY**
Experience in setting up solar-energy survey for
Azerbaijan
05 p0020 A75-17081
- SOLAR GENERATORS**
Hot side heat exchanger for an ocean thermal
difference power plant
05 p0004 A75-10527
- Study of energy distribution in the field of
concentration of a solar power plant with a
hyperboloid counterreflector
05 p0010 A75-11195
- Analysis of different systems concerning the
energy distribution on board a satellite
[IAF PAPER 74-084] 05 p0014 A75-13716
- Utilization of tubular thermoelectric modules in
solar generators
05 p0020 A75-17067
- Design of a tubular heat collector for a solar
power installation with a parabolocylindric
concentrator
05 p0020 A75-17069
- Prospects for using dynamic thermocompression
converter in solar power plants
05 p0020 A75-17076
- Concepts for central solar electric power generation
05 p0021 A75-17504
- Thermodynamic analysis of a solar energy system
with a closed-cycle gas-turbine converter
06 p0049 A75-23402
- Energy distribution in the concentration field of
a solar installation with a hyperboloidal
counter-reflector
06 p0049 A75-23407
- Investigations and selection of components and
materials for flexible solar generator
06 p0050 A75-24182
- Solar generators for terrestrial applications
06 p0054 A75-24257
- Testing of a photoelectric generator in a
mountainous region of the Azerbaïdzhân SSR
06 p0057 A75-26714
- Derivation of a total satellite energy system ---
solar power station for terrestrial consumption
[AIAA PAPER 75-640] 06 p0064 A75-29118
- Power processor design considerations for a solar
electric propulsion spacecraft
[NASA-CR-140842] 05 p0029 N75-12064
- Solar power system and component research program
[PB-236159/0] 05 p0037 N75-14280
- Solar thermal electric power systems
[PB-235475/1] 05 p0038 N75-14283
- Chemical vapor deposition research for fabrication
of solar energy converters
[PB-235481/9] 05 p0041 N75-15185
- Research applied to solar-thermal power systems:
Chemical vapor deposition research for
fabrication of solar energy converters
[PB-234565/0] 05 p0041 N75-15186
- Solar thermal electric power systems
[PB-236368/7] 06 p0071 N75-16118
- Terrestrial photovoltaic power systems with
sunlight concentration
[PB-236180/6] 06 p0072 N75-16120
- Technical and economic feasibility of the ocean
thermal differences process as a solar-driven
energy process
[PB-236422/2] 06 p0077 N75-17003
- Solar sea power --- axial flow pumps
[PB-236997/3] 06 p0082 N75-17821
- Solar thermal power systems based on optical
transmission
[PB-237005/4] 06 p0088 N75-18742
- Assessment of the Rankine cycle for potential
application to solar powered cooling of buildings
[PB-238069/9] 06 p0089 N75-18755
- Summary of results of solar power arrays for the
concentration of energy study
[PB-238003/8] 06 p0089 N75-18756
- Terrestrial photovoltaic power systems with
sunlight concentration
[PB-238582/1] 06 p0105 N75-20886
- SOLAR HEATING**
Solar augmented home heating heat pump system
05 p0004 A75-10524
- Thermal energy storage devices suitable for solar
heating
05 p0007 A75-10553
- Utilization of solar energy today
05 p0012 A75-12987
- Solar thermal absorption heat pump breakeven
coefficient of performance
[ASME PAPER 74-WA/ENER-2] 05 p0015 A75-16834
- Sizing of solar energy storage systems using local
weather records
[ASME PAPER 74-WA/HT-20] 05 p0017 A75-16865
- Convergence and speed of calculations for
thermoelectric heat pump
05 p0020 A75-17084
- Solar collector performance evaluated outdoors at
NASA-Lewis Research Center
06 p0058 A75-27531
- Solar heating and cooling of buildings
06 p0059 A75-27783
- SIMSHAC - A simulation program for solar heating
and cooling of buildings
06 p0061 A75-28093
- Solar energy and energy conservation in a
state-assisted housing for the elderly project
[AIAA PAPER 75-611] 06 p0062 A75-28591
- Solar electric and thermal conversion system in
close proximity to the consumer --- solar panels
on house roofs
[AIAA PAPER 75-628] 06 p0062 A75-28597
- Research, development, and the energy crisis
[GPO-27-032] 05 p0023 N75-10580
- Solar heating and cooling of buildings. Phase 0:
Final report. Executive summary
[PB-235426/4] 05 p0042 N75-15195
- Dynamic conversion of solar generated heat to
electricity
[NASA-CR-134724] 06 p0066 N75-16079
- Solar heating and cooling of buildings. Phase 0:
Feasibility and planning study. Volume 1:
[PB-235431/4] 06 p0069 N75-16101

- Solar heating and cooling of buildings. Phase 0: Feasibility and planning study. Volume 2: Technical report [PB-235432/2] 06 p0069 N75-16102
- Solar heating and cooling of buildings, phase 0. Volume 3: Appendices [PB-235424/9] 06 p0070 N75-16103
- Solar heating and cooling of buildings, phase 0. Volume 1: Executive summary [PB-235422/3] 06 p0070 N75-16107
- Solar heating and cooling of buildings. Phase 0. Feasibility and planning study. Volume 3, book 2, appendix c, task 3: Assessment of capture potential. Appendix d, task 4: Social and environmental study [PB-235434/8] 06 p0070 N75-16108
- Latent heat and sensible heat storage for solar heating systems [PB-236190/5] 06 p0077 N75-17005
- Comparison of computer programs used for modeling solar heating and air conditioning systems for buildings [LBL-3066] 06 p0079 N75-17279
- Design and construction of a residential solar heating and cooling system [PB-237042/7] 06 p0082 N75-17823
- Use of solar energy in buildings in New York state [PB-236974/2] 06 p0083 N75-17825
- Solar thermal conversion program. Central receiver POCE project, subsystem specifications studies [PB-238002/0] 06 p0087 N75-18733
- LLL-SOHIO solar process heat project [UCID-16630-74-1] 06 p0093 N75-19827
- Solar heating and cooling of buildings study conducted for department of the Army. Volume 1: Executive summary and implementation plans [AD-A002576] 06 p0104 N75-20879
- Solar heating and cooling of buildings study conducted for Department of the Army. Volume 2: Technical report [AD-A002563] 06 p0104 N75-20880
- SOLAR MAGNETIC FIELD**
The nature of the sunspot phenomenon. III - Energy consumption and energy transport. IV - The intrinsic instability of the magnetic configuration 06 p0064 A75-29137
- SOLAR PHYSICS**
The Mitre solar energy demonstration system 06 p0055 A75-24676
- SOLAR PROPULSION**
Power processor design considerations for a solar electric propulsion spacecraft [NASA-CR-140842] 05 p0029 N75-12064
- SOLAR RADIATION**
Solar radiation heat transfer to high temperature heat carriers [ASME PAPER 74-WA/HT-14] 05 p0017 A75-16861
- Solar energy --- and solar powered equipment [NASA-TT-F-16155] 06 p0081 N75-17787
- Report and recommendations of the Solar Energy Data Workshop [PB-238066/5] 06 p0089 N75-18757
- SOLAR REFLECTORS**
Study of energy distribution in the field of concentration of a solar power plant with a hyperboloid counterreflector 05 p0010 A75-11195
- Compact solar energy concentrator 05 p0021 A75-19050
- Material considerations involved in solar energy conversion 06 p0047 A75-22522
- Energy distribution in the concentration field of a solar installation with a hyperboloidal counter-reflector 06 p0049 A75-23407
- Reflector-absorber systems for solar thermionic converters [ESRO-TT-123] 06 p0104 N75-20878
- SOLAR SIMULATORS**
Status of the NASA-Lewis flat-plate collector tests with a solar simulator 06 p0058 A75-27533
- SOLID PROPELLANTS**
Use of low grade solid fuels in gas turbines [ASME PAPER 74-WA/ENER-5] 05 p0016 A75-16837
- SOLIDS**
Energy recovery from solid waste --- production engineering model 06 p0079 N75-17200
- SOLVENT EXTRACTION**
Development of a process for producing an ashless, low-sulfur fuel from coal. Volume 4. Product studies. Part 3 Products from coal minerals [PB-237764/6] 06 p0095 N75-19840
- Development of a process for producing an ashless, low-sulfur fuel from coal. Volume 4. Product studies. Part 4. Sulfur removal from coal minerals [PB-237765/3] 06 p0095 N75-19841
- 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 [PB-237766/1] 06 p0095 N75-19842
- SPACE ENVIRONMENT SIMULATION**
Performance of advanced silicon solar cells in a space environment 06 p0052 A75-24232
- Electron and proton irradiation of high-efficiency silicon solar cells 06 p0053 A75-24233
- SPACE MANUFACTURING**
Solar energy concentrator system for crystal growth and zone refining in space [NASA-CR-120623] 06 p0086 N75-18719
- SPACE POWER REACTORS**
Economic radioisotope thermoelectric generator program: Program plan [IESD-3112-3] 05 p0034 N75-13393
- SPACE PROGRAMS**
Technology application at Rockwell International 06 p0078 N75-17189
- Research and technology operating plan summary: Fiscal year 1975 research and technology program --- space programs, energy technology, and aerospace sciences [NASA-TM-X-70410] 06 p0096 N75-20155
- SPACE SHUTTLE ORBITERS**
Electrical power generation subsystem for Space Shuttle Orbiter 05 p0002 A75-10477
- SPACE SHUTTLES**
Overcoming two significant hurdles to space power generation Transportation and assembly [AIAA PAPER 75-641] 06 p0063 A75-28601
- SPACE TRANSPORTATION**
Overcoming two significant hurdles to space power generation Transportation and assembly [AIAA PAPER 75-641] 06 p0063 A75-28601
- SPACECRAFT COMPONENTS**
Investigations and selection of components and materials for flexible solar generator 06 p0050 A75-24182
- Solar collector thermal power system. Volume 1: Preliminary technology systems study [AD-A000940] 06 p0091 N75-19339
- Solar collector thermal power system. Volume 2: Development, fabrication, and testing of fifteen foot heat pipes [AD-A000941] 06 p0091 N75-19340
- Solar collector thermal power system. Volume 3: Basic study and experimental evaluation of thermal train components [AD-A000942] 06 p0091 N75-19341
- SPACECRAFT DESIGN**
Interplanetary spacecraft design using solar electric propulsion [AIAA PAPER 74-1084] 05 p0010 A75-11283
- The heat pipe - Its development, and its aerospace applications 05 p0015 A75-15054
- SPACECRAFT LAUNCHING**
How spacecraft are fueled --- technology of fueling spacecraft for flight [JPRS-63514] 05 p0027 N75-10983
- SPACECRAFT MODULES**
The modular solar energy satellite: Investigation on large solar cell surfaces in space for the purpose of earth power supply [ILR-17-1974] 05 p0036 N75-14271
- SPACECRAFT POWER SUPPLIES**
Electrical power generation subsystem for Space Shuttle Orbiter 05 p0002 A75-10477

- Solar electric propulsion spacecraft power subsystem for an Encke comet rendezvous mission
05 p0002 A75-10481
- Technology considerations for Organic Rankine Cycle Electric Power Systems
05 p0002 A75-10484
- NASA objectives for improved solar power plants
05 p0002 A75-10485
- Solar cell and array standardization for Air Force spacecraft
05 p0002 A75-10486
- RTG technology development - Where we are/where we are going --- radioisotope thermoelectric generator
05 p0002 A75-10496
- Performance testing of thermoelectric generators at JPL
05 p0002 A75-10503
- SNAP 19 Viking RTG flight configuration and integration testing --- Radioisotope Thermoelectric Generator
05 p0003 A75-10504
- Space power systems - Retrospect and prospect [IAF PAPER 74-082]
05 p0014 A75-13714
- Recent advances in components of space power systems [IAF PAPER 74-083]
05 p0014 A75-13715
- Analysis of different systems concerning the energy distribution on board a satellite [IAF PAPER 74-084]
05 p0014 A75-13716
- Advances in space power generation [IAF PAPER 74-086]
05 p0015 A75-13718
- Fundamentals of automatic control of space nuclear power plants --- Russian book
06 p0048 A75-23229
- Radiation effects on high efficiency silicon-solar cells
06 p0051 A75-24197
- Optimisation of solar cell shielding for geostationary missions
06 p0051 A75-24203
- Photovoltaic power generation; Proceedings of the International Conference, Hamburg, West Germany, September 25-27, 1974
06 p0051 A75-24213
- Historic development of photovoltaic power generation
06 p0051 A75-24215
- Development and space qualification of new high-efficiency silicon solar cells
06 p0052 A75-24218
- Latest developments of the circular solar array --- with deployment structure for central antenna communication satellite
06 p0053 A75-24246
- Design and qualification of the CTS solar cell blanket --- onboard Canadian Communications Technology Satellite
06 p0053 A75-24248
- Power generation for the X4 spacecraft - A step in the development of a high power/mass ratio, hybrid solar array for applications spacecraft
06 p0053 A75-24251
- Development of a flexible, fold-out solar array --- power to weight ratio for communication satellites
06 p0053 A75-24252
- RTG electrical power for spacecraft --- Radioisotope Thermoelectric Generators
06 p0057 A75-26067
- Lasers investigated for space propulsion
06 p0061 A75-28439
- Power processor design considerations for a solar electric propulsion spacecraft [NASA-CR-140842]
05 p0029 A75-12064
- Evaluation of an ion exchange membrane fuel cell for space power [AD-786888]
05 p0037 A75-14274
- SPACECRAFT PROPULSION**
- Nuclear propulsion technology transfer to energy systems [AIAA PAPER 74-1072]
05 p0001 A75-10264
- Interplanetary spacecraft design using solar electric propulsion [AIAA PAPER 74-1084]
05 p0010 A75-11283
- Physics and potentials of fissioning plasmas for space power and propulsion [IAF PAPER 74-087]
05 p0015 A75-13719
- Lasers investigated for space propulsion
06 p0061 A75-28439
- SPECTRAL REFLECTANCE**
- Use of flexible reflective surfaces for solar energy concentration
06 p0056 A75-25678
- SPECTRAL SIGNATURES**
- Laser induced luminescence signatures of refined and virgin crude petroleum - Their composition and remote sensing implications
06 p0050 A75-23790
- STANDARDS**
- Energy and environmental standards --- environmental standards and energy policy [GPO-37-171]
05 p0030 A75-12431
- STATIONARY ORBITS**
- Optimisation of solar cell shielding for geostationary missions
06 p0051 A75-24203
- STATISTICAL ANALYSIS**
- Statistical estimation of wildcat well outcome probabilities by visual analysis of structure contour maps of Stafford County, Kansas
06 p0092 A75-19778
- STEAM**
- Operational, maintenance, and environmental problems associated with a fossil fuel-fired potassium steam binary vapor cycle [ORNL-NSF-EP-30]
06 p0090 A75-18769
- STEAM FLOW**
- Analytical description of the modern steam automobile [NASA-TN-X-72199]
05 p0035 A75-14134
- Coal processing by electrofluids [PB-236588/0]
06 p0088 A75-18743
- Geothermal steam condensate reinjection
06 p0102 A75-20863
- STEAM TURBINES**
- A central receiver solar power plant in a hybrid mode of operation --- solar/fossil-fueled steam power plant [AIAA PAPER 75-624]
06 p0062 A75-28596
- Geothermal steam condensate reinjection
06 p0102 A75-20863
- STIRLING CYCLE**
- Prospects for using dynamic thermocompression converter in solar power plants
05 p0020 A75-17076
- Stirling engines - Capabilities and prospects
06 p0048 A75-23237
- The Stirling engine for vehicle propulsion
06 p0050 A75-23509
- STOCKPILING**
- Fuel and energy data: United States by states and regions, 1972 [PB-236581/5]
06 p0077 A75-17004
- STORAGE**
- Metal hydrides as hydrogen storage media [BNL-18887]
05 p0030 A75-12440
- STORAGE BATTERIES**
- Operating experiences with terrestrial solar battery systems in Japan
05 p0005 A75-10531
- 60 watt hydride-air fuel cell system
05 p0008 A75-10567
- Predicted energy densities for nickel-hydrogen and silver-hydrogen cells embodying metallic hydrides for hydrogen storage
05 p0008 A75-10572
- The impact of advanced batteries on electric power generation
05 p0013 A75-12991
- Recent advances in components of space power systems [IAF PAPER 74-083]
05 p0014 A75-13715
- Analysis of different systems concerning the energy distribution on board a satellite [IAF PAPER 74-084]
05 p0014 A75-13716
- Corrosion and related problems in high-temperature cells
06 p0055 A75-24377
- Fundamental research on the selection of new electrochemical generators of medium power
06 p0060 A75-27827
- Sulfur-based lithium-organic electrolyte secondary batteries [AD-A003309]
06 p0104 A75-20882
- STORAGE TANKS**
- Thermal energy storage devices suitable for solar heating
05 p0007 A75-10553

- A hot liquid energy storage system utilizing natural circulation
[ASME PAPER 74-WA/HT-16] 05 p0017 A75-16862
- Improving the oil storage system of western Siberia
[AD-A002717] 06 p0092 N75-19705
- STORM DAMAGE**
- OCS oil and gas: An environmental assessment, volume 3 --- effect of natural phenomena on OCS gas and oil development 06 p0083 N75-17836
- STREAM FUNCTIONS (FLUIDS)**
- Steady state free convection in an unconfined geothermal reservoir 05 p0009 A75-11069
- STRESS-STRAIN DIAGRAMS**
- Investigations and selection of components and materials for flexible solar generator 06 p0050 A75-24182
- STRUCTURAL ANALYSIS**
- Structural analysis of wind turbine rotors for NSF-NASA Mod-0 wind power system
[NASA-TN-X-3198] 06 p0080 N75-17712
- Coal structure and reactivity
[TID-26637] 06 p0097 N75-20805
- STRUCTURAL DESIGN**
- Solar cell modules for lightweight solar arrays --- onboard communication satellites 06 p0057 A75-26068
- Economic and energy conservation relationship relevant to state of New York building design and contract awards
[PB-237006/2] 06 p0082 N75-17824
- STRUCTURAL DESIGN CRITERIA**
- Design analysis of asymmetric solar receivers
[SAND-74-0124] 06 p0076 N75-16986
- SUBSONIC AIRCRAFT**
- The use of hydrogen in commercial aircraft - An assessment 05 p0006 A75-10542
- Advanced subsonic transports - A challenge for the 1990's
[AIAA PAPER 75-304] 06 p0049 A75-23251
- On the future of jet propulsion in subsonic transport aviation 06 p0058 A75-27777
- SUBSONIC FLOW**
- Possible development of acoustical instability in a system consisting of a combustion chamber and a subsonic MHD generator 06 p0045 A75-19959
- SULFUR COMPOUNDS**
- The hydrogen sulfide emissions abatement program at the Geysers Geothermal Power Plant 06 p0102 N75-20859
- SUN**
- Our prodigal sun --- solar energy technology
[NASA-EP-118] 05 p0032 N75-12885
- SUNSPOTS**
- The nature of the sunspot phenomenon. III - Energy consumption and energy transport. IV - The intrinsic instability of the magnetic configuration 06 p0064 A75-29137
- SUPERCONDUCTING MAGNETS**
- Will superconducting magnetic energy storage be used on electric utility systems 06 p0056 A75-25832
- Superconducting synchronous machine 06 p0061 A75-27967
- Superconducting magnetic energy storage --- theta pinch thermonuclear fusion test reactor
[LA-UR-74-737] 05 p0032 N75-12814
- Energy and cryoengineering
[LA-UR-74-741] 06 p0082 N75-17814
- SUPERCONDUCTIVITY**
- A superconducting microwave engine 06 p0056 A75-25831
- Wisconsin superconductive energy storage project, volume 1
[PB-238082/2] 06 p0105 N75-20887
- SUPERCONDUCTORS**
- The Electric Power Research Institute's role in applying superconductivity to future utility systems 06 p0056 A75-25827
- A high-speed superconducting generator 06 p0060 A75-27960
- Superconductive d.c. generator 06 p0061 A75-27961
- Main problems met in the study of cryogenic generators 06 p0061 A75-27962
- Economic and system aspects of a superconducting magnetic energy storage device and a dc superconducting transmission line
[LA-UR-74-1145] 06 p0091 N75-19080
- SUPERSONIC TRANSPORTS**
- Conceptual design of reduced energy transports
[AIAA PAPER 75-303] 06 p0047 A75-22508
- Study of active cooling for supersonic transports
[NASA-CR-132573] 06 p0079 N75-17336
- SURFACE COOLING**
- Effect of heat transfer from the lateral surfaces of semiconductor thermocouples on the energy characteristics of a thermoelectric generator 05 p0021 A75-18798
- SURFACE GEOMETRY**
- The COMSAT non-reflective silicon solar cell - A second generation improved cell 06 p0053 A75-24245
- The evaluation of surface geometry modification to improve the directional selectivity of solar energy collectors
[PB-236412/3] 06 p0083 N75-17830
- SURFACE NAVIGATION**
- The use of solar cells in the lighthouse service 06 p0054 A75-24255
- SURFACE PROPERTIES**
- Air-stable selective surfaces for solar energy collectors
[PB-236196/2] 06 p0071 N75-16116
- Fracture-induced permeability: Present situation and prospects for coal
[UCID-16593] 06 p0094 N75-19830
- SURFACE VEHICLES**
- Mode shift strategies in intercity transportation and their effect on energy consumption
[AIAA PAPER 75-315] 06 p0055 A75-25013
- SYMPHONIE SATELLITES**
- The technology of the solar generator on the Symphonie satellite 06 p0053 A75-24237
- SYNCHRONOUS MOTORS**
- Superconducting synchronous machine 06 p0061 A75-27967
- SYNCHRONOUS SATELLITES**
- The technology of the solar generator on the Symphonie satellite 06 p0053 A75-24237
- SYNTHANE**
- Conceptual design of a heat pipe methanator --- conversion of synthesis coal gas to methane
[LA-5596] 06 p0074 N75-16774
- SYNTHETIC FUELS**
- Char oil energy development
[PB-233263/3] 05 p0025 N75-10603
- Coal processing by electrofluids
[PB-236588/0] 06 p0088 N75-18743
- Synthetic Liquid Fuel Research and Development Act of 1974 --- energy conservation and cost analyses
[GPO-44-818] 06 p0103 N75-20867
- Synthetic fuels for ground transportation with special emphasis on hydrogen
[NASA-TN-X-72652] 06 p0103 N75-20868
- Synthetic fuels from fusion reactors
[BNL-19351] 06 p0106 N75-21098
- Synopsis of studies on synthetic fuels production by fusion reactors
[BNL-19336] 06 p0106 N75-21104
- SYSTEM EFFECTIVENESS**
- Electrostatic voltage generation from flowing water 05 p0009 A75-10580
- Derivation of a total satellite energy system --- solar power station for terrestrial consumption
[AIAA PAPER 75-640] 06 p0064 A75-29118
- SYSTEMS ANALYSIS**
- Energy systems - Modeling and policy analysis 06 p0055 A75-24750
- Solar power system and component research program
[PB-236159/0] 05 p0037 N75-14280
- SYSTEMS ENGINEERING**
- Cost effective designing for the economic RTG --- radioisotope thermoelectric generators 05 p0003 A75-10507
- Light-weight radioisotope thermoelectric generator design 05 p0003 A75-10508

A planning methodology for the analysis and design of wind-power systems 05 p0004 A75-10517

Small coal burning gas turbine for modular integrated utility systems 05 p0006 A75-10546

Independent energy systems for better efficiency 05 p0006 A75-10549

Conceptual design of a series of laser-fusion power plants of 100 to 3000 MW/e/ 05 p0007 A75-10562

Sizing of solar energy storage systems using local weather records [ASME PAPER 74-WA/HT-20] 05 p0017 A75-16865

Systems aspects of ocean thermal energy conversion [AIAA PAPER 75-615] 06 p0062 A75-28593

100 MWe solar power plant design configuration and performance [AIAA PAPER 75-623] 06 p0062 A75-28595

Advanced heat source concepts --- module design for space electric power generation [MLM-2134] 05 p0024 N75-10591

Caltech seminar series on energy consumption in private transportation [PB-235348/0] 05 p0040 N75-15179

State of the art and prospects for electric vehicles [BIL-OA-TRANS-1250-(6196.3)] 06 p0074 N75-16712

The multirail superflywheel [AD-A001081] 06 p0085 N75-18594

Large diameter 300 PSI gasifier. Preliminary engineering report. Volume 1: Description [PB-238360/2] 06 p0105 N75-20889

Problems of the future and potentialities of system engineering --- metallic materials, plastics, traffic and energy supplies [ESRO-TT-110] 06 p0107 N75-21218

SYSTEMS MANAGEMENT

Management of power plant waste heat in cold regions [AD-A003217] 06 p0104 N75-20881

T

TABLES (DATA)

Fuel and energy data: United States by states and regions, 1972 [PB-236581/5] 06 p0077 N75-17004

TANKER SHIPS

On the potentialities of polyphenylene oxide (PPO) as a wet-insulation material for cargo tanks of LNG-carriers [REPT-194-M] 05 p0035 N75-14002

TAR SANDS

Energy from US and Canadian tar sands: Technical, environmental, economic, legislative, and policy aspects [GPO-43-005] 06 p0067 N75-16083

TECHNOLOGICAL FORECASTING

Hydrogen for the electric utilities - Long range possibilities 05 p0005 A75-10536

Next generation transports will emphasize fuel savings 05 p0011 A75-11426

Fuel outlook dictating technical transport research 05 p0011 A75-11427

Fusion reactors as future energy sources 05 p0011 A75-11735

Solar energy conversion and storage systems for the future 05 p0013 A75-12988

The impact of advanced batteries on electric power generation 05 p0013 A75-12991

Current expectations for fusion power from toroidal machines 05 p0014 A75-12996

Windpower - Look backward, then move forward confidently --- for electric power generation in rural areas 05 p0014 A75-12997

U.S. energy resources - Outlook for the future 05 p0014 A75-12999

Prospects for tapping solar energy on a large scale 05 p0015 A75-14014

Power from ocean waves [ASME PAPER 74-WA/PWR-5] 05 p0018 A75-16879

The energy perspective --- world fossil fuel reserves and alternate energy sources 05 p0019 A75-17000

Future long-range transports - Prospects for improved fuel efficiency [AIAA PAPER 75-316] 06 p0047 A75-22514

Advanced subsonic transports - A challenge for the 1990's [AIAA PAPER 75-304] 06 p0049 A75-23251

The future of silicon solar cells for terrestrial use 06 p0058 A75-27717

On the future of jet propulsion in subsonic transport aviation 06 p0058 A75-27777

Energy supply and demand challenges and some possible solutions 06 p0059 A75-27779

The outlook for fusion energy sources - Remaining technological hurdles 06 p0059 A75-27782

New technology challenges in exploration, exploitation and environmental impact of geothermal systems 06 p0060 A75-27788

Prospects of photosynthetic energy production 06 p0060 A75-27792

Geothermal energy --- technology assessment 06 p0060 A75-27826

Fundamental research on the selection of new electrochemical generators of medium power 06 p0060 A75-27827

Solar energy in earth processes --- review 06 p0061 A75-28437

Nuclear power growth, 1974 - 2000 --- forecasting future reactor technology [WASH-1139-74] 05 p0031 N75-12723

Dependence of the United States on essential imported materials, year 2000; volume 1 [AD-A000842] 06 p0096 N75-20157

Dependence of the United States on essential imported materials, year 2000. Volume 2: Appendices [AD-A000843] 06 p0096 N75-20158

TECHNOLOGY ASSESSMENT

Combustion dynamics research for 'Project Independence' [AIAA PAPER 74-1069] 05 p0001 A75-10262

Intersociety Energy Conversion Engineering Conference, 9th, San Francisco, Calif., August 26-30, 1974, Proceedings 05 p0001 A75-10476

RTG technology development - Where we are/where we are going --- radioisotope thermoelectric generator 05 p0002 A75-10496

Economics analyses of solar energy utilization 05 p0004 A75-10520

Status of JPL solar powered experiments for terrestrial applications 05 p0005 A75-10530

A review of thermal battery technology 05 p0007 A75-10557

Advanced betavoltaic power sources 05 p0007 A75-10563

Energy crisis - Fact or fiction 05 p0011 A75-12115

Energy development; Proceedings of the Energy Sources Conference, Anaheim, Calif., July 14-19, 1974 05 p0012 A75-12986

Progress in coal gasification 05 p0013 A75-12993

Fusion power research - Where do we stand 05 p0013 A75-12995

Space power systems - Retrospect and prospect [IAF PAPER 74-082] 05 p0014 A75-13714

Recent advances in components of space power systems [IAF PAPER 74-083] 05 p0014 A75-13715

Advances in space power generation [IAF PAPER 74-086] 05 p0015 A75-13718

Rating aircraft on energy 05 p0015 A75-14346

Progress in development of auxiliary MHD power plant components at Avco Everett Research Laboratory, Inc [ASME PAPER 74-WA/ENER-6] 05 p0016 A75-16838

The energy perspective --- world fossil fuel reserves and alternate energy sources 05 p0019 A75-17000

Fusion power - Prospects and impact 05 p0021 A75-18080

- Air transportation energy consumption - Yesterday, today, and tomorrow
[AIAA PAPER 75-319] 06 p0047 A75-22515
- Some LNG vehicle developments --- for automotive conversion systems and fueling stations
06 p0048 A75-23236
- Stirling engines - Capabilities and prospects
06 p0048 A75-23237
- Report on photovoltaics research and technology in the United States
06 p0051 A75-24214
- Historic development of photovoltaic power generation
06 p0051 A75-24215
- Latest developments of the circular solar array --- with deployment structure for central antenna communication satellite
06 p0053 A75-24246
- Review of central power magnetohydrodynamics [AIAA PAPER 75-264] 06 p0055 A75-25005
- Lighter than air - A look at the past, a look at the possibilities
06 p0056 A75-25995
- Status of the NASA-Lewis flat-plate collector tests with a solar simulator
06 p0058 A75-27533
- Solar cells - Present state and perspectives on terrestrial applications
06 p0058 A75-27716
- Thermoelectric generators --- using semiconductor thermocouples
06 p0058 A75-27718
- Coal gasification - A review of status and technology
06 p0059 A75-27781
- Solar heating and cooling of buildings
06 p0059 A75-27783
- MEGASTAR: The Meaning of Energy Growth: An Assessment of Systems, Technologies, and Requirements
[NASA-CR-120355] 05 p0023 N75-10584
- How spacecraft are fueled --- technology of fueling spacecraft for flight
[JPRS-63514] 05 p0027 N75-10983
- Utilization of solar energy --- an assessment of present technology
[NASA-TT-P-16090] 05 p0033 N75-13382
- A review of the status of MHD power generation technology including suggestions for a Canadian MHD research program
[UTIAS-39] 05 p0035 N75-13641
- Solar energy
[NASA-TT-P-16092] 05 p0038 N75-15149
- Assessment of the technology required to develop photovoltaic power system for large scale national energy applications
[NSF/RA/N-74-072] 06 p0080 N75-17785
- Energy systems analysis and technology assessment program
[BNL-18984] 06 p0094 N75-19831
- Energy utilization by households and technology assessment as a way to increase its effectiveness --- management methods and family decision making
06 p0097 N75-20829
- TECHNOLOGY TRANSFER**
- Nuclear propulsion technology transfer to energy systems
[AIAA PAPER 74-1072] 05 p0001 A75-10264
- The application of aerospace technology in the cryogenics field
06 p0048 A75-23239
- Solar cells - Present state and perspectives on terrestrial applications
06 p0058 A75-27716
- Technology and community development materials processing, and electrical and nuclear technology --- technical research center of Finland
05 p0031 N75-12695
- Lead accumulator batteries in telecommunications
[BLL-TRANS-2943-(9022.81)] 06 p0074 N75-16967
- Proceedings of the first 1974 Technology Transfer Conference
[NASA-CR-142119] 06 p0078 N75-17188
- Technology application at Rockwell International
06 p0078 N75-17189
- The Environmental protection agency industrial technology transfer program
06 p0078 N75-17193
- Transfer of space technology to industry
06 p0078 N75-17195
- Applications of aerospace technology in the electric power industry
06 p0079 N75-17197
- The initiatives of the Los Alamos Scientific Laboratory in the transfer of a new excavation technology
06 p0079 N75-17203
- Economic modeling and energy policy planning --- technology transfer, market research
06 p0079 N75-17210
- TECHNOLOGY UTILIZATION**
- Two-watt radioisotope power generators for underwater applications
05 p0007 A75-10556
- Applications of plasma core reactors to terrestrial energy systems
[AIAA PAPER 74-1074] 05 p0010 A75-11281
- Mission applications of electric propulsion
[AIAA PAPER 74-1085] 05 p0010 A75-11284
- Solar energy: Technology and applications --- Book
05 p0012 A75-12425
- Prospects and scientific problems of the utilization of methods of direct electric power generation from chemical fuels /fuel cells/
05 p0012 A75-12911
- Utilization of solar energy today
05 p0012 A75-12987
- The heat pipe - Its development, and its aerospace applications
05 p0015 A75-15054
- New applications for optical components - High energy focusing
05 p0015 A75-16525
- Coal gasification by Atomics International's Rockgas process
[ASME PAPER 74-WA/PWR-11] 05 p0018 A75-16883
- A case study - Utilization of solar energy in residential dwellings
[ASME PAPER 74-WA/SOL-2] 05 p0018 A75-16885
- Energy. Volume 1 - Demands, resources, impact, technology, and policy --- Book
06 p0045 A75-20066
- Progress in heat pipe and porous heat exchanger technology
06 p0045 A75-20686
- Liquid hydrogen --- liquefaction, storage, transportation, applications
06 p0046 A75-22043
- Technology utilization - Incentives and solar energy
06 p0048 A75-22913
- Solar generators for terrestrial applications
06 p0054 A75-24257
- Current worldwide utilization and ultimate potential of geothermal energy systems
06 p0060 A75-27787
- The adaptation of free space power transmission technology to the SSPS concept --- Satellite Solar Power Stations
[AIAA PAPER 75-642] 06 p0063 A75-28602
- Advanced nuclear research
[GPO-41-253] 05 p0026 N75-10764
- Application of technology from the Rover program and related developments --- to energy needs
[LA-5558] 05 p0028 N75-11468
- Applications of fusion power technology to the chemical industry
[BNL-18815] 05 p0029 N75-11730
- A survey of LNG technological needs in the USA: 1974 to beyond 2000
05 p0030 N75-12435
- Survey of applications of fusion power technology to the chemical and material processing industry
[BNL-18866] 05 p0031 N75-12443
- Japanese/United States Symposium on Solar Energy systems. Volume 1: Summary of proceedings
[MTR-6284-VOL-1] 05 p0036 N75-14264
- Beneficial uses of waste heat
[RT/PROT-(74)10] 06 p0068 N75-16091
- Energy conversion from coal utilizing CPU-400 technology
[PB-235817/4] 06 p0068 N75-16093
- Air conditioning of office buildings with all-electric supply. Part 1: Technical conception
[OA-TRANS-938-PT-1] 06 p0074 N75-16970
- Review of thermal battery technology
[SLA-74-5381] 06 p0076 N75-16989

- Proceedings of the first 1974 Technology Transfer Conference
[NASA-CR-142119] 06 p0078 N75-17188
- Energy recovery from solid waste --- production engineering model 06 p0079 N75-17200
- The initiatives of the Los Alamos Scientific Laboratory in the transfer of a new excavation technology 06 p0079 N75-17203
- Combining total energy and energy industrial center concepts to increase utilization efficiency of geothermal energy 06 p0102 N75-20860
- Cooperative efforts by industry and government to develop geothermal resources 06 p0102 N75-20861
- TELECOMMUNICATION**
- Lead accumulator batteries in telecommunications [BLL-TRANS-2943-(9022.81)] 06 p0074 N75-16967
- TEMPERATURE CONTROL**
- A design parameter for assessing wicking capabilities of heat pipes [AIAA PAPER 74-1266] 05 p0010 A75-11107
- The heat pipe - Its development, and its aerospace applications 05 p0015 A75-15054
- An analysis of photovoltaic power generation and thermal control interfaces --- for solar arrays 06 p0053 A75-24243
- Study of active cooling for supersonic transports [NASA-CR-132573] 06 p0079 N75-17336
- Solar electric propulsion system thermal analysis [NASA-CR-120622] 06 p0085 N75-18319
- TEMPERATURE DISTRIBUTION**
- Determination of the temperature field in a tubular thermoelectric module 05 p0020 A75-17068
- Sizing of focused solar collector fields with specified collector tube inlet temperature --- Rankine cycle [SLA-74-5288] 06 p0094 N75-19832
- TEMPERATURE GRADIENTS**
- Hot side heat exchanger for an ocean thermal difference power plant 05 p0004 A75-10527
- A heat pump powered by natural thermal gradients 05 p0006 A75-10550
- Axial temperature differential analysis of linear focused collectors for solar power [SLA-74-5078] 05 p0036 N75-14268
- TEMPERATURE MEASURING INSTRUMENTS**
- Methodical approach to temperature and pressure measurements for in situ energy-recovery processes [UCID-16631] 06 p0097 N75-20693
- TEMPERATURE PROFILES**
- Thermal performance characteristics of heat pipes 06 p0046 A75-21465
- TEMPERATURE SENSORS**
- Temperature sensor for photoelectric energy converters 06 p0057 A75-26712
- TEST FACILITIES**
- Recent MHD generator testing at Avco Everett Research Laboratory, Inc [ASME PAPER 74-WA/ENER-7] 05 p0016 A75-16839
- THERMAL ABSORPTION**
- Solar thermal absorption heat pump breakeven coefficient of performance [ASME PAPER 74-WA/ENER-2] 05 p0015 A75-16834
- THERMAL BATTERIES**
- A review of thermal battery technology 05 p0007 A75-10557
- Development and performance of a miniature, high-voltage thermal battery 05 p0007 A75-10559
- Development of a thermal battery for emergency radio power under arctic conditions 05 p0007 A75-10560
- Corrosion and related problems in high-temperature cells 06 p0055 A75-24377
- Development and performance of a miniature, high-voltage thermal battery [SLA-74-5363] 06 p0076 N75-16988
- Review of thermal battery technology [SLA-74-5381] 06 p0076 N75-16989
- Pellet type thermal battery [SAND-74-0007] 06 p0076 N75-16991
- Sixty minute thermal battery: A feasibility study [SLA-73-5888] 06 p0077 N75-16994
- THERMAL DEGRADATION**
- Pyrolysis system evaluation study [NASA-CR-141664] 06 p0086 N75-18722
- THERMAL DISSOCIATION**
- Thermolysis of water for the generation of hydrogen 06 p0049 A75-23504
- THERMAL ENERGY**
- Solar farms utilizing low-pressure closed-cycle gas turbines 05 p0003 A75-10514
- Metal hydrides for thermal energy storage 05 p0004 A75-10522
- Thermal energy storage devices suitable for solar heating 05 p0007 A75-10553
- The Harwell thermo-mechanical generator 05 p0009 A75-10579
- Performance of the thermal trap solar collector [ASME PAPER 74-WA/SOL-5] 05 p0019 A75-16888
- Theory of heat extraction from fractured hot dry rock 06 p0057 A75-26544
- Roles for solar thermal conversion systems in our energy economy 06 p0059 A75-27784
- Current worldwide utilization and ultimate potential of geothermal energy systems 06 p0060 A75-27787
- New technology challenges in exploration, exploitation and environmental impact of geothermal systems 06 p0060 A75-27788
- Ocean thermal power and windpower systems - Natural solar energy conversion for near-term impact on world energy markets 06 p0060 A75-27790
- Thermal power plants --- German book 06 p0064 A75-28962
- Ocean thermal energy conversion system evaluation [AIAA PAPER 75-616] 06 p0064 A75-29115
- Tropical ocean thermal power plants and potential products [AIAA PAPER 75-617] 06 p0064 A75-29116
- Solar thermal conversion mission analysis [AIAA PAPER 75-619] 06 p0064 A75-29117
- Research applied to solar-thermal power systems: Chemical vapor deposition research for fabrication of solar energy converters [PB-234565/0] 05 p0041 N75-15186
- Geothermal energy: A new application of rock mechanics [LA-UR-74-821] 06 p0068 N75-16089
- Evaluation of thermal methods for recovery of viscous oils in Missouri and Kansas [PB-237831/3] 06 p0090 N75-18762
- THERMAL FATIGUE**
- Investigations and selection of components and materials for flexible solar generator 06 p0050 A75-24182
- THERMAL INSULATION**
- Heat mirrors for solar-energy collection and radiation insulation 05 p0004 A75-10525
- On the potentialities of polyphenylene oxide (PPO) as a wet-insulation material for cargo tanks of LNG-carriers [REPT-194-M] 05 p0035 N75-14002
- THERMAL POLLUTION**
- Environmental impact of a geothermal power plant 06 p0049 A75-23291
- Beneficial uses of waste heat [RT/PROT-(74)10] 06 p0068 N75-16091
- THERMAL RADIATION**
- An analytical and experimental investigation of a laboratory solar pond model [ASME PAPER 74-WA/SOL-3] 05 p0019 A75-16886
- THERMAL REACTORS**
- Thermal power plants --- German book 06 p0064 A75-28962
- THERMAL RESISTANCE**
- Controlled heat pipes 05 p0012 A75-12912
- Determination of the temperature field in a tubular thermoelectric module 05 p0020 A75-17068

THERMIONIC CONVERTERS

Empirical method of designing the current-voltage characteristics for the discharge mode of a thermionic converter

06 p0057 A75-26332

Design study of the energy characteristics of thermionic electric power generating components and assemblies

06 p0064 A75-28893

Reflector-absorber systems for solar thermionic converters
[ESRO-TT-123]

06 p0104 N75-20878

THERMIONIC POWER GENERATION

Design study of the energy characteristics of thermionic electric power generating components and assemblies

06 p0064 A75-28893

THERMISTORS

Temperature sensor for photoelectric energy converters

06 p0057 A75-26712

THERMOCHEMICAL PROPERTIES

The generation of hydrogen by the thermal decomposition of water

05 p0005 A75-10532

THERMOCHEMISTRY

Nuclear energy requirements for hydrogen production from water

05 p0005 A75-10533

Efficiencies of electrolytic and thermochemical hydrogen production

06 p0045 A75-20300

Energy, hydrogen, and pollution --- energy technology

06 p0046 A75-22041

THERMOCOUPLES

Effect of heat transfer from the lateral surfaces of semiconductor thermocouples on the energy characteristics of a thermoelectric generator

05 p0021 A75-18798

THERMODYNAMIC CYCLES

Small coal burning gas turbine for modular integrated utility systems

05 p0006 A75-10546

Solar operation of ammonia-water multistage air conditioning cycles in the tropics

06 p0048 A75-23021

On the future of jet propulsion in subsonic transport aviation

06 p0058 A75-27777

Part load specific fuel consumption of gas turbines

06 p0063 A75-28650

Thermal power plants --- German book

06 p0064 A75-28962

THERMODYNAMIC EFFICIENCY

Prospects for using dynamic thermocompression converter in solar power plants

05 p0020 A75-17076

Thermodynamic considerations of 'solid state engines' based on thermoelastic martensitic transformations and the shape memory effect

06 p0045 A75-19631

Efficiencies of electrolytic and thermochemical hydrogen production

06 p0045 A75-20300

Thermodynamic analysis of a solar energy system with a closed-cycle gas-turbine converter

06 p0049 A75-23402

Thermodynamics of multistage air-cooled gas turbine

06 p0050 A75-23817

A generalization of the Carnot theorem - The theorem of useful power

06 p0057 A75-26448

Part load specific fuel consumption of gas turbines

06 p0063 A75-28650

THERMODYNAMIC PROPERTIES

A heat pump powered by natural thermal gradients

05 p0006 A75-10550

Application of thermodynamic and material- and energy-balance calculations to gasification processes

06 p0055 A75-24785

Heat Pipe Symposium/Workshop
[PB-236008/9]

05 p0035 N75-14094

Analytical description of the modern steam automobile
[NASA-TM-X-72199]

05 p0035 N75-14134

THERMOELASTICITY

Thermodynamic considerations of 'solid state engines' based on thermoelastic martensitic transformations and the shape memory effect

06 p0045 A75-19631

THERMOELECTRIC COOLING

Convergence and speed of calculations for thermoelectric heat pump

05 p0020 A75-17084

THERMOELECTRIC GENERATORS

RTG technology development - Where we are/where we are going --- radioisotope thermoelectric generator

05 p0002 A75-10496

A modular heat source for curium-244 and plutonium-238

05 p0002 A75-10497

Performance testing of thermoelectric generators at JPL

05 p0002 A75-10503

SNAP 19 Viking RTG flight configuration and integration testing --- Radioisotope Thermoelectric Generator

05 p0003 A75-10504

Operational testing of the high performance thermoelectric generator /HPG-02/

05 p0003 A75-10505

A 10% efficient economic RTG design --- radioisotope thermoelectric generator

05 p0003 A75-10506

Cost effective designing for the economic RTG --- radioisotope thermoelectric generators

05 p0003 A75-10507

Light-weight radioisotope thermoelectric generator design

05 p0003 A75-10508

Two-watt radioisotope power generators for underwater applications

05 p0007 A75-10556

The Harwell thermo-mechanical generator

05 p0009 A75-10579

High efficiency thermoelectric generator

05 p0014 A75-13067

Utilization of tubular thermoelectric modules in solar generators

05 p0020 A75-17067

Determination of the temperature field in a tubular thermoelectric module

05 p0020 A75-17068

Effect of heat transfer from the lateral surfaces of semiconductor thermocouples on the energy characteristics of a thermoelectric generator

05 p0021 A75-18798

RTG electrical power for spacecraft --- Radioisotope Thermoelectric Generators

06 p0057 A75-26067

Thermoelectric generators --- using semiconductor thermocouples

06 p0058 A75-27718

Devices based on thermoelectrical phenomena
[AD-783821]

05 p0026 N75-10836

Economic radioisotope thermoelectric generator program: Program plan

05 p0034 N75-13393

Economic radioisotope thermoelectric generator study program

05 p0036 N75-14269

Economic radioisotope thermoelectric generator study program: Appendices.

05 p0036 N75-14270

Multi-hundred watt radioisotope thermoelectric generator program, part 1 --- ground support equipment and safety management

06 p0092 N75-19354

Multi-hundred watt radioisotope thermoelectric generator program, part 2 --- ground support equipment

06 p0092 N75-19355

Heat transfer design and proof tests of a radioisotope thermoelectric generator

06 p0092 N75-19608

Manportable thermoelectric generator
[AD-A002042]

06 p0095 N75-19847

THERMOELECTRIC POWER GENERATION

Solar farms utilizing low-pressure closed-cycle gas turbines

05 p0003 A75-10514

Evaluation of central solar tower power plant

05 p0003 A75-10515

- The hot deeps of the Red Sea as a potential heat source for thermoelectric power generation
05 p0004 A75-10516
- Thin film coatings in solar-thermal power systems
06 p0056 A75-25679
- Devices based on thermoelectrical phenomena
05 p0026 N75-10836
- Thermodynamic analysis and parameter optimization of a solar thermoelectric power unit with radiation heat dissipation
06 p0082 N75-17819
- THERMOELECTRICITY**
- Solar collector thermal power system. Volume 1: Preliminary technology systems study
[AD-A000940] 06 p0091 N75-19339
- Solar collector thermal power system. Volume 2: Development, fabrication, and testing of fifteen foot heat pipes
[AD-A000941] 06 p0091 N75-19340
- Solar collector thermal power system. Volume 3: Basic study and experimental evaluation of thermal train components
[AD-A000942] 06 p0091 N75-19341
- THERMOHYDRAULICS**
- Gulf stream based ocean thermal power plants
[AIAA PAPER 75-643] 06 p0063 A75-28603
- THERMOLUMINESCENCE**
- Novel materials for power systems. Part 3: Selective emitters for energy conversion
[AD-784449] 05 p0026 N75-10608
- THERMONUCLEAR POWER GENERATION**
- Conceptual design of a series of laser-fusion power plants of 100 to 3000 Mw/e/
05 p0007 A75-10562
- Fusion reactors as future energy sources
05 p0011 A75-11735
- Fusion power research - Where do we stand
05 p0013 A75-12995
- Current expectations for fusion power from toroidal machines
05 p0014 A75-12996
- Fusion power - Prospects and impact
05 p0021 A75-18080
- An electron beam initiated fusion neutron generator
06 p0045 A75-19657
- Numerical simulation of direct energy conversion --- from fusion reactions
06 p0045 A75-19660
- Foreseeable thermal, mechanical, and materials engineering problems of fusion reactor power plants
[SMRT PAPER A2/1] 06 p0046 A75-21713
- DCTR power supply and energy storage review meeting
[WASH-1310] 05 p0031 N75-12445
- Superconducting magnetic energy storage --- theta pinch thermonuclear fusion test reactor
[LA-UR-74-737] 05 p0032 N75-12814
- Status and objective of Tokamak systems for fusion research
[WASH-1295] 05 p0035 N75-13644
- New approaches to CTR: General relativistic power plants
[UCRL-75443] 06 p0073 N75-16362
- Steps into the future. Development of the power industry in the USSR
[BLL-M-23330-(5828.4F)] 06 p0085 N75-18714
- Man-made sun. Thermonuclear engineering developments
[BLL-M-23333-(5828.4F)] 06 p0091 N75-19014
- THETA PINCH**
- Superconducting magnetic energy storage --- theta pinch thermonuclear fusion test reactor
[LA-UR-74-737] 05 p0032 N75-12814
- THIN FILMS**
- Heat mirrors for solar-energy collection and radiation insulation
05 p0004 A75-10525
- Development of very low cost solar cells for terrestrial power generation
06 p0052 A75-24226
- Use of flexible reflective surfaces for solar energy concentration
06 p0056 A75-25678
- Thin film coatings in solar-thermal power systems
06 p0056 A75-25679
- Research on cadmium stannate selective optical films for solar energy applications
[PB-236208/5] 06 p0071 N75-16117
- Development of low cost thin film polycrystalline silicon solar cells for terrestrial applications
[PB-238505/2] 06 p0105 N75-20890
- THRUST CONTROL**
- Powerplant energy management --- transport aircraft engine thrust control
[AIAA PAPER 74-1066] 05 p0001 A75-10259
- THRUST VECTOR CONTROL**
- Effect of attitude constraints on solar-electric geocentric transfers
[AIAA PAPER 75-350] 06 p0055 A75-24957
- TIDE POWERED GENERATORS**
- Tidal power and its integration into the electric system
05 p0013 A75-12994
- TIDEPower**
- Tidal power and its integration into the electric system
05 p0013 A75-12994
- Optimising pumped storage with tidal power in an estuary
[ASME PAPER 74-WA/PWR-7] 05 p0018 A75-16881
- Other primary energy resources --- geothermal, tidal, wind, waterwave and glacier energy utilization
06 p0050 A75-23512
- TIME OPTIMAL CONTROL**
- Effect of attitude constraints on solar-electric geocentric transfers
[AIAA PAPER 75-350] 06 p0055 A75-24957
- TIRES**
- An evaluation of discarded tires as a potential source of fuel
05 p0012 A75-12416
- An evaluation: The potential of discarded tires as a source of fuel
[NASA-TM-X-58143] 05 p0038 N75-15153
- TITANIUM COMPOUNDS**
- Iron titanium hydride as a source of hydrogen fuel for stationary and automotive applications
[BNL-18651] 05 p0030 N75-12441
- TITANIUM OXIDES**
- Transparent heat-mirror films of TiO₂/Ag/TiO₂ for solar energy collection and radiation insulation
05 p0015 A75-16378
- TOKAMAK FUSION REACTORS**
- Fusion power research - Where do we stand
05 p0013 A75-12995
- Foreseeable thermal, mechanical, and materials engineering problems of fusion reactor power plants
[SMRT PAPER A2/1] 06 p0046 A75-21713
- Man-made sun. Thermonuclear engineering developments
[BLL-M-23333-(5828.4F)] 06 p0091 N75-19014
- Synthetic fuels from fusion reactors
[BNL-19351] 06 p0106 N75-21098
- TOROIDAL PLASMAS**
- Current expectations for fusion power from toroidal machines
05 p0014 A75-12996
- Foreseeable thermal, mechanical, and materials engineering problems of fusion reactor power plants
[SMRT PAPER A2/1] 06 p0046 A75-21713
- TOXICOLOGY**
- Environmental aspects of cadmium sulfide usage in solar energy conversion. Part 1: Toxicological and environmental health considerations, a bibliography
[PB-238285/1] 06 p0105 N75-20884
- TRAFFIC**
- Problems of the future and potentialities of system engineering --- metallic materials, plastics, traffic and energy supplies
[ESRO-TT-110] 06 p0107 N75-21218
- TRAJECTORY OPTIMIZATION**
- Effect of attitude constraints on solar-electric geocentric transfers
[AIAA PAPER 75-350] 06 p0055 A75-24957
- TRANSIENT HEATING**
- Dynamic response of solar heat storage systems
[ASME PAPER 74-WA/HT-22] 05 p0018 A75-16867
- TRANSMISSION LINES**
- The Electric Power Research Institute's role in applying superconductivity to future utility systems
06 p0056 A75-25827

- Economic and system aspects of a superconducting magnetic energy storage device and a dc superconducting transmission line
[LA-UR-74-1145] 06 p0091 N75-19080
- TRANSONIC WIND TUNNELS**
A generalised analysis of the performance of a variety of drive systems for high Reynolds number, transonic wind tunnels
[RAE-TR-73134] 06 p0073 N75-16572
- TRANSPORT AIRCRAFT**
Powerplant energy management --- transport aircraft engine thrust control
[AIAA PAPER 74-1066] 05 p0001 A75-10259
Next generation transports will emphasize fuel savings
05 p0011 A75-11426
Fuel outlook dictating technical transport research
05 p0011 A75-11427
Rating aircraft on energy
05 p0015 A75-14346
Conceptual design of reduced energy transports
[AIAA PAPER 75-303] 06 p0047 A75-22508
Future long-range transports - Prospects for improved fuel efficiency
[AIAA PAPER 75-316] 06 p0047 A75-22514
Advanced subsonic transports - A challenge for the 1990's
[AIAA PAPER 75-304] 06 p0049 A75-23251
Future long-range transports: Prospects for improved fuel efficiency
[NASA-TM-X-72659] 06 p0079 N75-17339
Fuel conservation possibilities for terminal area compatible aircraft
[NASA-CR-132608] 06 p0091 N75-19224
- TRANSPORT VEHICLES**
A comparative analysis of the energy consumption for several urban passenger ground transportation systems
[PB-238041/8] 06 p0107 N75-21160
- TRANSPORTATION**
Guidelines to reduce energy consumption through transportation actions
[PB-235983/4] 06 p0068 N75-16094
Transportation and the new energy policies: Truck sizes and weights, part 2
[GPO-29-802] 06 p0073 N75-16410
- TRANSPORTATION ENERGY**
Fuel energy systems - Conversion and transport efficiencies
05 p0007 A75-10554
- TRAPS**
Solar energy trap
[NASA-CASE-MPS-22744-1] 05 p0024 N75-10586
- TREES (PLANTS)**
Energy plantations: Should we grow trees for power plant fuel?
[VP-X-129] 05 p0030 N75-12436
- TROPICAL REGIONS**
Solar operation of ammonia-water multistage air conditioning cycles in the tropics
06 p0048 A75-23021
Tropical ocean thermal power plants and potential products
[AIAA PAPER 75-617] 06 p0064 A75-29116
- TRUCKS**
Independent truckers and the energy crisis
[GPO-31-412] 05 p0023 N75-10581
Transportation and the new energy policies: Truck sizes and weights, part 2
[GPO-29-802] 06 p0073 N75-16410
- TUBE HEAT EXCHANGERS**
The analysis of the performance of a pancake absorber-heat exchanger for a solar concentrator
[ASME PAPER 74-WA/SOL-1] 05 p0018 A75-16884
Utilization of tubular thermoelectric modules in solar generators
05 p0020 A75-17067
Design of a tubular heat collector for a solar power installation with a parabolocylindric concentrator
05 p0020 A75-17069
- TUNING**
Interferometric tuning of a 15-atm CO₂ laser
06 p0058 A75-27518
- TUNNELING (EXCAVATION)**
Legal economic, and energy considerations in the use of underground space
[PB-236755/5] 06 p0080 N75-17749
- TURBINE BLADES**
Aluminum nitride and silicon nitride for high-temperature vehicular gas turbine engines
05 p0011 A75-11362
- TURBINE ENGINES**
Thermal power plants --- German book
06 p0064 A75-28962
- TURBINE PUMPS**
Energy storage underground --- hydroelectric pumped-storage and combustion turbine facilities
05 p0013 A75-12989
Pumped air storage for electric power generation
05 p0013 A75-12990
- TURBOFAN ENGINES**
Gas turbine engines - A state-of-the-art review
05 p0009 A75-10840
On the future of jet propulsion in subsonic transport aviation
06 p0058 A75-27777
Study of the costs and benefits of composite materials in advanced turbofan engines
[NASA-CR-134696] 06 p0073 N75-16637
Preliminary study of advanced turbofans for low energy consumption
[NASA-TM-X-71663] 06 p0084 N75-18241
- TURBOGENERATORS**
Concepts for central solar electric power generation
05 p0021 A75-17504
Geothermal power station --- using heat pipes
[AD-785948] 05 p0037 N75-14275
- TURBOPROP ENGINES**
Gas turbine engines - A state-of-the-art review
05 p0009 A75-10840
- TURBOSHAPTS**
Gas turbine engines - A state-of-the-art review
05 p0009 A75-10840

U

- U.S.S.R.**
Energy from the earth's depths
[BLL-M-23516-(5828.4F)] 06 p0074 N75-16968
Exploration of Antarctica: Past and present
[BLL-M-23343-(5828.4F)] 06 p0080 N75-17722
Steps into the future. Development of the power industry in the USSR
[BLL-M-23330-(5828.4F)] 06 p0085 N75-18714
- UNDERGROUND STORAGE**
Energy storage underground --- hydroelectric pumped-storage and combustion turbine facilities
05 p0013 A75-12989
Legal economic, and energy considerations in the use of underground space
[PB-236755/5] 06 p0080 N75-17749
- UNDERWATER ENGINEERING**
Two-watt radioisotope power generators for underwater applications
05 p0007 A75-10556
- UNDERWATER STRUCTURES**
Prospects for utilization of underwater houses and chambers in development of marine oil deposits
05 p0029 N75-11606
- UNIQUENESS THEOREM**
Convergence and speed of calculations for thermoelectric heat pump
05 p0020 A75-17084
- UNITED STATES OF AMERICA**
MEGASTAR: The Meaning of Energy Growth: An Assessment of Systems, Technologies, and Requirements
[NASA-CR-120355] 05 p0023 N75-10584
Energy and security: Implications for American policy
[AD-785084] 05 p0032 N75-12857
Energy required to develop power in the United States
05 p0032 N75-13378
Japanese/United States Symposium on Solar Energy systems. Volume 1: Summary of proceedings
[MTR-6284-VOL-1] 05 p0036 N75-14264
Conservation and efficient use of energy
[H-REPT-93-1634] 05 p0036 N75-14265
Fuel and energy data: United States by states and regions, 1972
[PB-236581/5] 06 p0077 N75-17004
The reserve base of bituminous coal and anthracite for underground mining in the Eastern United States
[PB-237815/6] 06 p0085 N75-18713

The USA: The scientific and technical revolution and trends in foreign policy
[NASA-TT-F-16102] 06 p0096 N75-20160

URANIUM PLASMAS
Applications of plasma core reactors to terrestrial energy systems
[AIAA PAPER 74-1074] 05 p0010 A75-11281
Physics and potentials of fissioning plasmas for space power and propulsion
[IAF PAPER 74-087] 05 p0015 A75-13719

URBAN DEVELOPMENT
Energy from urban wastes 05 p0006 A75-10548

URBAN PLANNING
The Solar Community - Energy for residential heating, cooling, and electrical power
06 p0059 A75-27785

URBAN TRANSPORTATION
Energy efficiency of current intercity passenger transportation modes
[AIAA PAPER 75-314] 06 p0047 A75-22513
Mode shift strategies in intercity transportation and their effect on energy consumption
[AIAA PAPER 75-315] 06 p0055 A75-25013
A comparative analysis of the energy consumption for several urban passenger ground transportation systems
[PB-238041/8] 06 p0107 N75-21160

USER REQUIREMENTS
Solar electric and thermal conversion system in close proximity to the consumer --- solar panels on house roofs
[AIAA PAPER 75-628] 06 p0062 A75-28597

UTAH
Average oil yield tables for oil shale sequences in cores from the Uinta Basin, Utah, that average 15, 20, 25, 30, 35, and 40 gallons per ton
[PB-236068/3] 06 p0072 N75-16124

UTILITIES
Small coal burning gas turbine for modular integrated utility systems 05 p0006 A75-10546
The Energy Systems Optimization Computer Program /ESOP/ developed for Modular Integrated Utility Systems /MIUS/ analysis 05 p0006 A75-10551
The FCG-1 fuel cell powerplant for electric utility use 05 p0013 A75-12992
The Hydrogen Economy - A utility perspective --- energy technology 05 p0014 A75-12998
Hydrogen storage and production in utility systems [BNL-18920] 06 p0097 N75-20580
Utility company views of geothermal development 06 p0102 N75-20864

UTILIZATION
Effective utilization of solar energy to produce clean fuel
[PB-233956/2] 05 p0026 N75-10605

V

VACUUM DEPOSITION
Thin film coatings in solar-thermal power systems 06 p0056 A75-25679

VAPOR DEPOSITION
Chemical vapor deposition research for fabrication of solar energy converters
[PB-235481/9] 05 p0041 N75-15185
Research applied to solar-thermal power systems: chemical vapor deposition research for fabrication of solar energy converters
[PB-234565/0] 05 p0041 N75-15186
Chemical vapor deposition research for fabrication of solar energy converters
[PB-236189/7] 06 p0072 N75-16119

VAPOR PHASES
Workshop in Gas-Phase Molecular Interactions and the Nation's Energy Problem
[PB-236712/6] 06 p0086 N75-18718

VAPORIZING
Operational, maintenance, and environmental problems associated with a fossil fuel-fired potassium steam binary vapor cycle
[ORNL-NSP-EP-30] 06 p0090 N75-18769

VEGETATION
Effective utilization of solar energy to produce clean fuel
[PB-233956/2] 05 p0026 N75-10605

VEHICULAR TRACKS
A wind energy conversion system based on the tracked-vehicle airfoil concept 05 p0004 A75-10518

VIKING MARS PROGRAM
SNAP 19 Viking RTG flight configuration and integration testing --- Radioisotope Thermoelectric Generator 05 p0003 A75-10504

VOLT-AMPERE CHARACTERISTICS
Methanol/air acidic fuel cell system 05 p0008 A75-10566
Report on progress in achieving direct conversion of a major fraction of sonic flow kinetic power into electrical power by electrofluid dynamic /EFD/ processes 05 p0009 A75-10576
Further progress in the technology of silk screened CdS solar cells 06 p0052 A75-24225
Empirical method of designing the current-voltage characteristics for the discharge mode of a thermionic converter 06 p0057 A75-26332

VOLTAGE CONVERTERS (DC TO DC)
Milliwatt fuel cell system for sensors 05 p0008 A75-10565

VOLTAGE GENERATORS
Electrostatic voltage generation from flowing water 05 p0009 A75-10580

W

WALL TEMPERATURE
Thermal performance characteristics of heat pipes 06 p0046 A75-21465

WASTE DISPOSAL
Soil burial of radioisotopic fuel capsules 06 p0046 A75-21274
Biological conversion of organic refuse to methane
[PB-235468/6] 05 p0041 N75-15183
Bureau of Mines research programs on recycling and disposal of mineral, metal, and energy-based wastes
[PB-227476/9] 05 p0042 N75-15203
Pollutional problems and research needs for an oil shale industry
[PB-236608/6] 06 p0084 N75-17848
Nuclear system that burns its own wastes shows promise
[NASA-NEWS-RELEASE-75-44] 06 p0085 N75-18716
Fuel gas production from solid waste
[PB-238068/1] 06 p0095 N75-19843
Energy recovery from solid waste. Volume 1: Summary report
[NASA-CR-2525] 06 p0098 N75-20830

WASTE ENERGY UTILIZATION
Economics of a hydrogen storage peaking power plant
[ASME PAPER 74-WA/PWR-6] 05 p0018 A75-16880
Urban waste energy resources
[AIAA PAPER 75-632] 06 p0062 A75-28598
Bioconversion --- of solar energy and solid waste energy into useable fuels
[GPO-37-403] 05 p0028 N75-11463
Air conditioning of office buildings with all-electric supply. Part 1: Technical conception
[OA-TRANS-938-PT-1] 06 p0074 N75-16970
Energy recovery from solid waste --- production engineering model 06 p0079 N75-17200
Energy recovery from solid waste. Volume 1: Summary report
[NASA-CR-2525] 06 p0098 N75-20830
Management of power plant waste heat in cold regions
[AD-A003217] 06 p0104 N75-20881

WASTE UTILIZATION
Potential of Rankine engines to produce power from waste heat streams 05 p0006 A75-10547
Energy from urban wastes 05 p0006 A75-10548
An evaluation of discarded tires as a potential source of fuel 05 p0012 A75-12416

- Two-stage methane production from solid wastes
[ASME PAPER 74-WA/ENER-11] 05 p0017 A75-16842
- Gasification of solid wastes in fixed beds
[ASME PAPER 74-WA/PWR-10] 05 p0018 A75-16882
- Energy problems - Solar energy and manure gas
05 p0020 A75-17024
- Methanol from forestry, municipal, and
agricultural organic residues
[BNWL-SA-5053] 06 p0085 N75-18702
- Pyrolysis system evaluation study
[NASA-CR-141664] 06 p0086 N75-18722
- Waste lubricating oil research. A comparison of
bench-test properties of re-refined and virgin
lubricating oils --- materials recovery
[PB-238124/2] 06 p0097 N75-20746
- Energy recovery from solid waste. Volume 1:
Summary report
[NASA-CR-2525] 06 p0098 N75-20830
- Energy and fixed nitrogen from agricultural residues
[BNWL-SA-5070] 06 p0103 N75-20874
- WATER**
- The generation of hydrogen by the thermal
decomposition of water 05 p0005 A75-10532
- Nuclear energy requirements for hydrogen
production from water 05 p0005 A75-10533
- Thermolysis of water for the generation of hydrogen
06 p0049 A75-23504
- Primary data on economic activity and water use in
prototype oil shale development areas of
Colorado: An initial inquiry
[PB-236039/4] 05 p0037 N75-14277
- Production of hydrogen from water using nuclear
energy. A review --- for hydrogen-based energy
[JAERI-M-5642] 06 p0093 N75-19824
- WATER CONSUMPTION**
- The economics of using wind power for electricity
supply in the Netherlands and for water supply
on Curacao
[NASA-TT-F-15982] 05 p0024 N75-10587
- WATER FLOW**
- Hot side heat exchanger for an ocean thermal
difference power plant 05 p0004 A75-10527
- Electrostatic voltage generation from flowing water
05 p0009 A75-10580
- Steady state free convection in an unconfined
geothermal reservoir 05 p0009 A75-11069
- WATER INJECTION**
- Profitability analysis of producing crude oil by
waterflooding using a simulation technique
[PB-237843/8] 06 p0088 N75-18738
- Solvent stimulation tests in two California
oilfields
[PB-237849/5] 06 p0090 N75-18761
- WATER MANAGEMENT**
- Some aspects of a solar battery system and its use
for irrigation in remote sun-rich regions
06 p0054 A75-24256
- WATER POLLUTION**
- Environmental impact of a geothermal power plant
06 p0049 A75-23291
- Benthic decomposition of adsorbed octadecane ---
impact of oil pollution, deoxygenation of
waterways 06 p0106 N75-20891
- WATER RESOURCES**
- Some generalizations of sample water-supply
calculations for solar-powered pumping plants
05 p0020 A75-17077
- WATER TEMPERATURE**
- Collection and concentration of solar energy using
Fresnel type lenses
[NASA-CR-142194] 06 p0080 N75-17784
- WATERWAVE ENERGY**
- Other primary energy resources --- geothermal,
tidal, wind, waterwave and glacier energy
utilization 06 p0050 A75-23512
- WATERWAVE ENERGY CONVERSION**
- Characteristics of a rocking wave power device ---
for waterwave energy conversion 06 p0062 A75-28450
- Site limitations on Solar Sea Power Plants
[AIAA PAPER 75-618] 06 p0062 A75-28594
- WATERWAVE POWERED MACHINES**
- The oceanic biomass energy plantation --- seaweed
harvesting for food and fuel
[AIAA PAPER 75-635] 06 p0063 A75-28599
- WEATHER DATA RECORDERS**
- Sizing of solar energy storage systems using local
weather records
[ASME PAPER 74-WA/HT-20] 05 p0017 A75-16865
- WEIGHT ANALYSIS**
- Light-weight radioisotope thermoelectric generator
design 05 p0003 A75-10508
- Solar cell modules for lightweight solar arrays
--- onboard communication satellites
06 p0057 A75-26068
- WELLS**
- Offshore investigation: Producing shut-in
leases, January 1974, phase 1 --- potentially
productive oil and gas wells 05 p0027 N75-11457
- Radiological surveillance program for the project
Gasbuggy production test, 15 May - 6 November 1973
[NERC-LV-539-30] 06 p0073 N75-16337
- Dry oil
[ELL-M-23508-(5828.4F)] 06 p0074 N75-16969
- WEST INDIES**
- The economics of using wind power for electricity
supply in the Netherlands and for water supply
on Curacao
[NASA-TT-F-15982] 05 p0024 N75-10587
- WHEELS**
- Wind power machines --- including operating
principles
[NASA-TT-F-16195] 06 p0080 N75-17786
- WICKS**
- A design parameter for assessing wicking
capabilities of heat pipes
[AIAA PAPER 74-1266] 05 p0010 A75-11107
- An investigation of heat-pipe wick characteristics
05 p0012 A75-12914
- WIND SHEAR**
- Structural analysis of wind turbine rotors for
NSF-NASA Mod-0 wind power system
[NASA-TM-X-3198] 06 p0080 N75-17712
- WIND TUNNEL DRIVES**
- A generalised analysis of the performance of a
variety of drive systems for high Reynolds
number, transonic wind tunnels
[RAE-TR-73134] 06 p0073 N75-16572
- WIND VELOCITY MEASUREMENT**
- Wind power potential of Alaska. Part 1: Surface
wind data from specific coastal sites
[PB-238507/8] 06 p0105 N75-20885
- WINDMILLS (WINDPOWERED MACHINES)**
- Unsteady aerodynamics of variable pitch vertical
axis windmill
[AIAA PAPER 75-649] 06 p0063 A75-28604
- Standardized wind electric power unit
[AD-783764] 05 p0025 N75-10598
- Wind power projects of the French electrical
authority
[NASA-TT-F-16057] 05 p0033 N75-13384
- Exploiting wind power for the production of
electricity --- windmill utilization in Denmark
[NASA-TT-F-16058] 05 p0033 N75-13385
- Structural analysis of wind turbine rotors for
NSF-NASA Mod-0 wind power system
[NASA-TM-X-3198] 06 p0080 N75-17712
- Wind power machines --- including operating
principles
[NASA-TT-F-16195] 06 p0080 N75-17786
- Wind motors: Theory, construction, assembly and
use in drawing water and generating electricity
[NASA-TT-F-16201] 06 p0093 N75-19821
- WINDPOWER UTILIZATION**
- A planning methodology for the analysis and design
of wind-power systems 05 p0004 A75-10517
- Windpower - Look backward, then move forward
confidently --- for electric power generation in
rural areas 05 p0014 A75-12997
- Prospects for tapping solar energy on a large scale
05 p0015 A75-14014
- Considerations regarding a utilization of solar
energy --- thermal, electric and wind energy
systems 06 p0050 A75-23510

- Other primary energy resources --- geothermal,
tidal, wind, waterwave and glacier energy
utilization 06 p0050 A75-23512
- Ocean thermal power and windpower systems -
Natural solar energy conversion for near-term
impact on world energy markets 06 p0060 A75-27790
- The economics of using wind power for electricity
supply in the Netherlands and for water supply
on Curacao 05 p0024 N75-10587
[NASA-TT-F-15982]
- Wind energy developments in the 20th century
[NASA-TM-X-71634] 05 p0033 N75-13380
- Wind power projects of the French electrical
authority 05 p0033 N75-13384
[NASA-TT-F-16057]
- Exploiting wind power for the production of
electricity --- windmill utilization in Denmark
[NASA-TT-F-16058] 05 p0033 N75-13385
- Wind energy
[GPO-37-390] 05 p0033 N75-13387
- Report of the Wind Power Committee --- a
feasibility analysis of the use of wind for a
major energy source 05 p0039 N75-15154
[NASA-TT-F-16062]
- Wind power potential of Alaska. Part 1: Surface
wind data from specific coastal sites
[PB-238507/8] 06 p0105 N75-20885
- WINDPOWERED GENERATORS**
- A planning methodology for the analysis and design
of wind-power systems 05 p0004 A75-10517
- A wind energy conversion system based on the
tracked-vehicle airfoil concept 05 p0004 A75-10518
- Windpower - Look backward, then move forward
confidently --- for electric power generation in
rural areas 05 p0014 A75-12997
- Wind energy developments in the 20th century
05 p0020 A75-17503
- Wind and solar power engineering
[AD-786844] 05 p0039 N75-15168
- Wind motors: Theory, construction, assembly and
use in drawing water and generating electricity
[NASA-TT-F-16201] 06 p0093 N75-19821
- WINDPOWERED PUMPS**
- Wind motors: Theory, construction, assembly and
use in drawing water and generating electricity
[NASA-TT-F-16201] 06 p0093 N75-19821
- WORKING FLUIDS**
- Dynamic response of solar heat storage systems
[ASME PAPER 74-WA/HT-22] 05 p0018 A75-16867
- Stirling engines - Capabilities and prospects
06 p0048 A75-23237
- WYOMING**
- Preliminary evaluation of underground coal
gasification at Hanna, Wyoming
[BM-TPR-82] 05 p0025 N75-10599

Z

ZONE MELTING

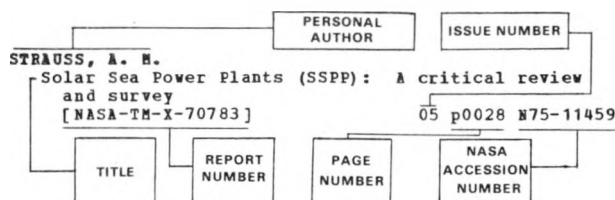
- Solar energy concentrator system for crystal
growth and zone refining in space
[NASA-CR-120623] 06 p0086 N75-18719

PERSONAL AUTHOR INDEX

ENERGY / A Continuing Bibliography (Issue 6)

OCTOBER 1975

Typical Personal Author Index Listing



Listings in this index are arranged alphabetically by personal author. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document listed (e.g., NASA report, translation, NASA contractor report). The issue, page and accession numbers are located beneath and to the right of the title, e.g., 05 p0028 N75-11459. Under any one author's name the accession numbers are arranged in sequence with the /AA accession numbers appearing first.

A

- AAMOT, H. W. C.**
 Management of power plant waste heat in cold regions
 [AD-A003217] 06 p0104 N75-20881
- ABBIN, J. P., JR.**
 Sizing of focused solar collector fields with specified collector tube inlet temperature
 [SLA-74-5288] 06 p0094 N75-19832
- ABIDOV, T. Z.**
 Design of a tubular heat collector for a solar power installation with a parabolocylindric concentrator
 05 p0020 A75-17069
- ACKERMAN, J. P.**
 Status and outlook for energy conversion via fuel cells
 [CONF-740462-1] 06 p0087 N75-18729
- ACTON, J. P.**
 Electricity conservation measures in the commercial sector: The Los Angeles experience
 [R-1592-PEA] 05 p0034 N75-13388
- ADAMS, K. G.**
 In situ oil shale: A cost sensitivity analysis
 [SAND-74-0146] 06 p0087 N75-18727
- AIKENS, D. A.**
 Electrochemical power sources
 [AD-A001610] 06 p0094 N75-19836
- AKIYAMA, S.**
 Superconducting synchronous machine
 06 p0061 A75-27967
- ALEREZA, T.**
 Assessment of Rankine cycle for potential application to solar-powered cooling of buildings
 [ASME PAPER 74-WA/SOL-7] 05 p0019 A75-16890
 Assessment of the Rankine cycle for potential application to solar powered cooling of buildings
 [PB-238069/9] 06 p0089 N75-18755
- ALEXANDER, A. D., III**
 United States transportation fuel economics (1975 - 1995)
 [NASA-TM-X-3197] 06 p0107 N75-21154
- ALFF, R. K.**
 Pumped air storage for electric power generation
 05 p0013 A75-12990
- ALFORD, W. J., JR.**
 Future long-range transports - Prospects for improved fuel efficiency
 [AIAA PAPER 75-316] 06 p0047 A75-22514
 Future long-range transports: Prospects for improved fuel efficiency
 [NASA-TM-X-72659] 06 p0079 N75-17339
- ALICH, J. A., JR.**
 Effective utilization of solar energy to produce clean fuel
 [PB-233956/2] 05 p0026 N75-10605
- ALIEV, N. P.**
 Testing of a photoelectric generator in a mountainous region of the Azerbaizhan SSR
 06 p0057 A75-26714
- ALLEN, A. E.**
 Energy storage underground
 05 p0013 A75-12989
- ALLEN, C. H.**
 A process for cleaning and removal of sulfur compounds from low Btu gases
 [PB-236522/9] 06 p0065 N75-15768
- ALLEN, G. W.**
 The hydrogen sulfide emissions abatement program at the Geysers Geothermal Power Plant
 06 p0102 N75-20859
- ALLEN, H. L., III**
 Benthal decomposition of adsorbed octadecane
 06 p0106 N75-20891
- ALLEN, R.**
 Proceedings of the Solar Heating and Cooling for Buildings Workshop. Part 2: Panel sessions, March 23
 [PB-235483/5] 06 p0069 N75-16095
- ALLER, P. F.**
 A modular heat source for curium-244 and plutonium-238
 05 p0002 A75-10497
- ALLISON, H. J.**
 Solar energy conversion and storage systems for the future
 05 p0013 A75-12988
 Prospects for tapping solar energy on a large scale
 05 p0015 A75-14014
- ALLISON, J.**
 The COMSAT non-reflective silicon solar cell - A second generation improved cell
 06 p0053 A75-24245
- ALTSEHNER, J. H.**
 Nuclear propulsion technology transfer to energy systems
 [AIAA PAPER 74-1072] 05 p0001 A75-10264
- ALYAUDINOV, R. A.**
 Electronic model of the U-25 device
 06 p0081 N75-17794
- AMAND, A. H.**
 Procedure for preparation for shipment of natural gas storage vessel
 [NASA-CR-141455] 05 p0036 N75-14135
- AMINGUAL, D.**
 The effects of irradiation on high-efficiency silicon solar cells
 06 p0051 A75-24199
 High efficiency silicon solar cells
 06 p0052 A75-24217
- ANAND, D. K.**
 Heat Pipe Symposium/Workshop
 [PB-236008/9] 05 p0035 N75-14094
- ANBAR, M.**
 Pollution-free electrochemical power generation from low grade coal
 [PB-236162/4] 06 p0070 N75-16109
- ANDERSON, K. E.**
 Development of lithium/sulfur cells for application to electric automobiles
 [CONF-740805-7] 06 p0094 N75-19829
- ANDERSON, L. C.**
 Fuel gas production from solid waste
 [PB-238068/1] 06 p0095 N75-19843
- ANTONELLI, A.**
 Beneficial uses of waste heat
 [RT/PROT-(74) 10] 06 p0068 N75-16091

APPLEBY, A. J.

Efficiencies of electrolytic and thermochemical hydrogen production 06 p0045 A75-20300

ARAD, U. B.

Energy and security: Implications for American policy [AD-785084] 05 p0032 N75-12857

ARBATOV, G. A.

The USA: The scientific and technical revolution and trends in foreign policy [NASA-TT-F-16102] 06 p0096 N75-20160

ARDEMA, M. D.

Conceptual design of reduced energy transports [AIAA PAPER 75-303] 06 p0047 A75-22508

ARIFOV, U. A.

Development of solar engineering in the USSR [AD-784708] 05 p0025 N75-10597

ARNDT, R.

The COMSAT non-reflective silicon solar cell - A second generation improved cell 06 p0053 A75-24245

ARNOLD, M. D.

Evaluation of thermal methods for recovery of viscous oils in Missouri and Kansas [PB-237831/3] 06 p0090 N75-18762

ASCHOFF, V.

Mission and organization of the DFVLR: Two years of integrated society of German aeronautical and space flight research [NASA-TT-F-16086] 05 p0035 N75-13882

ASHWORTH, R. A.

Low Btu gasification high temperature-low temperature H₂S removal comparison effect on overall thermal efficiency in a combined cycle power plant [PB-235780/4] 06 p0072 N75-16125

ATCHISON, K.

Nuclear system that burns its own wastes shows promise [NASA-NEWS-RELEASE-75-44] 06 p0085 N75-18716

ATKINS, K. L.

Mission applications of electric propulsion [AIAA PAPER 74-1085] 05 p0010 A75-11284

ATZEI, A.

Investigation of the technology and performance of lithium doped solar cells 06 p0052 A75-24219

AUSTIN, A. L.

A comparison of methods for electric power generation from geothermal hot water deposits [ASME PAPER 74-WA/ENER-10] 05 p0016 A75-16841
US energy flow charts for 1950, 1960, 1970, 1980, 1985, and 1990 [UCRL-51487] 05 p0024 N75-10593
The total flow concept for geothermal energy conversion 06 p0100 N75-20846

AVERY, W. H.

Tropical ocean thermal power plants and potential products [AIAA PAPER 75-617] 06 p0064 A75-29116

AXTHANN, R. C.

Environmental impact of a geothermal power plant 06 p0049 A75-23291
Utilization of plasma exhaust energy for fuel production [COO-3028-7] 05 p0028 N75-11465

B

BABA, Y.

Operating experiences with terrestrial solar battery systems in Japan 05 p0005 A75-10531

BABEL, H. W.

Material considerations involved in solar energy conversion 06 p0047 A75-22522

BACHNER, F. J.

Transparent heat-mirror films of TiO₂/Ag/TiO₂ for solar energy collection and radiation insulation 05 p0015 A75-16378

BACKUS, C. E.

Terrestrial photovoltaic power systems with sunlight concentration [PB-236180/6] 06 p0072 N75-16120

Terrestrial photovoltaic power systems with sunlight concentration [PB-238582/1] 06 p0105 N75-20886

BAIBOTAEV, K. B.

Method for calculating solar radiation for semicylindrical collectors 06 p0057 A75-26718

BAILIE, R. C.

Application of thermodynamic and material- and energy-balance calculations to gasification processes 06 p0055 A75-24785

BAKER, B. S.

Milliwatt fuel cell system for sensors 05 p0008 A75-10565
60 watt hydride-air fuel cell system 05 p0008 A75-10567

BAKER, J. W.

A city invests in its future 06 p0102 N75-20862

BAKER, N. R.

Oxides of nitrogen control techniques for appliance conversion to hydrogen fuel 05 p0006 A75-10541

BAKER, W. E.

A practical model law for chemical explosive fracture of oil shale 06 p0078 N75-17023

BAKIROV, M. IA.

Testing of a photoelectric generator in a mountainous region of the Azerbaizhan SSR 06 p0057 A75-26714

BAKSTAD, P.

Systems aspects of ocean thermal energy conversion [AIAA PAPER 75-615] 06 p0062 A75-28593

BALASUBRAMANIAM, M.

Solar thermal absorption heat pump breakeven coefficient of performance [ASME PAPER 74-WA/ENER-2] 05 p0015 A75-16834

BALCONB, J. D.

Nuclear propulsion technology transfer to energy systems [AIAA PAPER 74-1072] 05 p0001 A75-10264
Control system design and simulation for solar heated structures [LA-UR-74-1085] 06 p0082 N75-17813

BALDWIN, A. R.

Sixty minute thermal battery: A feasibility study [SLA-73-5888] 06 p0077 N75-16994

BALL, D.

Study of potential problems and optimum opportunities in retrofitting industrial processes to low and intermediate energy gas from coal [PB-237116/9] 06 p0088 N75-18739

BAMANN, D. E.

The collaborative study of EPA methods, 5, 6, and 7 in fossil fuel-fired steam generators [PB-237695/2] 06 p0091 N75-18788

BANKSTON, C. A.

The initiatives of the Los Alamos Scientific Laboratory in the transfer of a new excavation technology 06 p0079 N75-17203

BANNEROT, R. B.

The evaluation of surface geometry modification to improve the directional selectivity of solar energy collectors [PB-236412/3] 06 p0083 N75-17830

BAPTIST, O. C.

Solvent stimulation tests in two California oilfields [PB-237849/5] 06 p0090 N75-18761

BARAKEH, A. K.

Petroleum in Alabama [PB-237353/8] 06 p0085 N75-18442

BARBER, R. E.

A prototype solar powered, Rankine Cycle system providing residential air conditioning and electricity 05 p0004 A75-10523
Potential of Rankine engines to produce power from waste heat streams 06 p0006 A75-10547

BARBER, R. J.

Independent energy systems for better efficiency 05 p0006 A75-10549

- BARNERT, H.**
Energy supply in a closed cycle 06 p0049 A75-23503
Thermolysis of water for the generation of hydrogen 06 p0049 A75-23504
- BARNETT, W. J.**
Cost effective designing for the economic RTG 05 p0003 A75-10507
- BARR, W. L.**
DART: A simulation code for a direct energy converter for fusion reactors [UCRL-51557] 05 p0043 N75-15462
- BASHKATOV, V. A.**
Electronic model of the U-25 device 06 p0081 N75-17794
- BATTLES, J. E.**
Development of high specific energy batteries for electric vehicles [ANL-8058] 06 p0076 N75-16990
- BAUGHMAN, M. L.**
Energy systems - Modeling and policy analysis 06 p0055 A75-24750
Interfuel substitution in the consumption of energy in the United States. Part 1: Residential and commercial sector [PB-234536/1] 05 p0040 N75-15178
- BAUGHN, J.**
Solar energy storage within the absorption cycle [ASME PAPER 74-WA/HT-18] 05 p0017 A75-16864
- BAYER, A.**
Energy and the environment in Baden-Wuerttemberg [KFK-1966-UF] 05 p0030 N75-12439
- BAYLISS, B. P.**
Combining total energy and energy industrial center concepts to increase utilization efficiency of geothermal energy 06 p0102 N75-20860
- BEARD, D. S.**
DCTR power supply and energy storage review meeting [WASH-1310] 05 p0031 N75-12445
- BECK, E. J.**
Heat transfer design and proof tests of a radioisotope thermoelectric generator [AD-A002218] 06 p0092 N75-19608
- BECKER, F. E.**
Progress in development of auxiliary MHD power plant components at Avco Everett Research Laboratory, Inc [ASME PAPER 74-WA/ENER-6] 05 p0016 A75-16838
- BECKMAN, W. A.**
Simulation of a solar heating and cooling system 06 p0048 A75-23018
- BELIKOV, A. G.**
Energy characteristics of coaxial plasma source [AD-787419] 06 p0073 N75-16368
- BELL, W. F.**
Development of advanced fuel cell system, phase 2 [NASA-CR-134721] 06 p0067 N75-16084
- BELLER, M.**
Applications of fusion power technology to the chemical industry [BNL-18815] 05 p0029 N75-11730
Survey of applications of fusion power technology to the chemical and material processing industry [BNL-18866] 05 p0031 N75-12443
Energy systems analysis and technology assessment program [BNL-18984] 06 p0094 N75-19831
- BENNETT, J. A.**
Evaluation of advanced lift concepts and fuel conservative short-haul aircraft, volume 1 [NASA-CR-137525] 06 p0096 N75-20291
Evaluation of advanced lift concepts and fuel conservative short-haul aircraft, volume 2 [NASA-CR-137526] 06 p0097 N75-20292
- BERGER, B. J.**
Environmental aspects of methanol as vehicular fuel: Health and environmental effects [UCRL-76076] 06 p0095 N75-19867
- BERNARD, J.**
The effects of irradiation on high-efficiency silicon solar cells 06 p0051 A75-24199
- BERNIERE, M.**
The technology of the solar generator on the Syphonie satellite 06 p0053 A75-24237
- BEZAUDUN, MR.**
Analysis of different systems concerning the energy distribution on board a satellite [IAF PAPER 74-084] 05 p0014 A75-13716
- BEZLER, P.**
Synthetic fuels from fusion reactors [BNL-19351] 06 p0106 N75-21098
- BIANCARDI, F. R.**
Applications of plasma core reactors to terrestrial energy systems [AIAA PAPER 74-1074] 05 p0010 A75-11281
- BILGEM, E.**
Solar radiation heat transfer to high temperature heat carriers [ASME PAPER 74-WA/HT-14] 05 p0017 A75-16861
- BILLERBECK, W. J.**
Solar cell modules for lightweight solar arrays 06 p0057 A75-26068
- BIRD, D. K.**
Geophysical, geochemical, and geological investigations of the Dunes geothermal system, Imperial Valley, California [IGPP-DCR-74-31] 06 p0098 N75-20836
- BISHOP, E. H.**
A wind energy conversion system based on the tracked-vehicle airfoil concept 05 p0004 A75-10518
- BLACK, R. E.**
Advanced subsonic transports - A challenge for the 1990's [ATAA PAPER 75-304] 06 p0049 A75-23251
- BLACKKETTER, D. O.**
A wind energy conversion system based on the tracked-vehicle airfoil concept 05 p0004 A75-10518
- BLACKWELL, D. D.**
A brief description of geological and geophysical exploration of the Marysville geothermal area 06 p0099 N75-20839
- BLACKWOOD, T. R.**
Efficiencies in power generation [PB-234160/0] 05 p0034 N75-13398
- BLAKE, F. A.**
Solar/hydroelectric combined power systems 06 p0059 A75-27786
100 MWe solar power plant design configuration and performance [ATAA PAPER 75-623] 06 p0062 A75-28595
Solar power system and component research program [PB-236159/0] 05 p0037 N75-14280
- BLASKI, M. F.**
Electrical power generation subsystem for Space Shuttle Orbiter 05 p0002 A75-10477
- BLASKO, D. P.**
Natural gas fields, Cook Inlet Basin, Alaska [PB-235767/1] 06 p0066 N75-16071
- BLASKOWSKI, H. J.**
Low-BTU gasification of coal for electric power generation [PB-236972/6] 06 p0088 N75-18740
- BLAUGHER, R. B.**
A high-speed superconducting generator 06 p0060 A75-27960
- BLOKHWIN, A.**
Energy from the earth's depths [BLL-M-23516-(5828.4F)] 06 p0074 N75-16968
- BLOWD, E.**
Solar thermal conversion mission analysis [ATAA PAPER 75-619] 06 p0064 A75-29117
- BOBER, K. W.**
Solar one - The Delaware solar house and results obtained during the first year of operation 06 p0054 A75-24254
Solar electric and thermal conversion system in close proximity to the consumer [ATAA PAPER 75-628] 06 p0062 A75-28597
- BOEHM, H.**
Methanol/air acidic fuel cell system 05 p0008 A75-10566
- BOERI, G.**
Beneficial uses of waste heat [RT/PROT-(74) 10] 06 p0068 N75-16091
- BOGOMOLOV, E. N.**
Thermodynamics of multistage air-cooled gas turbine 06 p0050 A75-23817

- BOHN, T.
Nuclear district-heating and nuclear long-distance energy
[JUL-1077] 06 p0093 N75-19828
- BOND, P. A.
The design and development of an interactive energy model
[PB-236144/2] 06 p0070 N75-16110
- BONDIN, Y. S.
Electronic model of the U-25 device
06 p0081 N75-17794
- BONNEVILLE, R.
Wind power projects of the French electrical authority
[NASA-TT-P-16057] 05 p0033 N75-13384
- BONNEMAY, M.
Fundamental research on the selection of new electrochemical generators of medium power
06 p0060 A75-27827
- BONNET, D.
Solar cells - Operation, development and applications
05 p0015 A75-15201
- BOON, R. W.
Wisconsin superconductive energy storage project, volume 1
[PB-238082/2] 06 p0105 N75-20887
- BORETZ, J. E.
Technology considerations for Organic Rankine Cycle Electric Power Systems
05 p0002 A75-10484
- BOS, P. B.
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[AIAA PAPER 75-619] 06 p0064 A75-29117
- BOURKE, R. D.
Solar heating and cooling of buildings
06 p0059 A75-27783
- BOUSSUGE, MR.
Analysis of different systems concerning the energy distribution on board a satellite
[IAF PAPER 74-084] 05 p0014 A75-13716
- BOWDEN, M. K.
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[NASA-CR-2502] 06 p0073 N75-16557
Evaluation of advanced lift concepts and fuel conservative short-haul aircraft, volume 1
[NASA-CR-137525] 06 p0096 N75-20291
Evaluation of advanced lift concepts and fuel conservative short-haul aircraft, volume 2
[NASA-CR-137526] 06 p0097 N75-20292
- BOWSER, G. C., JR.
Development of a thermal battery for emergency radio power under arctic conditions
05 p0007 A75-10560
- BOYD, R. M.
Preliminary evaluation of underground coal gasification at Hanna, Wyoming
[BM-TPR-82] 05 p0025 N75-10599
- BOZZUTO, C. R.
Low-BTU gasification of coal for electric power generation
[PB-236972/6] 06 p0088 N75-18740
- BRAASCH, H.
Investigations and selection of components and materials for flexible solar generator
06 p0050 A75-24182
- BRADSHAW, G. C.
Radioisotope space power generator
[GA-A-12848] 05 p0038 N75-14832
- BRANDENBURG, C. F.
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[BM-TPR-82] 05 p0025 N75-10599
- BRANDLI, A. E.
The Energy Systems Optimization Computer Program /ESOP/ developed for Modular Integrated Utility Systems /MIUS/ analysis
05 p0006 A75-10551
- BRANDSTETTER, A.
The hot deeps of the Red Sea as a potential heat source for thermoelectric power generation
05 p0004 A75-10516
- BRANTLEY, L. W., JR.
Solar energy absorber
[NASA-CASE-MPS-22743-1] 05 p0024 N75-10585
Solar energy trap
[NASA-CASE-MPS-22744-1] 05 p0024 N75-10586
- BREELLE, Y.
Hydrogen fuel cells and motors
06 p0046 A75-22042
- BREWER, G. D.
Study of active cooling for supersonic transports
[NASA-CR-132573] 06 p0079 N75-17336
- BRIGGS, D. E.
Evaluation of coal conversion processes to provide clean fuels, part 1
[PB-234202/0] 05 p0025 N75-10600
Evaluation of coal conversion processes to provide clean fuels, part 2
[PB-234203/8] 05 p0025 N75-10604
- BRIGHAM, W. E.
Geothermal reservoir engineering research
06 p0101 N75-20853
- BRINN, D. G.
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[PB-234294/7] 05 p0034 N75-13400
- BRITTAIN, W. M.
SNAP 19 Viking RTG flight configuration and integration testing
05 p0003 A75-10504
- BROWNEL, G.
Fundamental research on the selection of new electrochemical generators of medium power
06 p0060 A75-27827
- BROTT, C. A.
A brief description of geological and geophysical exploration of the Marysville geothermal area
06 p0099 N75-20839
- BROVALSKII, I. O. A.
Design study of the energy characteristics of thermionic electric power generating components and assemblies
06 p0064 A75-28893
- BROWN, D. W.
Geothermal energy: A new application of rock mechanics
[LA-UR-74-821] 06 p0068 N75-16089
- BROWN, W. C.
The adaptation of free space power transmission technology to the SSPS concept
[AIAA PAPER 75-642] 06 p0063 A75-28602
- BRUGHAN, J.
Investment and operating costs of binary cycle geothermal power plants
06 p0101 N75-20855
- BRUMLEVE, T. D.
Prospects for solar energy utilization
[SAND-74-8604] 05 p0034 N75-13389
Sensible heat storage in liquids
[SLL-73-0263] 06 p0074 N75-16773
- BRUMMER, S. B.
Sulfur-based lithium-organic electrolyte secondary batteries
[AD-A003309] 06 p0104 N75-20882
- BUBE, R. H.
II-VI photovoltaic heterojunctions for solar energy conversion
05 p0012 A75-12734
- BUCH, F.
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05 p0012 A75-12734
- BUCHBERG, H.
Natural convection in enclosed spaces - A review of application to solar energy collection
[ASME PAPER 74-WA/HT-12] 05 p0017 A75-16860
- BUDENHOLZER, R. A.
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05 p0014 A75-12999
- BULLARD, C. W., III
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[PB-235487/6] 06 p0070 N75-16104
- BUNDSCHUH, V.
Other primary energy resources
06 p0050 A75-23512
- BUPP, I. C.
The economics of nuclear power
06 p0047 A75-22734
- BURGER, J. M.
Energy storage for utilities via hydrogen systems
05 p0005 A75-10537
Energy storage for utilities via hydrogen systems
[BNL-19266] 06 p0086 N75-18725

- BURRIS, L.
Development of high specific energy batteries for electric vehicles
[ANL-8058] 06 p0076 N75-16990
- BURTON, J. S.
The Mitre solar energy demonstration system
06 p0055 A75-24676
- BUSH, D. M.
Pellet type thermal battery
[SAND-74-0007] 06 p0076 N75-16991
Sixty minute thermal battery: A feasibility study
[SLA-73-5888] 06 p0077 N75-16994
- BUTLER, D. R.
Cooperative efforts by industry and government to develop geothermal resources
06 p0102 N75-20861
- BUTZ, L. W.
Simulation of a solar heating and cooling system
06 p0048 A75-23018
- BYRD, J., JR.
The design and development of an interactive energy model
[PB-236144/2] 06 p0070 N75-16110

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- CAHN, R. P.
Feasibility study of alternative fuels for automotive transportation. Volume 1: Executive summary
[PB-235581/6] 05 p0041 N75-15187
Feasibility study of alternative fuels for automotive transportation. Volume 2: Technical section
[PB-235582/4] 05 p0041 N75-15188
Feasibility study of alternative fuels and automotive transportation. Volume 3: Appendices
[PB-235583/2] 05 p0041 N75-15189
- CAIRNS, E. J.
Corrosion and related problems in high-temperature cells
06 p0055 A75-24377
- CALISE, A. J.
Extended energy management methods for flight performance optimization
[AIAA PAPER 75-30] 05 p0021 A75-18269
- CAMP, R. W.
Milliwatt fuel cell system for sensors
05 p0008 A75-10565
- CAMPBELL, G. G.
Preliminary evaluation of underground coal gasification at Hanna, Wyoming
[BM-TPR-82] 05 p0025 N75-10599
- CAPUTO, R. S.
Two-watt radioisotope power generators for underwater applications
05 p0007 A75-10556
- CARAWAY, W. H.
Solvent stimulation tests in two California oilfields
[PB-237849/5] 06 p0090 N75-18761
- CARLSON, G. A.
Interesting possibilities of fusion-fission
[BNWL-SA-5069] 06 p0096 N75-20106
- CASHION, W. B.
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[PB-236068/3] 06 p0072 N75-16124
- CATTON, I.
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[ASME PAPER 74-WA/HT-12] 05 p0017 A75-16860
- CHAMPLY, R.
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[NASA-TT-F-16201] 06 p0093 N75-19821
- CHAN, F. K.
A SASOL type process for gasoline, methanol, SNG, and low-Btu gas from coal
[PB-237670/5] 06 p0095 N75-19838
- CHASTEN, A. J.
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06 p0102 N75-20863
- CHEN, C. S.
Cooling by solar heat
[AIAA PAPER 75-609] 06 p0062 A75-28590
- CHENG, P.
Steady state free convection in an unconfined geothermal reservoir
05 p0009 A75-11069
- CHEPURNIY, N.
An analytical and experimental investigation of a laboratory solar pond model
[ASME PAPER 74-WA/SOL-3] 05 p0019 A75-16886
- CHEKASSKII, A. KH.
Temperature sensor for photoelectric energy converters
06 p0057 A75-26712
- CHINNAPPA, J. C. V.
Solar operation of ammonia-water multistage air conditioning cycles in the tropics
06 p0048 A75-23021
- CHIU, S. C.
Economics of a hydrogen storage peaking power plant
[ASME PAPER 74-WA/PWR-6] 05 p0018 A75-16880
- CHRISTENBURY, S. T.
SNAP 19 Viking RTG flight configuration and integration testing
05 p0003 A75-10504
- CHU, T. L.
Development of low cost thin film polycrystalline silicon solar cells for terrestrial applications
[PB-238505/2] 06 p0105 N75-20890
- CLARK, A. F.
Shallow solar pond energy conversion system: An analysis of a conceptual 10-MWe plant
[UCRL-51533-REV-1] 05 p0028 N75-11467
- CLARK, R. P.
Development and performance of a miniature, high-voltage thermal battery
05 p0007 A75-10559
Development and performance of a miniature, high-voltage thermal battery
[SLA-74-5363] 06 p0076 N75-16988
- COCHET-MUCHY, B.
Energy, hydrogen, and pollution
06 p0046 A75-22041
- COHN, E. M.
NASA objectives for improved solar power plants
05 p0002 A75-10485
- COLARDELLE, P.
The effects of irradiation on high-efficiency silicon solar cells
06 p0051 A75-24199
High efficiency silicon solar cells
06 p0052 A75-24217
- COLE, R. B.
Hydrogen as a fuel
[AD-787484] 06 p0066 N75-15818
- COLIN, R.
Lead accumulator batteries in telecommunications
[BLL-TRANS-2943-(9022.81)] 06 p0074 N75-16967
- COLLINS, B.
Power generation for the X4 spacecraft - A step in the development of a high power/mass ratio, hybrid solar array for applications spacecraft
06 p0053 A75-24251
- COLLINS, L. W.
An evaluation of discarded tires as a potential source of fuel
05 p0012 A75-12416
An evaluation: The potential of discarded tires as a source of fuel
[NASA-TM-X-58143] 05 p0038 N75-15153
- COMBS, J.
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[IGPP-UCR-74-31] 06 p0098 N75-20836
- COMBS, J. B.
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06 p0061 A75-28438
- COMMONER, B.
The effect of recent energy price increases on field crop production costs
[PB-238659/7] 06 p0107 N75-21155
- CONNELL, J. W.
Hot side heat exchanger for an ocean thermal difference power plant
05 p0004 A75-10527
- CONNER, J. G.
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06 p0059 A75-27781

- COOK, C. S.
Evaluation of a fossil fuel fired ceramic
regenerative heat exchanger
[PB-236346/3] 06 p0092 N75-19599
- COOK, G. L.
Retorting indexes for oil-shale pyrolyses from
ethylene-ethane ratios of product gases
[PB-234050/3] 05 p0034 N75-13399
- COOKE-YARBOROUGH, E. H.
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05 p0009 A75-10579
- COOL, R. W.
Electron and proton irradiation of high-efficiency
silicon solar cells
06 p0053 A75-24233
- COOPER, B.
An assessment and analysis of the energy emergency
[GPO-25-382] 06 p0066 N75-16076
- COPELEN, T. B.
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investigations of the Dunes geothermal system,
Imperial Valley, California
[IGPP-UCR-74-31] 06 p0098 N75-20836
- CORDER, T. E.
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and cooling of buildings
06 p0061 A75-28093
- CORDER, W. C.
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ton-a-day coal gasification process development
unit for the agglomerating burner-gasification
[PB-237625/9] 06 p0087 N75-18734
- CORNAN, J. C.
Solar augmented home heating heat pump system
05 p0004 A75-10524
- CORNELL, R. H.
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measurements for in situ energy-recovery processes
[UCID-16631] 06 p0097 N75-20693
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subsystem for an Encke comet rendezvous mission
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- COTTON, F. O.
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bench-test properties of re-refined and virgin
lubricating oils
[PB-238124/2] 06 p0097 N75-20746
- COUNT, B. M.
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06 p0062 A75-28450
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generation
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summary
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automotive transportation. Volume 2: Technical
section
[PB-235582/4] 05 p0041 N75-15188
- Feasibility study of alternative fuels and
automotive transportation. Volume 3: Appendices
[PB-235583/2] 05 p0041 N75-15189
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distillate and gasoline produced by petroleum
refining
[PB-236900/7] 06 p0085 N75-18443
- CURRAN, H. M.
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application to solar-powered cooling of buildings
[ASME PAPER 74-WA/SOL-7] 05 p0019 A75-16890
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application to solar powered cooling of buildings
[PB-238069/9] 06 p0089 N75-18755
- CURTIN, D. J.
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silicon solar cells
06 p0053 A75-24233
- Solar cell modules for lightweight solar arrays
06 p0057 A75-26068
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- DALAL, V. L.
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06 p0056 A75-25086
- DALIBOT, B.
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06 p0054 A75-24257
- DALTON, C.
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06 p0079 N75-17200
- DAMBOLENA, I. G.
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of wind-power systems
05 p0004 A75-10517
- DANIELS, A.
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06 p0048 A75-23237
- DAVIDSON, J. W.
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05 p0021 A75-18080
- DAVIES, R. L.
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standpoint
[NASA-CR-132578] 06 p0084 N75-18220
- DAVITIAN, H.
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automotive applications - A comparison of
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05 p0005 A75-10540
- DAY, J. A.
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05 p0013 A75-12990
- DEB, S.
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for irrigation in remote sun-rich regions
06 p0054 A75-24256
- DECORA, A. W.
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ethylene-ethane ratios of product gases
[PB-234050/3] 05 p0034 N75-13399
- DEITCH, L.
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06 p0100 N75-20843
- DENTON, J. C.
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Grove, Jefferson County, Alabama, by vertical
borehole in advance of mining
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- DEUTCH, H. J.
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policy
05 p0014 A75-13597

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[AD-764449] 05 p0026 N75-10608
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[PB-237843/8] 06 p0088 N75-18738
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- DOROUDIAN, M.
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screened CdS solar cells 06 p0052 A75-24225
- DOUGLAS, D. L.
The impact of advanced batteries on electric power
generation 05 p0013 A75-12991
- DOUGLASS, R. H., JR.
Systems aspects of ocean thermal energy conversion
[AIAA PAPER 75-615] 06 p0062 A75-28593
Phase 0 study for a geothermal superheated water
proof of concept facility 06 p0102 N75-20858
- DOUHANI, G. A.
Development of oil and gas on the Continental Shelf
[GPO-31-891] 06 p0075 N75-16973
- DOWDY, H. W.
Feasibility demonstration of a road vehicle fueled
with hydrogen-enriched gasoline 05 p0008 A75-10574
- DOWNS, W. R.
An evaluation of discarded tires as a potential
source of fuel 05 p0012 A75-12416
An evaluation: The potential of discarded tires
as a source of fuel
[NASA-TM-X-58143] 05 p0038 N75-15153
- DRABKIN, L. H.
Thermodynamic analysis of a solar energy system
with a closed-cycle gas-turbine converter 06 p0049 A75-23402
Thermodynamic analysis and parameter optimization
of a solar thermoelectric power unit with
radiation heat dissipation
[AD-A000211] 06 p0082 N75-17819
- DRUMMOND, W. E.
Fusion power research - Where do we stand 05 p0013 A75-12995
- DUBOIS, J. E.
Energy problems in a global context 06 p0075 N75-16978
- DUFF, W. S.
The analysis of the performance of a pancake
absorber-heat exchanger for a solar concentrator
[ASME PAPER 74-WA/SOL-1] 05 p0018 A75-16884
- DUFFIE, J. A.
Simulation of a solar heating and cooling system 06 p0048 A75-23018
- DUGAN, J. P., JR.
Future long-range transports - Prospects for
improved fuel efficiency 06 p0047 A75-22514
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improved fuel efficiency
[NASA-TM-X-72659] 06 p0079 N75-17339
- DUGGER, G. L.
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products
[AIAA PAPER 75-617] 06 p0064 A75-29116
- DUNHAM, J. T.
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disposal of mineral, metal, and energy-based
wastes
[PB-227476/9] 05 p0042 N75-15203
- DURAND, H.
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use 06 p0058 A75-27717
- DUXBURY, J. H.
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electric propulsion
[AIAA PAPER 74-1084] 05 p0010 A75-11283
- DUY, T. N.
High efficiency silicon solar cells 06 p0052 A75-24217
- DYAS, N. W.
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[GPO-31-891] 06 p0075 N75-16973
- DYKSTRA, L. J.
Solar sea power
[PB-236997/3] 06 p0082 N75-17821

E

- EASTER, R. W.
Predicted energy densities for nickel-hydrogen and
silver-hydrogen cells embodying metallic
hydrides for hydrogen storage 05 p0008 A75-10572
- EASTON, C. R.
Evaluation of central solar tower power plant 05 p0003 A75-10515
- ECKERLE, J.
Continued development of energy transmission and
conversion systems
[PB-236181/4] 05 p0037 N75-14278
- EDELBAUM, T. N.
Effect of attitude constraints on solar-electric
geocentric transfers
[AIAA PAPER 75-350] 06 p0055 A75-24957
- EDELSTEIN, F.
Heat pipe manufacturing study
[NASA-CR-139140] 05 p0023 N75-10347
- EDESKUTY, F. J.
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- EDWARDS, D. K.
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of application to solar energy collection
[ASME PAPER 74-WA/HT-12] 05 p0017 A75-16860
- EGGEN, A. C. W.
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[ASME PAPER 74-WA/PWR-10] 05 p0018 A75-16882
- EICKHOFF, H. G.
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result by using a high temperature reactor for
the future supply of mineral oil in the FRG
[JUL-1017-RG] 05 p0029 N75-11470
- ELDER, C. H.
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Grove, Jefferson County, Alabama, by vertical
borehole in advance of mining
[BM-RI-7968] 05 p0028 N75-11462
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investigations of the Dunes geothermal system,
Imperial Valley, California
[IGPP-UCR-74-31] 06 p0098 N75-20836
- ELSNER, N. E.
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[GA-A-12848] 05 p0038 N75-14832
- ENGDAHL, R.
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opportunities in retrofitting industrial
processes to low and intermediate energy gas
from coal
[PB-237116/9] 06 p0088 N75-18739

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Research Laboratory, Inc
[ASME PAPER 74-WA/ENER-7] 05 p0016 A75-16839

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[AIAA PAPER 74-1066] 05 p0001 A75-10259

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05 p0020 A75-17081

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[PB-238582/1] 06 p0105 N75-20886

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number, transonic wind tunnels
[RAE-TR-73134] 06 p0073 N75-16572

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[VP-X-129] 05 p0030 N75-12436

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06 p0107 N75-21153

EZRA, A. A.

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06 p0048 A75-22913

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A generalization of the Carnot theorem - The
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06 p0057 A75-26448

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06 p0060 A75-27960

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05 p0012 A75-12734

FAN, J. C. C.

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05 p0015 A75-16378

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organic-semiconductor solar cells
05 p0010 A75-11146

FARBER, E. A.

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[ASME PAPER 74-WA/SOL-2] 05 p0018 A75-16885
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[ASME PAPER 74-WA/SOL-6] 05 p0019 A75-16889

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automotive transportation. Volume 1: Executive
summary
[PB-235581/6] 05 p0041 N75-15187
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automotive transportation. Volume 2: Technical
section
[PB-235582/4] 05 p0041 N75-15188
Feasibility study of alternative fuels and
automotive transportation. Volume 3: Appendices
[PB-235583/2] 05 p0041 N75-15189
Effects of changing the proportions of automotive
distillate and gasoline produced by petroleum
refining
[PB-236900/7] 06 p0085 N75-18443

FARRIS, P. J.

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05 p0013 A75-12992

FAUDE, D.

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FEDOTOV, V.

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[AD-783764] 05 p0025 N75-10598

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[PB-237215/9] 06 p0084 N75-17853

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05 p0005 A75-10535

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conservative short-haul aircraft, volume 1
[NASA-CR-137525] 06 p0096 N75-20291
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conservative short-haul aircraft, volume 2
[NASA-CR-137526] 06 p0097 N75-20292

FILATOV, A. I.

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under the conditions of the Turkmen SSR
05 p0020 A75-17083

FILBY, E. E.

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[ICP-1054] 06 p0074 N75-16651

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production
[COO-3028-7] 05 p0028 N75-11465

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relevant to state of New York building design
and contract awards
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FLORSCHUTZ, L. W.

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sunlight concentration
[PB-238582/1] 06 p0105 N75-20886

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solar energy collection and radiation insulation
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cell modules
06 p0054 A75-24258

FORSHAN, E. V.

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chemicals group
[PB-236322/4] 06 p0071 N75-16111

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[NASA-CR-134724] 06 p0066 N75-16079
- FRAAS, A. P.**
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05 p0006 A75-10546
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05 p0007 A75-10562
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[ASME PAPER 74-WA/ENER-3] 05 p0016 A75-16835
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- FRANKLIN, E.**
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06 p0053 A75-24252
- FRETTER, E. P.**
Report on progress in achieving direct conversion of a major fraction of sonic flow kinetic power into electrical power by electrofluid dynamic /EFD/ processes
05 p0009 A75-10576
- FUJIMO, H.**
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06 p0061 A75-27967
- FULCHER, H. K.**
Overview of Reclamation's geothermal program in Imperial Valley, California
06 p0098 N75-20835
- FUNK, J. E.**
The generation of hydrogen by the thermal decomposition of water
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- FURLONG, D. A.**
Use of low grade solid fuels in gas turbines
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- G**
- GALENA, S.**
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[AD-784449] 05 p0026 N75-10608
- GALES, C.**
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06 p0046 A75-22044
- GANNON, R. E.**
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- GAUTHIER, A.**
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05 p0011 A75-12198
- GEISOW, J.**
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- GERTLER, M.**
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- GERVAIS, R. L.**
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05 p0003 A75-10515
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- GIBBS, H.**
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- GIBSON, C. J.**
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- GIBSON, E. K.**
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- GLASER, P. E.**
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- GLENDENNING, I.**
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06 p0062 A75-28450
- GOETZINGER, J. W.**
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[PB-238124/2] 06 p0097 N75-20746
- GOPORTH, T. T.**
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06 p0099 N75-20839
- GOGUEL, J.**
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06 p0060 A75-27826
- GOLDBERGER, W. M.**
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[PB-237625/9] 06 p0087 N75-18734
- GOLDENBERG, N.**
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05 p0002 A75-10496
- GOLDHAMMER, L. J.**
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06 p0052 A75-24232

- GOLDSMITH, J. V.
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terrestrial applications 05 p0005 A75-10530
- GOMCHARENKO, V. P.
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- GOODELLE, G. S.
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- GOODENOUGH, J. B.
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radiation insulation 05 p0004 A75-10525
- GORDON, T. J.
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- GORODETSKII, A. P.
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[AD-783821] 05 p0026 N75-10836
- GRAUBARD, M. H.
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- GRAVEN, R. M.
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buildings [LEL-3066] 06 p0079 N75-17279
- GRAY, S. L.
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- GREENE, M. I.
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- GREGORY, D. L.
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05 p0004 A75-10520
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[AIAA PAPER 75-640] 06 p0064 A75-29118
- GREGORY, D. P.
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into electrical power by electrofluid dynamic
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- GRIGOREV, V. N.
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heat treatment furnaces [BLL-M-21957-(5828.4F)] 06 p0080 N75-17467
- GRINGARTEN, A. C.
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rock 06 p0057 A75-26544
- GROWICH, S.
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The Colorado School of Mines Nevada geothermal study
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- GROSSKREUTZ, J. C.
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studies [PB-238002/0] 06 p0087 N75-18733
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heat treatment furnaces [BLL-M-21957-(5828.4F)] 06 p0080 N75-17467
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- HAENEL, R.
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Laboratory, Inc [ASME PAPER 74-WA/ENER-6] 05 p0016 A75-16838
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equipment in MHD power plants 06 p0055 A75-24384
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7 in fossil fuel-fired steam generators
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- HAMILTON, J. T.
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06 p0078 N75-17195
- HAMILTON, W.
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- HAMMOND, V. L.
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06 p0050 A75-23507
- HARPER, M.**
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06 p0056 A75-25832
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06 p0053 A75-24245
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[PB-234160/0] 05 p0034 N75-13398
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- HEINS, C. F.**
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06 p0051 A75-24214
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- HIGGINS, G. F.**
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[PB-237209/2] 06 p0083 N75-17826
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Legal economic, and energy considerations in the use of underground space
[PB-236755/5] 06 p0080 N75-17749
- HOEHN, F. W.**
Feasibility demonstration of a road vehicle fueled with hydrogen-enriched gasoline
05 p0008 A75-10574
- HOFFMAN, K. C.**
Metal hydrides as hydrogen storage media
[BNL-18887] 05 p0030 N75-12440
Iron titanium hydride as a source of hydrogen fuel for stationary and automotive applications
[BNL-18651] 05 p0030 N75-12441
Energy systems analysis and technology assessment program
[BNL-18984] 06 p0094 N75-19831
Metal hydrides as a source of hydrogen fuel
[BNL-14804-R] 06 p0104 N75-20876
- HOILMAN, K.**
Novel materials for power systems. Part 3: Selective emitters for energy conversion
[AD-784449] 05 p0026 N75-10608
- HOLDAWAY, M. J.**
A brief description of geological and geophysical exploration of the Marysville geothermal area
06 p0099 N75-20839
- HOLLANDER, A.**
Proceedings of the Workshop on Bio-Solar Conversion
[PB-236142/6] 06 p0069 N75-16096
- HOLLECK, G. L.**
Sulfur-based lithium-organic electrolyte secondary batteries
[AD-A003309] 06 p0104 N75-20882
- HOLLENBERG, J. W.**
Hydrogen as a fuel
[AD-787484] 06 p0066 N75-15818
- HOLT, B.**
Investment and operating costs of binary cycle geothermal power plants
06 p0101 N75-20855
- HOLT, J. P.**
MHD energy conversion systems
[AIAA PAPER 74-1071] 05 p0001 A75-10263
- HOLY, Z. J.**
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[CONF-740555-1] 06 p0077 N75-16995
- HORIGONE, T.**
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[NASA-TT-F-16091] 05 p0033 N75-13383
Solar energy
[NASA-TT-F-16092] 05 p0038 N75-15149
- HOSKEN, R. W.**
Compact solar energy concentrator
05 p0021 A75-19050
- HOWARD, B. C.**
DART: A simulation code for a direct energy converter for fusion reactors
[UCRL-51557] 05 p0043 N75-15462

HOWELL, J. R.

The evaluation of surface geometry modification to improve the directional selectivity of solar energy collectors
[PB-236412/3] 06 p0083 N75-17830

HOWLETT, R.

The Harwell thermo-mechanical generator
05 p0009 A75-10579

HUANG, C. J.

Energy recovery from solid waste
06 p0079 N75-17200

HUDSON, H.

Energy and security: Implications for American policy
[AD-785084] 05 p0032 N75-12857

HUDSON, S. M.

An engine project engineer's view of advanced secondary power systems
[SAE PAPER 740884] 05 p0019 A75-16925

HUGHES, W. L.

Solar energy conversion and storage systems for the future
05 p0013 A75-12988
Prospects for tapping solar energy on a large scale
05 p0015 A75-14014

HUTCHIN, J. A.

High-efficiency graded band-gap Al_xGa_{1-x}As-GaAs solar cell
06 p0058 A75-27519

HUTTER, U.

Wind power machines
[NASA-TT-F-16195] 06 p0080 N75-17786

IAKUBOV, I. U. M.

Method for calculating solar radiation for semicylindrical collectors
06 p0057 A75-26718

IBRAGIMOV, D. I.

Effectiveness of using semiconductor heat pumps under the conditions of the Turkmen SSR
05 p0020 A75-17083

ICERMAN, L.

Energy. Volume 1 - Demands, resources, impact, technology, and policy
06 p0045 A75-20066

ILARI, O.

Beneficial uses of waste heat
[RT/PROT-(74) 10] 06 p0068 N75-16091

INGLEY, H. A.

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[ASME PAPER 74-WA/SOL-6] 05 p0019 A75-16889

INMAN, R. E.

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[PB-233956/2] 05 p0026 N75-10605

ISHIDA, M.

Application of thermodynamic and material- and energy-balance calculations to gasification processes
06 p0055 A75-24785

ISHIHARA, A.

Superconducting synchronous machine
06 p0061 A75-27967

ISLER, R. J.

Energy storage for utilities via hydrogen systems
05 p0005 A75-10537
Energy storage for utilities via hydrogen systems
[BNL-19266] 06 p0086 N75-18725

ISMAN, M.

Energy problems - Solar energy and manure gas
05 p0020 A75-17024

IUDITSKII, V. D.

Empirical method of designing the current-voltage characteristics for the discharge mode of a thermionic converter
06 p0057 A75-26332

IURKEVICH, I. R.

Determination of the temperature field in a tubular thermoelectric module
05 p0020 A75-17068

IVANOV, P. P.

Some developments of industrial magnetohydrodynamic electric power plants
06 p0081 N75-17792

J

JAARSMA, F.

Impact of future fuels on military aero-engines
06 p0075 N75-16981

JACKMAN, A.

Solar energy storage within the absorption cycle
[ASME PAPER 74-WA/HT-18] 05 p0017 A75-16864

JACOBI, W. I.

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06 p0056 A75-25678

JACOBI, W. M.

Clinch River Breeder Reactor: A combined power and fuel source
[CONF-740609-4] 05 p0038 N75-14593

JACOBSON, D. L.

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[ASME PAPER 74-WA/HT-61] 05 p0018 A75-16869
An intercell heat pipe for fuel cell and battery cooling
[AD-782888] 05 p0027 N75-11226
Terrestrial photovoltaic power systems with sunlight concentration
[PB-238582/1] 06 p0105 N75-20886

JACOBSON, I. A., JR.

Retorting indexes for oil-shale pyrolyses from ethylene-ethane ratios of product gases
[PB-234050/3] 05 p0034 N75-13399

JAMES, E. C.

Unsteady aerodynamics of variable pitch vertical axis windmill
[AIAA PAPER 75-649] 06 p0063 A75-28604

JAMES, L. W.

GaAs concentrator solar cell
06 p0058 A75-27520

JARVIS, P. M.

Pumped air storage for electric power generation
05 p0013 A75-12990

JAYADEVAIAH, T. S.

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[ASME PAPER 74-WA/PWR-6] 05 p0018 A75-16880

JEBINS, A. B.

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[PB-237045/0] 06 p0082 N75-17822

JENKINS, R. M.

An analysis of photovoltaic power generation and thermal control interfaces
06 p0053 A75-24243

JERIE, J.

Part load specific fuel consumption of gas turbines
06 p0063 A75-28650

JOHANSSON, M.

Exploiting wind power for the production of electricity
[NASA-TT-F-16058] 05 p0033 N75-13385

JOHNSON, F. D.

Applications of aerospace technology in the electric power industry
06 p0079 N75-17197

JOHNSON, G. R.

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[ASME PAPER 74-WA/SOL-8] 05 p0019 A75-16891
SIMSHAC - A simulation program for solar heating and cooling of buildings
06 p0061 A75-28093

JOHNSON, R. T., JR.

Fuel cells: Direct conversion of electrochemical energy into electricity
[SAND-74-0125] 06 p0103 N75-20869

JONES, A. T.

Survey of hydrogen compatibility problems in energy storage and energy transmission applications
[SAND-74-8219] 06 p0087 N75-18726

JONKE, A. A.

Reduction of atmospheric pollution by the application of fluidized-bed combustion
[PB-235840/6] 06 p0072 N75-16151

JORDAN, J. F.

Development of very low cost solar cells for terrestrial power generation
06 p0052 A75-24226

- JOSKOW, P. L.**
Interfuel substitution in the consumption of energy in the United States. Part 1: Residential and commercial sector [PB-234536/1] 05 p0040 N75-15178
- JOHNTGEN, H.**
The production of gaseous energy carriers from fossil fuels 06 p0049 A75-23502
- JUTTENHANN, H.**
Heat pumps in large buildings [OA-TRANS-939] 06 p0078 N75-17184
- JUVINALL, G. L.**
A novel negative-limited sealed nickel-cadmium cell 05 p0008 A75-10571

K

- KADOMTSEV, B.**
Man-made sun. Thermonuclear engineering developments [BLL-M-23333-(5828.4P)] 06 p0091 N75-19014
- KAHN, J. S.**
AEC in situ oil shale program [UCID-16520] 06 p0068 N75-16090
- KALPADELIS, C. D.**
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- KALHAMMER, P. R.**
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- KANEVSKII, V. T.**
Utilization of tubular thermoelectric modules in solar generators 05 p0020 A75-17067
- Determination of the temperature field in a tubular thermoelectric module 05 p0020 A75-17068
- KAMINS, R. H.**
Hawaii geothermal project 06 p0099 N75-20840
- KAMINSKY, F. C.**
A planning methodology for the analysis and design of wind-power systems 05 p0004 A75-10517
- KANT, F. H.**
Feasibility study of alternative fuels for automotive transportation. Volume 1: Executive summary [PB-235581/6] 05 p0041 N75-15187
- Feasibility study of alternative fuels for automotive transportation. Volume 2: Technical section [PB-235582/4] 05 p0041 N75-15188
- Feasibility study of alternative fuels and automotive transportation. Volume 3: Appendices [PB-235583/2] 05 p0041 N75-15189
- Effects of changing the proportions of automotive distillate and gasoline produced by petroleum refining [PB-236900/7] 06 p0085 N75-18443
- KAPLAN, R. S.**
Bureau of Mines research programs on recycling and disposal of mineral, metal, and energy-based wastes [PB-227476/9] 05 p0042 N75-15203
- KAPPELMAYER, O.**
Geothermics with special reference to application 05 p0011 A75-11576
- KARAKI, S.**
Utilization of solar energy today 05 p0012 A75-12987
- KATELL, S.**
An economic analysis of oil shale operations featuring gas combustion retorting [PB-237851/1] 06 p0093 N75-19813
- KATZ, D. L.**
Evaluation of coal conversion processes to provide clean fuels, part 1 [PB-234202/0] 05 p0025 N75-10600
- Evaluation of coal conversion processes to provide clean fuels, part 2 [PB-234203/8] 05 p0025 N75-10604

- KEDDY, E. S.**
Process environment effects on heat pipes for fluid-bed gasification of coal [LA-UR-74-984] 05 p0029 N75-12252
- KEENAN, J. D.**
Two-stage methane production from solid wastes [ASME PAPER 74-WA/ENER-11] 05 p0017 A75-16842
- KEETON, S. C.**
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- KELLER, G. V.**
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- The Colorado School of Mines Nevada geothermal study 06 p0099 N75-20837
- KELLER, W. E.**
Nuclear propulsion technology transfer to energy systems [AIAA PAPER 74-1072] 05 p0001 A75-10264
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- KELM, S.**
Reflector-absorber systems for solar thermionic converters [ESRO-TT-123] 06 p0104 N75-20878
- KENAHAN, C. B.**
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- KERNODE, R. L.**
Synthetic oil from coal [PB-234460/4] 05 p0040 N75-15176
- KERR, R. L.**
Advances in space power generation [IAF PAPER 74-086] 05 p0015 A75-13718
- KESSLER, R.**
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- KEULKS, G. W.**
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- KHADAROV, P.**
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- KHARITONOV, V. P.**
Standardized wind electric power unit [AD-783764] 05 p0025 N75-10598
- KHOZYSH, G. A.**
Improving the oil storage system of western Siberia [AD-A002717] 06 p0092 N75-19705
- KHOZHIEV, A. KH.**
Method for calculating solar radiation for semicylindrical collectors 06 p0057 A75-26718
- KHUDENKO, A. A.**
Study of channel-type systems for solar-energy radiative heat transport 05 p0010 A75-11196
- A study of channel systems for radiative solar-heat transfer 06 p0049 A75-23408
- KIDDER, R. E.**
Laser compression of matter - Optical power and energy requirements 06 p0046 A75-22352
- KILBEARY, R.**
The energy crisis and decision making in the family [PB-238783/5] 06 p0106 N75-21028
- KILLIAN, H. J.**
Solar cell and array standardization for Air Force spacecraft 05 p0002 A75-10486
- KIM, A. G.**
Methane in the Pittsburgh coalbed, Washington County, Pennsylvania [PB-237848/7] 06 p0089 N75-18760
- KING, J. H., JR.**
Energy storage for utilities via hydrogen systems 05 p0005 A75-10537

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[BNL-19266] 06 p0086 N75-18725
- KINTIGH, J. K.
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05 p0021 A75-17504
- KIRCHHOFF, R. H.
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difference power plant 05 p0004 A75-10527
- KIRGIZBAEV, D. A.
Study of energy distribution in the field of
concentration of a solar power plant with a
hyperboloid counterreflector 05 p0010 A75-11195
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a solar installation with a hyperboloidal
counter-reflector 06 p0049 A75-23407
- KIRILLIN, V. A.
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[AD-A001515] 06 p0089 N75-18754
- KISPERT, R. G.
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[AIAA PAPER 75-632] 06 p0062 A75-28598
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[PB-238068/1] 06 p0095 N75-19843
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Laboratory, Inc
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Research Laboratory, Inc
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field crop production costs
[PB-238659/7] 06 p0107 N75-21155
- KLINE, R.
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generation Transportation and assembly
[AIAA PAPER 75-641] 06 p0063 A75-28601
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energy consumption
[NASA-TM-X-71663] 06 p0084 N75-18241
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06 p0060 A75-27792
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[PB-236142/6] 06 p0069 N75-16096
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of semiconductor thermocouples on the energy
characteristics of a thermoelectric generator
05 p0021 A75-18798
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investigations of the Dunes geothermal system,
Imperial Valley, California
[IGPP-UCR-74-31] 06 p0098 N75-20836
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a system consisting of a combustion chamber and
a subsonic MHD generator 06 p0045 A75-19959
- KOLSTAD, G. A.
Recommended research program in geothermal chemistry
[WASH-1344] 06 p0077 N75-16997
- KOMEYA, K.
Aluminum nitride and silicon nitride for
high-temperature vehicular gas turbine engines
05 p0011 A75-11362
- KONOPLEV, A. A.
Empirical method of designing the current-voltage
characteristics for the discharge mode of a
thermionic converter 06 p0057 A75-26332
- KONOVALOV, B.
Wind and solar power engineering
[AD-786844] 05 p0039 N75-15168
- KOSTKO, Z. N.
An investigation of heat-pipe wick characteristics
05 p0012 A75-12914
- KOVBASTUK, V. I.
Some developments of industrial
magnetohydrodynamic electric power plants
06 p0081 N75-17792
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[ASME PAPER 74-WA/PWR-10] 05 p0018 A75-16882
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chemicals group
[PB-236322/4] 06 p0071 N75-16111
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cells - A comparative analysis 06 p0052 A75-24222
- KRAUSS, O. P.
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assessment as a way to increase its effectiveness
06 p0097 N75-20829
- KRAVCHENKO, A. F.
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[AD-783821] 05 p0026 N75-10836
- KRESSEL, H.
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- KRIEBEL, C.
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[PB-235469/4] 05 p0038 N75-14284
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[PB-236997/3] 06 p0082 N75-17821
- KRISHNAN, C. K.
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06 p0045 A75-19660
- KROKOSKY, E.
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against crude-petroleum import interruptions:
Feasible alternatives, program costs, and
operational methods of funding
[PB-237209/2] 06 p0083 N75-17826
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06 p0049 A75-23505
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energy
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- KUHN, H.
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conception
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05 p0029 N75-11606
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- KURVIN, C. W.
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[NASA-CASE-GSC-11182-1] 05 p0032 N75-13007

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[AD-787484] 06 p0066 N75-15818
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- L**
- LADY, E. R.
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clean fuels, part 1
[PB-234202/0] 05 p0025 N75-10600
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clean fuels, part 2
[PB-234203/8] 05 p0025 N75-10604
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- LANKFORD, J.
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06 p0078 N75-17023
- LAQUER, H. L.
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[LA-UR-74-737] 05 p0032 N75-12814
- LARSON, D. H.
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environmental effects
[PB-237215/9] 06 p0084 N75-17853
- LARUE, J. C.
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lithium doped solar cells
06 p0052 A75-24219
- LATHAM, T. S.
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- LAU, K. H.
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geothermal reservoir
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thermionic electric power generating components
and assemblies
06 p0064 A75-28893
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06 p0059 A75-27785
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chemicals group
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- LEVENTAL, G. B.
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generation from chemical fuels /fuel cells/
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Experience in the first step of the mastery of the U-25 device 06 p0081 N75-17793
- LINNEHAN, D. G.**
Bureau of Mines research programs on recycling and disposal of mineral, metal, and energy-based wastes
[PB-227476/9] 05 p0042 N75-15203
- LINVILLE, B.**
Bureau of Mines energy program, 1973
[PB-234682/3] 05 p0040 N75-15172
- LISIN, A. S.**
Dynamic method for calculating the series resistance of a semiconductor photoelectric converter 06 p0057 A75-26713
- LITTMAN, H.**
Electrochemical power sources
[AD-A001610] 06 p0094 N75-19836
- LIVELY, C. F., JR.**
The Energy Systems Optimization Computer Program /ESOP/ developed for Modular Integrated Utility Systems /MIUS/ analysis 05 p0006 A75-10551
- LO, M. P.**
Time factors in slowing down the rate of growth of demand for primary energy in the United States 06 p0059 A75-27780
- LOCKERBETZ, W.**
The effect of recent energy price increases on field crop production costs
[PB-238659/7] 06 p0107 N75-21155
- LOEP, G. O. G.**
Utilization of solar energy today 05 p0012 A75-12987
- LOESCH, H. R.**
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- LOF, G. O. G.**
Design and construction of a residential solar heating and cooling system
[PB-237042/7] 06 p0082 N75-17823
- LOFGREN, B. E.**
Measuring ground movement in geothermal areas of Imperial Valley, California 06 p0099 N75-20842
- LOGOTHETTI, T. J.**
The use of hydrogen in commercial aircraft - An assessment 05 p0006 A75-10542
- LOKHANHEKIN, M.**
Assessment of the Rankine cycle for potential application to solar powered cooling of buildings
[PB-238069/9] 06 p0089 N75-18755
- LOKHANHEKIN, M.**
Assessment of Rankine cycle for potential application to solar-powered cooling of buildings
[ASME PAPER 74-WA/SOL-7] 05 p0019 A75-16890
- LONDON, A. L.**
Geothermal reservoir engineering research 06 p0101 N75-20853
- LONG, W. W.**
The initiatives of the Los Alamos Scientific Laboratory in the transfer of a new excavation technology 06 p0079 N75-17203
- LORANS, D.**
Development of a flexible, fold-out solar array 06 p0053 A75-24252
- LORCH, H. G.**
Latent heat and sensible heat storage for solar heating systems
[PB-236190/5] 06 p0077 N75-17005
- LORENSEN, L. E.**
Materials screening program for the LLL geothermal project
[UCRL-75353] 06 p0082 N75-17815
- LOESCH, H. G.**
Thermal energy storage devices suitable for solar heating 05 p0007 A75-10553
- LOTKER, M.**
Hydrogen for the electric utilities - Long range possibilities 05 p0005 A75-10536
The Hydrogen Economy - A utility perspective 05 p0014 A75-12998
Hydrogen economy: A utility perspective
[BNL-19267] 06 p0103 N75-20870
- LOWI, A.**
Solar thermal absorption heat pump breakeven coefficient of performance
[ASME PAPER 74-WA/ENER-2] 05 p0015 A75-16834
- LUCKEL, W. J.**
The FCG-1 fuel cell powerplant for electric utility use 05 p0013 A75-12992
- LUFT, W.**
Radiation effects on high efficiency silicon-solar cells 06 p0051 A75-24197
- LUIKOV, A. V.**
Progress in heat pipe and porous heat exchanger technology 06 p0045 A75-20686
- LUKE, I. F.**
Evaluation of an ion exchange membrane fuel cell for space power
[AD-786888] 05 p0037 N75-14274
- LUKES, T.**
Research on the application of solar energy to the food drying industry
[PB-238073/1] 06 p0105 N75-20888
- LUKSHA, E.**
A novel negative-limited sealed nickel-cadmium cell 05 p0008 A75-10571
- LUNDBERG, A. W.**
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[ASME PAPER 74-WA/ENER-10] 05 p0016 A75-16841
- LOTWACK, E.**
Assessment of the technology required to develop photovoltaic power system for large scale national energy applications
[NSF/RA/N-74-072] 06 p0080 N75-17785
- LYON, R. W.**
Recommended research program in geothermal chemistry
[WASH-1344] 06 p0077 N75-16997

M

- MAASS, K.**
Methanol/air acidic fuel cell system 05 p0008 A75-10566
- MACLENNAN, C.**
Tidal power and its integration into the electric system 05 p0013 A75-12994
- MADDALON, D. V.**
Rating aircraft on energy 05 p0015 A75-14346
- MADOR, R. J.**
Coal-gas combustion in industrial gas turbines
[AIAA PAPER 74-1114] 05 p0010 A75-11286
- MAEDA, M.**
Production of hydrogen from water using nuclear energy. A review
[JAERI-M-5642] 06 p0093 N75-19824
- MAGEE, E. M.**
Evaluation of pollution control in fossil fuel conversion processes. Gasification, section 1: Synthane process
[PB-237113/6] 06 p0095 N75-19879
- MAGEE, R. S.**
Hydrogen as a fuel
[AD-787484] 06 p0066 N75-15818
- MAGNUSON, K.**
Manportable thermoelectric generator
[AD-A002042] 06 p0095 N75-19847
- MAKHILIN, A. G.**
Convergence and speed of calculations for thermoelectric heat pump 05 p0020 A75-17084
- MALES, R. H.**
Energy crisis - Fact or fiction 05 p0011 A75-12115
- MANESS, R. F.**
A process for cleaning and removal of sulfur compounds from low Btu gases
[PB-236522/9] 06 p0065 N75-15768

- HANN, D. B.**
A survey of LNG technological needs in the USA:
1974 to beyond 2000
05 p0030 N75-12435
- HARBURY, P.**
Floating vs flying - A propulsion energy comparison
06 p0056 A75-25987
- MARCHETTI, C.**
The use of hydrogen as an energy carrier
05 p0015 A75-15795
- MARINESCU, M.**
High efficiency thermoelectric generator
05 p0014 A75-13067
- MARKMAN, M. A.**
Utilization of tubular thermoelectric modules in
solar generators
05 p0020 A75-17067
Determination of the temperature field in a
tubular thermoelectric module
05 p0020 A75-17068
- MARSHALL, O. W.**
Independent energy systems for better efficiency
05 p0006 A75-10549
- MARTIN, J. F.**
The MHD power generation system with directly
fired coal
05 p0009 A75-10577
- MARTIN, J. H.**
Profitability analysis of producing crude oil by
waterflooding using a simulation technique
[PB-237843/8]
06 p0088 N75-18738
- MARTIN, M. D.**
Power from ocean waves
[ASME PAPER 74-WA/PWR-5]
05 p0018 A75-16879
- MARTINO, E. J.**
Development of lithium/sulfur cells for
application to electric automobiles
[CONF-740805-7]
06 p0094 N75-19829
- MASCY, A. C.**
Air transportation energy consumption - Yesterday,
today, and tomorrow
[AIAA PAPER 75-319]
06 p0047 A75-22515
Transportation vehicle energy intensities. A
joint DOT/NASA reference paper
[NASA-TM-X-62404]
05 p0035 N75-13690
- MASLAN, P.**
Institutional and environmental problems in
geothermal resource development
06 p0100 N75-20843
- MASSENGALE, E. W.**
Oil for the free world in the 1970's
[AD-779352]
05 p0031 N75-12448
- MATHIAS, K. E.**
Preliminary results of geothermal desalting
operations at the East Mesa test site Imperial
Valley, California
06 p0101 N75-20850
- MATTHEWS, H. B.**
Geothermal down well pumping system
06 p0101 N75-20854
- MAUTZ, C. W.**
Radioisotope space power generator
[GA-A-12848]
05 p0038 N75-14832
- MAYER, H. H.**
Comparative performance characteristics of
cylindrical parabolic and flat plate solar
energy collectors
[ASME PAPER 74-WA/ENER-3]
05 p0016 A75-16835
Comparative performance characteristics of
cylindrical parabolic focusing and flat plate
solar energy collectors
[CONF-741104-3]
06 p0103 N75-20872
- MAYNARD, O. E.**
The adaptation of free space power transmission
technology to the SSPS concept
[AIAA PAPER 75-642]
06 p0063 A75-28602
- MCALEVY, R. F., III**
Hydrogen as a fuel
[AD-787484]
06 p0066 N75-15818
- MCBEE, W. D.**
Geothermal down well pumping system
06 p0101 N75-20854
- MCBRIDE, E.**
Dynamic conversion of solar generated heat to
electricity
[NASA-CR-134724]
06 p0066 N75-16079
- MCCABRIA, J. L.**
A high-speed superconducting generator
06 p0060 A75-27960
- MCCLUER, H. K.**
The hydrogen sulfide emissions abatement program
at the Geysers Geothermal Power Plant
06 p0102 N75-20859
- MCCULLOCH, W. H.**
Soil burial of radioisotopic fuel capsules
06 p0046 A75-21274
The Solar Community - Energy for residential
heating, cooling, and electrical power
06 p0059 A75-27785
Design analysis of asymmetric solar receivers
[SAND-74-0124]
06 p0076 N75-16986
- MCCURDY, W. A.**
Pressurised fluidized bed combustion
[PB-236498/2]
06 p0065 N75-15769
- MCDERMITT, J. H.**
Solar energy concentrator system for crystal
growth and zone refining in space
[NASA-CR-120623]
06 p0086 N75-18719
- MCDOWALD, T. E.**
Economic and system aspects of a superconducting
magnetic energy storage device and a dc
superconducting transmission line
[LA-OR-74-1145]
06 p0091 N75-19080
- MCGBE, R. P.**
Solar energy program plan for heating and cooling
buildings
[WASH-1337-5-DRAFT]
06 p0077 N75-16993
- MCGOWAN, J. G.**
Solar augmented home heating heat pump system
05 p0004 A75-10524
Hot side heat exchanger for an ocean thermal
difference power plant
05 p0004 A75-10527
Ocean thermal power and windpower systems -
Natural solar energy conversion for near-term
impact on world energy markets
06 p0060 A75-27790
Gulf stream based ocean thermal power plants
[AIAA PAPER 75-643]
06 p0063 A75-28603
- MCINTIRE, W. L.**
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secondary power systems
[SAE PAPER 740884]
05 p0019 A75-16925
- MCKAY, R. A.**
Helical rotary screw expander power system
06 p0101 N75-20856
- MCKELVEY, V. E.**
Solar energy in earth processes
06 p0061 A75-28437
- MCKENNA, R. F.**
Organic Rankine cycle silent power plant 1.5 kW,
28 volts dc
[AD-A000900]
06 p0088 N75-18745
- MCLELLAN, A., IV**
Changes in the global energy balance
[PB-238075/6]
06 p0106 N75-20936
- MCHICHAEL, P. C.**
Solar sea power
[PB-235469/4]
05 p0038 N75-14284
Solar sea power
[PB-236997/3]
06 p0082 N75-17821
- MCHILLEN, D. F.**
Pollution-free electrochemical power generation
from low grade coal
[PB-236162/4]
06 p0070 N75-16109
- MCHUNN, B. D.**
Char oil energy development
[PB-234018/0]
05 p0040 N75-15173
- MCSPADDEN, W. R.**
The Marysville, Montana Geothermal Project
06 p0100 N75-20849
- MEECHAN, C. J.**
Technology application at Rockwell International
06 p0078 N75-17189
- MEINEL, A. B.**
Air-stable selective surfaces for solar energy
collectors
[PB-236196/2]
06 p0071 N75-16116
- MELENTYEV, L. A.**
Prospects for magnetohydrodynamic electric power
plants in power engineering
06 p0081 N75-17791
- MELISS, M.**
Other primary energy resources
06 p0050 A75-23512
- HEWARD, C. J.**
A novel negative-limited sealed nickel-cadmium cell
05 p0008 A75-10571

MERCER, J. W., JR.

Geothermal reservoir simulation 06 p0101 N75-20852

MERRILL, B. C.

Char oil energy development [PB-234018/0] 05 p0040 N75-15173

MESSINGER, B.

Ocean thermal energy conversion system evaluation [AIAA PAPER 75-616] 06 p0064 A75-29115

MEULENBERG, A.

The COMSAT non-reflective silicon solar cell - A second generation improved cell 06 p0053 A75-24245

MEYER, A. P.

Development of advanced fuel cell system, phase 2 [NASA-CR-134721] 06 p0067 N75-16084

MEYER, R. T.

Evaluation of advanced lift concepts and fuel conservative short-haul aircraft, volume 1 [NASA-CR-137525] 06 p0096 N75-20291

Evaluation of advanced lift concepts and fuel conservative short-haul aircraft, volume 2 [NASA-CR-137526] 06 p0097 N75-20292

MICHAELS, R. J.

Intermediate-term energy programs to protect against crude-petroleum import interruptions: Feasible alternatives, program costs, and operational methods of funding [PB-237209/2] 06 p0083 N75-17826

MILLER, C. G.

Low to high temperature energy conversion system [NASA-CASE-NPO-13510-1] 06 p0074 N75-16972

MILLER, L. G.

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MILLER, M.

Assessment of Rankine cycle for potential application to solar-powered cooling of buildings [ASME PAPER 74-WA/SOL-7] 05 p0019 A75-16890

MILLER, M. P.

Energy efficiency of current intercity passenger transportation modes [AIAA PAPER 75-314] 06 p0047 A75-22513

MILLS, R. G.

Current expectations for fusion power from toroidal machines 05 p0014 A75-12996

MIRK, K. P.

The Lawrence Berkeley Laboratory geothermal program in northern Nevada 06 p0100 N75-20845

MISKUPF, R. J.

A modular heat source for curium-244 and plutonium-238 05 p0002 A75-10497

MITCHELL, K.

II-VI photovoltaic heterojunctions for solar energy conversion 05 p0012 A75-12734

MOIR, R. W.

Review of direct energy conversion of ion beams: Experimental results and reactor applications [UCRL-75600] 05 p0028 N75-11466

DART: A simulation code for a direct energy converter for fusion reactors [UCRL-51557] 05 p0043 N75-15462

Interesting possibilities of fusion-fission [BNWL-SA-5069] 06 p0096 N75-20106

MOON, R. L.

Gals concentrator solar cell 06 p0058 A75-27520

MOORE, G. L.

Sizing of solar energy storage systems using local weather records [ASME PAPER 74-WA/HT-20] 05 p0017 A75-16865

MOORE, G. W.

An evaluation of discarded tires as a potential source of fuel 05 p0012 A75-12416

An evaluation: The potential of discarded tires as a source of fuel [NASA-TM-X-58143] 05 p0038 N75-15153

MOORE, R. H.

A process for cleaning and removal of sulfur compounds from low Btu gases [PB-236522/9] 06 p0065 N75-15768

MORASH, R. T.

Independent energy systems for better efficiency 05 p0006 A75-10549

MORGAN, P.

A brief description of geological and geophysical exploration of the Marysville geothermal area 06 p0099 N75-20839

MORGENTHAUER, G. W.

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MOROZOV, G. M.

Some developments of industrial magnetohydrodynamic electric power plants 06 p0081 N75-17792

MORREY, J. R.

Coal structure and reactivity [TID-26637] 06 p0097 N75-20805

MORRIS, J. W., JR.

Cryogenic properties of Fe-Mn and Fe-Mn-Cr alloys [LBL-2764] 06 p0066 N75-15781

MORRIS, R. E.

Study of active cooling for supersonic transports [NASA-CR-132573] 06 p0079 N75-17336

MORRISON, C. A.

A case study - Utilization of solar energy in residential dwellings [ASME PAPER 74-WA/SOL-2] 05 p0018 A75-16885

Selection and evaluation of the University of Florida's solar powered absorption air conditioning system [ASME PAPER 74-WA/SOL-6] 05 p0019 A75-16889

MOULLHAYRAT, MR.

Analysis of different systems concerning the energy distribution on board a satellite [IAF PAPER 74-084] 05 p0014 A75-13716

MOUNT, R. L.

Progress in coal gasification 05 p0013 A75-12993

MOVSEV, E. A.

Experience in setting up solar-energy survey for Azerbaidzhan 05 p0020 A75-17081

NOW, C. C.

Energy consumption by industries in support of national defense: An energy demand model [AD-784964] 05 p0031 N75-12449

NOYERS, J. C.

Residential energy conservation [TID-26534] 05 p0031 N75-12442

NUCHNIK, G. F.

Prospects and scientific problems of the utilization of methods of direct electric power generation from chemical fuels /fuel cells/ 05 p0012 A75-12911

HUDGE, L. K.

Methanol from forestry, municipal, and agricultural organic residues [BNWL-SA-5053] 06 p0085 N75-18702

HUEHLHAUSER, J. W.

The MHD power generation system with directly fired coal 05 p0009 A75-10577

HUFFLER, L. J. P.

Current worldwide utilization and ultimate potential of geothermal energy systems 06 p0060 A75-27787

HUKHERJEE, M. K.

Some aspects of a solar battery system and its use for irrigation in remote sun-rich regions 06 p0054 A75-24256

HURAHOTO, M.

Laser induced luminescence signatures of refined and virgin crude petroleum - Their composition and remote sensing implications 06 p0050 A75-23790

HURIE, R. A.

Corrosion and related problems in high-temperature cells 06 p0055 A75-24377

MURRAY, H. S.

Control system design and simulation for solar heated structures [LA-UR-74-1085] 06 p0082 N75-17813

MUSCHICK, E.

The solution of information-deficiency problems of electroenergy technology 06 p0062 A75-28508

- HYLES, K. M.**
Development of high specific energy batteries for electric vehicles.
[ANL-8058] 06 p0076 N75-16990
- HUTTON, R. J.**
Progress in the development of cadmium sulphide terrestrial solar batteries
06 p0052 A75-24224

N

- NAGEL, A. L.**
Future long-range transports - Prospects for improved fuel efficiency
[AIAA PAPER 75-316] 06 p0047 A75-22514
- Future long-range transports: Prospects for improved fuel efficiency
[NASA-TM-X-72659] 06 p0079 N75-17339
- NABUCKI, C. W.**
Evaluation of advanced lift concepts and fuel conservative short-haul aircraft, volume 1
[NASA-CR-137525] 06 p0096 N75-20291
- Evaluation of advanced lift concepts and fuel conservative short-haul aircraft, volume 2
[NASA-CR-137526] 06 p0097 N75-20292
- NATHAN, C. A.**
Overcoming two significant hurdles to space power generation Transportation and assembly
[AIAA PAPER 75-641] 06 p0063 A75-28601
- NEALE, M. C.**
Energy resources and utilization
06 p0075 N75-16983
- NEDOSPASOV, A. V.**
Possible development of acoustical instability in a system consisting of a combustion chamber and a subsonic MHD generator
06 p0045 A75-19959
- Experience in the first step of the mastery of the U-25 device
06 p0081 N75-17793
- NEILL, C.**
An econometric analysis of fuel selection for power generation
06 p0055 A75-24751
- NEITZEL, R. E.**
Study of the costs and benefits of composite materials in advanced turbofan engines
[NASA-CR-134696] 06 p0073 N75-16637
- NELSON, D. T.**
Terrestrial photovoltaic power systems with sunlight concentration
[PB-238582/1] 06 p0105 N75-20886
- NELSON, P. A.**
High energy battery program at Argonne National Laboratory
[ANL-8064] 06 p0076 N75-16984
- Development of high specific energy batteries for electric vehicles
[ANL-8058] 06 p0076 N75-16990
- NEWGARD, P. M.**
Continued development of energy transmission and conversion systems
[PB-236181/4] 05 p0037 N75-14278
- NGUYEN-DUY, T.**
The effects of irradiation on high-efficiency silicon solar cells
06 p0051 A75-24199
- CdS-Cu₂S cells - An outlook for terrestrial applications
06 p0052 A75-24223
- WIDEVER, R. L.**
Economic impact on the free world of the oil crisis, October 1973 - March 1974
[AD-A003136] 06 p0107 N75-21156
- NIessen, H. F.**
Nuclear district-heating and nuclear long-distance energy
[JUL-1077] 06 p0093 N75-19828
- NODA, P.**
Aluminum nitride and silicon nitride for high-temperature vehicular gas turbine engines
05 p0011 A75-11362
- NOVIKOV, N.**
How spacecraft are fueled
[JPRS-63514] 05 p0027 N75-10983

- NUCCIOTTI, P.**
Meteorological factors and dispersion of pollutants in the atmosphere - A preliminary study about a large power plant
06 p0045 A75-21150
- NUCKOLLS, J.**
New approaches to CTR: General relativistic power plants
[UCRL-75443] 06 p0073 N75-16362

O

- OAKLEY, C. G.**
Use of solar energy in buildings in New York state
[PB-236974/2] 06 p0083 N75-17825
- OBYRNE, J. M.**
Electrostatic voltage generation from flowing water
05 p0009 A75-10580
- OEHS, K. J.**
State of the art and prospects for electric vehicles
[BLL-OA-TRANS-1250-(6196.3)] 06 p0074 N75-16712
- OESTERWIND, D.**
Other primary energy resources
06 p0050 A75-23512
- OGANOV, E. P.**
Effect of heat transfer from the lateral surfaces of semiconductor thermocouples on the energy characteristics of a thermoelectric generator
05 p0021 A75-18798
- OHNISHI, Y.**
Theory of heat extraction from fractured hot dry rock
06 p0057 A75-26544
- OHNO, S.**
Production of hydrogen from water using nuclear energy. A review
[JAERI-M-5642] 06 p0093 N75-19824
- OLENEV, N. M.**
Improving the oil storage system of western Siberia
[AD-A002717] 06 p0092 N75-19705
- OLSEN, H. L.**
Tropical ocean thermal power plants and potential products
[AIAA PAPER 75-617] 06 p0064 A75-29116
- OLSEN, L. C.**
Advanced betavoltaic power sources
05 p0007 A75-10563
- OLSON, L. L.**
Environmental aspects of cadmium sulfide usage in solar energy conversion. Part 1: Toxicological and environmental health considerations, a bibliography
[PB-238285/1] 06 p0105 N75-20884
- ONEILL, F.**
Interferometric tuning of a 15-atm CO₂ laser
06 p0058 A75-27518
- ONISCHAK, M.**
60 watt hydride-air fuel cell system
05 p0008 A75-10567
- OPJORDEN, R. W.**
Performance of advanced silicon solar cells in a space environment
06 p0052 A75-24232
- OPPENHEIM, A. K.**
Combustion R&D - Key to our energy future
05 p0009 A75-10596
- OPSCHOOR, G.**
On the potentialities of polyphenylene oxide (PPO) as a wet-insulation material for cargo tanks of LNG-carriers
[REPT-194-M] 05 p0035 N75-14002
- OSHIDA, I.**
Utilization of solar energy
[NASA-TT-F-16090] 05 p0033 N75-13382
- OSMEYER, W. E.**
A 10% efficient economic RTG design
05 p0003 A75-10506
- OSTROFF, H. S.**
F-15 secondary power systems
[SAE PAPER 740885] 06 p0048 A75-22948
- OVERBEY, W. K., JR.**
Relationships of earth fracture systems to productivity of a gas storage reservoir
[PB-237894/1] 06 p0089 N75-18759
- OWENS, S. L.**
Electrical power generation subsystem for Space Shuttle Orbiter
05 p0002 A75-10477

P

- PALMER, H. B.**
Solar farms utilizing low-pressure closed-cycle gas turbines
05 p0003 A75-10514
- PALMIERA, S.**
Meteorological factors and dispersion of pollutants in the atmosphere - A preliminary study about a large power plant
06 p0045 A75-21150
- PALZ, W.**
Solar cells - Present state and perspectives on terrestrial applications
06 p0058 A75-27716
- PANGBORN, J. B.**
Nuclear energy requirements for hydrogen production from water
05 p0005 A75-10533
- PARKER, E. N.**
The nature of the sunspot phenomenon. III - Energy consumption and energy transport. IV - The intrinsic instability of the magnetic configuration
06 p0064 A75-29137
- PARKER, E. R.**
Cryogenic properties of Fe-Mn and Fe-Mn-Cr alloys [LBL-2764]
06 p0066 N75-15781
- PARKER, J. H., JR.**
A high-speed superconducting generator
06 p0060 A75-27960
- PARNEV, L. K.**
Some developments of industrial magnetohydrodynamic electric power plants
06 p0081 N75-17792
- PARVIZI, A.**
Further progress in the technology of silk screened CdS solar cells
06 p0052 A75-24225
- PASHKOV, S. A.**
Some developments of industrial magnetohydrodynamic electric power plants
06 p0081 N75-17792
Experience in the first step of the mastery of the U-25 device
06 p0081 N75-17793
- PASTOR, G. R.**
Development of a process for producing an ashless, low-sulfur fuel from coal. Volume 2: Laboratory studies. Part 1: Autoclave experiments
[PB-236305/9] 05 p0040 N75-15169
- PATE, R. A.**
A hot liquid energy storage system utilizing natural circulation
[ASME PAPER 74-WA/HT-16] 05 p0017 A75-16862
- PATTERSON, R. C.**
Low-BTU gasification of coal for electric power generation
[PB-236972/6] 06 p0088 N75-18740
- PATTERSON, R. W.**
Evaluation of advanced lift concepts and fuel conservative short-haul aircraft, volume 1
[NASA-CR-137525] 06 p0096 N75-20291
Evaluation of advanced lift concepts and fuel conservative short-haul aircraft, volume 2
[NASA-CR-137526] 06 p0097 N75-20292
- PAUL, G. H.**
Interplanetary spacecraft design using solar electric propulsion
[AIAA PAPER 74-1084] 05 p0010 A75-11283
- PAULLIN, R. L.**
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[NASA-TM-X-62404] 05 p0035 N75-13690
- PAULSEN, P.**
Design and qualification of the CTS solar cell blanket
06 p0053 A75-24248
- PAITON, C. L.**
Development of a thermal battery for emergency radio power under arctic conditions
05 p0007 A75-10560
- PEARSON, R. O.**
Phase 0 study for a geothermal superheated water proof of concept facility
06 p0102 N75-20858
- PENNER, S. S.**
Energy. Volume 1 - Demands, resources, impact, technology, and policy
06 p0045 A75-20066
- PEOPLES, J. A.**
Analytical description of the modern steam automobile
[NASA-TM-X-72199] 05 p0035 N75-14134
- PERROUD, P.**
Production of hydrogen by the electrolysis of water
06 p0046 A75-22044
- PERRUSSEL, R. E.**
Development of a process for producing an ashless, low-sulfur fuel from coal. Volume 2: Laboratory studies. Part 1: Autoclave experiments
[PB-236305/9] 05 p0040 N75-15169
- PETERFISH, D.**
A brief description of geological and geophysical exploration of the Marysville geothermal area
06 p0099 N75-20839
- PETERS, W. D.**
Solar augmented home heating heat pump system
05 p0004 A75-10524
- PETERSON, H. A.**
Wisconsin superconductive energy storage project, volume 1
[PB-238082/2] 06 p0105 N75-20887
- PETERSON, R. E.**
Thin film coatings in solar-thermal power systems
06 p0056 A75-25679
- PETROV, B. M.**
Fundamentals of automatic control of space nuclear power plants
06 p0048 A75-23229
- PETTY, S.**
Recent MHD generator testing at Avco Everett Research Laboratory, Inc
[ASME PAPER 74-WA/ENER-7] 05 p0016 A75-16839
- PFEFFER, F. H.**
Pollutional problems and research needs for an oil shale industry
[PB-236608/6] 06 p0084 N75-17848
- PFEFFER, J. T.**
Biological conversion of organic refuse to methane
[PB-235468/6] 05 p0041 N75-15183
- PHILLIPS, W. F.**
A hot liquid energy storage system utilizing natural circulation
[ASME PAPER 74-WA/HT-16] 05 p0017 A75-16862
- PICHARD, G.**
CdS-Cu₂S cells - An outlook for terrestrial applications
06 p0052 A75-24223
- PICKETT, D. F.**
High energy density sintered plate type sealed nickel cadmium battery cells. I - The positive electrode/plaque relationships
05 p0008 A75-10569
High energy density sintered plate type nickel-cadmium battery cells. II - Electrochemical impregnation methods to produce nickel oxide electrodes
05 p0008 A75-10570
- PIERCE, J. R.**
Caltech seminar series on energy consumption in private transportation
[PB-235348/0] 05 p0040 N75-15179
- PIERSON, D. E.**
Imperial Valley's proposal to develop a guide for geothermal development within its county
06 p0100 N75-20844
- PIKUL, R. P.**
Program plan for environmental effects of energy
[PB-235115/3] 05 p0040 N75-15177
- PINDER, G. F.**
Geothermal reservoir simulation
06 p0101 N75-20852
- PINKEL, I. I.**
Alternative fuels for aviation
06 p0075 N75-16980
- PISCHINGER, F.**
Methanol as fuel for vehicle engines
06 p0050 A75-23506
- PISHIKOV, S. I.**
Experience in the first step of the mastery of the U-25 device
06 p0081 N75-17793

- Electronic model of the U-25 device
06 p0081 N75-17794
- PITCHER, E.
Manportable thermoelectric generator
[AD-A002042] 06 p0095 N75-19847
- PITMAN, J. K.
Average oil yield tables for oil shale sequences
in cores from the Uinta Basin, Utah, that
average 15, 20, 25, 30, 35, and 40 gallons per ton
[PB-236068/3] 06 p0072 N75-16124
- PITTINATO, G. P.
Material considerations involved in solar energy
conversion
06 p0047 A75-22522
- POBEREZHSHKII, L. P.
Possible development of acoustical instability in
a system consisting of a combustion chamber and
a subsonic MHD generator
06 p0045 A75-19959
- POLLACK, B. L.
Energy from urban wastes
05 p0006 A75-10548
- POPKOV, V.
Steps into the future. Development of the power
industry in the USSR
[BLL-M-23330-(5828.4F)] 06 p0085 N75-18714
- POPOVICI, T.
Scientific research seeks new sources of energy
06 p0107 N75-21216
- POST, R. F.
Fusion reactors as future energy sources
05 p0011 A75-11735
The outlook for fusion energy sources - Remaining
technological hurdles
06 p0059 A75-27782
Outlook for fusion energy sources: Remaining
technological hurdles
[UCRL-75418] 05 p0029 N75-11745
- POSTULA, F. D.
Radioisotope space power generator
[GA-A-12848] 05 p0038 N75-14832
- POTAPOV, V. M.
Testing of a photoelectric generator in a
mountainous region of the Azerbaizdhan SSR
06 p0057 A75-26714
- POWE, R. E.
A wind energy conversion system based on the
tracked-vehicle airfoil concept
05 p0004 A75-10518
- POWELL, J. C.
Dynamic conversion of solar generated heat to
electricity
[NASA-CR-134724] 06 p0066 N75-16079
Solar thermal conversion program. Central
receiver POCE project, subsystem specifications
studies
[PB-238002/0] 06 p0087 N75-18733
- POWELL, J. R.
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chemical industry
[BNL-18815] 05 p0029 N75-11730
Survey of applications of fusion power technology
to the chemical and material processing industry
[BNL-18866] 05 p0031 N75-12443
Synthetic fuels from fusion reactors
[BNL-19351] 06 p0106 N75-21098
Synopsis of studies on synthetic fuels production
by fusion reactors
[BNL-19336] 06 p0106 N75-21104
- POWERS, J. E.
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clean fuels, part 1
[PB-234202/0] 05 p0025 N75-10600
Evaluation of coal conversion processes to provide
clean fuels, part 2
[PB-234203/8] 05 p0025 N75-10604
- PRELAT, A. E.
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probabilities by visual analysis of structure
contour maps of Stafford County, Kansas
06 p0092 N75-19778
- PRIGMORE, D. R.
A prototype solar powered, Rankine Cycle system
providing residential air conditioning and
electricity
05 p0004 A75-10523
- PROKOPY, J. C.
Industrial energy studies of ground freight
transportation, volume 1
[PB-236016/2] 06 p0069 N75-16099
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transportation. Volume 2: Appendices
[PB-236017/0] 06 p0069 N75-16100
- PSCHUNDEE, W.
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solar cells with increased efficiency
06 p0051 A75-24216
- PUGH, P. G.
A generalised analysis of the performance of a
variety of drive systems for high Reynolds
number, transonic wind tunnels
[RAE-TR-73134] 06 p0073 N75-16572
- PUGLISI, V. J.
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nickel cadmium battery cells. I - The positive
electrode/plaque relationships
05 p0008 A75-10569
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nickel-cadmium battery cells. II -
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nickel oxide electrodes
05 p0008 A75-10570
- PULMANOV, N. V.
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06 p0057 A75-26714
- POLSIFER, A. E.
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[PB-236588/0] 06 p0088 N75-18743
- PUSHINA, L. I.
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characteristics for the discharge mode of a
thermionic converter
06 p0057 A75-26332
- POTNAM, A.
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[PB-237116/9] 06 p0088 N75-18739
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- RABENHORST, D. W.
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storage systems
06 p0047 A75-22523
The multirim superflywheel
[AD-A001081] 06 p0085 N75-18594
- RABIN, R.
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[PB-235115/3] 05 p0040 N75-15177
- RABINOWITZ, H.
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systems
06 p0056 A75-25827
- RADEBOLD, R.
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energy supply in future technical systems
06 p0050 A75-23511
- RAIKOV, I. I.
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thermionic electric power generating components
and assemblies
06 p0064 A75-28893
- RALPH, E. L.
Development and space qualification of new
high-efficiency silicon solar cells
06 p0052 A75-24218

- RAMAKUMAR, R.**
Solar energy conversion and storage systems for the future
05 p0013 A75-12988
Prospects for tapping solar energy on a large scale
05 p0015 A75-14014
- RAMEY, H. J., JR.**
Geothermal reservoir engineering research
06 p0101 N75-20853
- RAMSEY, J. W.**
Thin film coatings in solar-thermal power systems
06 p0056 A75-25679
- RAMSEY, W.**
Rationale for setting priorities for new energy technology research and development
[UCRL-51511] 05 p0024 N75-10594
- RANDALL, C. C.**
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[NASA-CR-137525] 06 p0096 N75-20291
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[NASA-CR-137526] 06 p0097 N75-20292
- RANKEN, W. A.**
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[AIAA PAPER 74-1072] 05 p0001 A75-10264
Conceptual design of a heat pipe methanator
[LA-5596] 06 p0074 N75-16774
- RANWELLS, J. E.**
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[WASH-1337-5-DRAFT] 06 p0077 N75-16993
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06 p0054 A75-24258
- READING, C. L.**
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[IAF PAPER 74-086] 05 p0015 A75-13718
- REAY, D. A.**
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05 p0015 A75-15054
- REED, T. B.**
Heat mirrors for solar-energy collection and radiation insulation
05 p0004 A75-10525
- REIDER, R.**
Cryogenics safety in a hydrogen fuel society
06 p0061 A75-27973
- REILLY, J. J.**
Metal hydrides as hydrogen storage media
[BNL-18887] 05 p0030 N75-12440
Iron titanium hydride as a source of hydrogen fuel for stationary and automotive applications
[BNL-18651] 05 p0030 N75-12441
Metal hydrides as a source of hydrogen fuel
[BNL-14804-R] 06 p0104 N75-20876
- REISS, E. H., JR.**
Milliwatt fuel cell system for sensors
05 p0008 A75-10565
- RENSHAW, J. H.**
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[NASA-CR-2502] 06 p0073 N75-16557
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[NASA-CR-137526] 06 p0097 N75-20292
- RENTSCH, H.**
Investigations and selection of components and materials for flexible solar generator
06 p0050 A75-24182
- REYNOLDS, H. H.**
Corrosion studies of materials for auxiliary equipment in MHD power plants
06 p0055 A75-24384
- RIBE, F. L.**
Fusion reactors as future energy sources
05 p0011 A75-11735
- RICHARDS, E. R.**
The use of solar cells in the lighthouse service
06 p0054 A75-24255
- RICHTER, R.**
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[AD-A000941] 06 p0091 N75-19340
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[AD-A000942] 06 p0091 N75-19341
- RIKKERS, R. F.**
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05 p0004 A75-10517
- RITTERMAN, P. F.**
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- RITTMER, E. S.**
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[IAF PAPER 74-083] 05 p0014 A75-13715
- ROBERTS, T. G.**
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06 p0045 A75-19657
- ROBERTSON, D. L.**
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[PB-236322/4] 06 p0071 N75-16111
Data base for the industrial energy study of the industrial chemicals group
[PB-237845/3] 06 p0087 N75-18732
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- ROBINSON, P. H.**
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06 p0056 A75-25086
- ROBISON, D.**
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[AD-785084] 05 p0032 N75-12857
- ROCHELLE, W. C.**
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05 p0006 A75-10551
- RODGERS, R. J.**
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- ROEGIERS, J. C.**
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[LA-UR-74-821] 06 p0068 N75-16089
- ROGERS, F. C.**
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- ROGERS, G. F. C.**
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- ROGERS, J. D.**
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[LA-5748-MS] 06 p0106 N75-21097
- ROHRMAN, C. A.**
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[BNWL-SA-5070] 06 p0103 N75-20874
- ROHRMAN, C. A.**
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[BNWL-SA-5053] 06 p0085 N75-18702
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- ROUKLOVE, P.
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at JPL 05 p0002 A75-10503
- ROWLEY, J. C.
The initiatives of the Los Alamos Scientific
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technology 06 p0079 N75-17203
Rock melting technology and geothermal drilling
06 p0101 N75-20851
- ROY, M.
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transport aviation 06 p0058 A75-27777
- ROZHKOVA, N. M.
Design study of the energy characteristics of
thermionic electric power generating components
and assemblies 06 p0064 A75-28893
- RUBI, V.
Methane gas engines for commercial vehicles and
busses 06 p0050 A75-23507
- RUBIN, B.
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technology research and development
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generators 06 p0061 A75-27962
- RUINA, D.
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transportation. Volume 2: Appendices
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- ROKWIED, M.
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materials for flexible solar generator 06 p0050 A75-24182
- RUSNAK, J. J.
The application of aerospace technology in the
cryogenics field 06 p0048 A75-23239
- RUSSO, F. A.
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thermoelectric generator /HPG-02/
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- RYAN, J. W.
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assessment 05 p0006 A75-10542
- RZAEV, P. F.
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Azerbaijan 05 p0020 A75-17081
- RZEMEK, K.
Certain problems of fuel consumption in air
transport 05 p0011 A75-11372
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- SABINS, F. P., JR.
Oil exploration needs for digital processing of
imagery 05 p0001 A75-10437
- SACHS, P.
Design and qualification of the CTS solar cell
blanket 06 p0053 A75-24248
- SACKETT, L. L.
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geocentric transfers
[AIAA PAPER 75-350] 06 p0055 A75-24957
- SADEK, S. E.
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[AIAA PAPER 75-632] 06 p0062 A75-28598
Fuel gas production from solid waste
[PB-238068/1] 06 p0095 N75-19843
- SAHA, H.
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06 p0054 A75-24256
- SALIEVA, R. B.
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calculations for solar-powered pumping plants
05 p0020 A75-17077
- SALTER, S.
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06 p0062 A75-28450
- SALZANO, F. J.
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05 p0005 A75-10537
The Hydrogen Economy - A utility perspective
05 p0014 A75-12998
Energy storage for utilities via hydrogen systems
[BNL-19266] 06 p0086 N75-18725
Hydrogen storage and production in utility systems
[BNL-18920] 06 p0097 N75-20580
Hydrogen economy: A utility perspective
[BNL-19267] 06 p0103 N75-20870
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[BNL-19249] 06 p0103 N75-20873
Synthetic fuels from fusion reactors
[BNL-19351] 06 p0106 N75-21098
- SANARA, G. A.
Solar energy: Sandia's photovoltaic research
program
[SLA-74-281] 05 p0034 N75-13392
- SANOILOV, E. M.
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[AD-783821] 05 p0026 N75-10836
- SANPSON, H. T.
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spacecraft 05 p0002 A75-10486
- SAN MARTIN, R. L.
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[ASME PAPER 74-WA/SOL-5] 05 p0019 A75-16888
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- SARIYEV, V. N.
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- SARKIS, L. A.
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1974 to beyond 2000 05 p0030 N75-12435
- SARRADIN, J.
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06 p0060 A75-27827
- SATO, S.
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energy. A review
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- SAVAGE, S. B.
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[ASME PAPER 74-WA/SOL-3] 05 p0019 A75-16886
- SAWYER, W. K.
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productivity of a gas storage reservoir
[PB-237894/1] 06 p0089 N75-18759
- SAITON, J. C.
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- SCALA, S. H.
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energy 06 p0050 A75-23510
- SCHAFERATH, M.
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06 p0050 A75-23508
- SCHANFEIN, M. J.
Cryogenic properties of Fe-Mn and Fe-Mn-Cr alloys
[LBL-2764] 06 p0066 N75-15781

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- SCHERTZ, W. W.
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[ANL-8058] 06 p0076 N75-16990
- SCHIEFELBEIN, G. F.
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compounds from low Btu gases
[PB-236522/9] 06 p0065 N75-15768
- SCHILLING, H. D.
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- SCHIMMEL, W. P., JR.
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06 p0059 A75-27785
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[SAND-74-26] 05 p0034 N75-13390
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Sizing of focused solar collector fields with
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[SLA-74-5288] 06 p0094 N75-19832
- SCHLENNER, H. V.
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[JUL-1077] 06 p0093 N75-19828
- SCHMALHOFFER, G.
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lithium doped solar cells
06 p0052 A75-24219
- SCHMIDT, R. A.
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[SAND-74-0035] 06 p0092 N75-19390
- SCHNEIDER, R. T.
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[IAF PAPER 74-087] 05 p0015 A75-13719
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05 p0003 A75-10508
- SCHOENHANN, P. H.
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- SCHORA, F. C., JR.
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05 p0013 A75-12993
- SCHOTT, G. J.
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- SCHREIBER, R. E.
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[LA-5558] 05 p0028 N75-11468
- SCHRENK, G. L.
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[ASME PAPER 74-WA/ENER-2] 05 p0015 A75-16834
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[SLA-74-281] 05 p0034 N75-13392
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06 p0049 A75-23503
- SCHUMANN, P. A.
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05 p0003 A75-10507
- SCHWARTZ, A., JR.
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[GPO-41-253] 05 p0026 N75-10764
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[AD-784449] 05 p0026 N75-10608
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[PB-236583/1] 06 p0088 N75-18736
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nickel cadmium battery cells. I - The positive
electrode/plaque relationships
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nickel-cadmium battery cells. II -
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nickel oxide electrodes
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[MLM-2134] 05 p0024 N75-10591
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field of geology and of the survey and
exploration of petroleum and gas
[JPRS-63414] 05 p0027 N75-11410
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of solar energy convertors
[PB-235481/9] 05 p0041 N75-15185
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Chemical vapor deposition research for
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[PB-234565/0] 05 p0041 N75-15186
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- SHATAS, R. A.
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06 p0045 A75-19657
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policy
[AD-785084] 05 p0032 N75-12857
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06 p0056 A75-25995
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06 p0081 N75-17792
Experience in the first step of the mastery of the U-25 device
06 p0081 N75-17793
Electronic model of the U-25 device
06 p0081 N75-17794
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[UCID-16591]
06 p0104 N75-20875
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[LA-UR-74-984]
05 p0029 N75-12252
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Prospects for magnetohydrodynamic electric power plants in power engineering
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Experience in the first step of the mastery of the U-25 device
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- SHIPLEY, J. P.**
Control system design and simulation for solar heated structures
[LA-UR-74-1085]
06 p0082 N75-17813
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[AIAA PAPER 75-617]
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[AIAA PAPER 74-1114]
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[NASA-CR-134696] 06 p0073 N75-16637
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06 p0099 N75-20841
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- TOWNES, H. W.**
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US Atomic Energy Commission 06 p0098 N75-20834
- WERNER, R. W.
Interesting possibilities of fusion-fission
[BNWL-SA-5069] 06 p0096 N75-20106
- WERTE, G.
Rationale for setting priorities for new energy
technology research and development
[UCRL-51511] 05 p0024 N75-10594
- WEST, A. J.
Survey of hydrogen compatibility problems in
energy storage and energy transmission
applications
[SAND-74-8219] 06 p0087 N75-18726
- WEST, C. D.
The Harwell thermo-mechanical generator
05 p0009 A75-10579
- WESTWOOD, I. J.
Optimising pumped storage with tidal power in an
estuary
[ASME PAPER 74-WA/PWR-7] 05 p0018 A75-16881
- WETMORE, W. C.
Fuel outlook dictating technical transport research
05 p0011 A75-11427
- WHEATON, W. L.
The Mitre solar energy demonstration system
06 p0055 A75-24676
- WHELOCK, T. D.
Coal processing by electrofluids
[PB-236588/0] 06 p0088 N75-18743
- WHISHAW, M. L.
Waste lubricating oil research. A comparison of
bench-test properties of re-refined and virgin
lubricating oils
[PB-238124/2] 06 p0097 N75-20746
- WHITNEY, W. T.
Interferometric tuning of a 15-atm CO₂ laser
06 p0058 A75-27518
- WILCOX, H. A.
The oceanic biomass energy plantation
[AIAA PAPER 75-635] 06 p0063 A75-28599
- WILLIAMS, D. A.
A heat pump powered by natural thermal gradients
05 p0006 A75-10550
- WILLIAMS, J. R.
Solar energy: Technology and applications
05 p0012 A75-12425
- WILLIAMS, L. J.
Conceptual design of reduced energy transports
[AIAA PAPER 75-303] 06 p0047 A75-22508
Air transportation energy consumption - Yesterday,
today, and tomorrow
[AIAA PAPER 75-319] 06 p0047 A75-22515
- WILLIAMSON, K. D., JR.
Cryogenics safety in a hydrogen fuel society
06 p0061 A75-27973
- WILSON, D. R.
Development of a theoretical method for predicting
the performance of hydrogen-oxygen MHD generators
05 p0009 A75-10578
- WILSON, R. F.
Collection and concentration of solar energy using
Fresnel type lenses
[NASA-CR-142194] 06 p0080 N75-17784
- WINN, C. B.
Dynamic simulation for performance analysis of
solar heated and cooled buildings
[ASME PAPER 74-WA/SOL-8] 05 p0019 A75-16891
SIMSHAC - A simulation program for solar heating
and cooling of buildings 06 p0061 A75-28093
- WINTER, S.
Rationale for setting priorities for new energy
technology research and development
[UCRL-51511] 05 p0024 N75-10594
- WINTER, S. D.
US energy flow charts for 1950, 1960, 1970, 1980,
1985, and 1990
[UCRL-51487] 05 p0024 N75-10593
- WINTZER, D.
Energy and the environment in Baden-Wuerttemberg
[KFK-1966-UF] 05 p0030 N75-12439
- WISE, D. L.
Urban waste energy resources
[AIAA PAPER 75-632] 06 p0062 A75-28598
Fuel gas production from solid waste
[PB-238068/1] 06 p0095 N75-19843
- WISE, J. F.
Solar cell and array standardization for Air Force
spacecraft 05 p0002 A75-10486
- WISWALL, R. H., JR.
Metal hydrides as hydrogen storage media
[BNL-18887] 05 p0030 N75-12440
- Iron titanium hydride as a source of hydrogen fuel
for stationary and automotive applications
[BNL-18651] 05 p0030 N75-12441
- Metal hydrides as a source of hydrogen fuel
[BNL-14804-R] 06 p0104 N75-20876
- WITHERSPOON, P. A.
Theory of heat extraction from fractured hot dry
rock 06 p0057 A75-26544
- WOLF, M.
Methods for low cost manufacture of silicon solar
arrays
[ASME PAPER 74-WA/ENER-4] 05 p0016 A75-16836
Historic development of photovoltaic power
generation 06 p0051 A75-24215
Process development for low cost integrated solar
arrays 06 p0054 A75-24259
- WOLLENBERG, R. A.
The Lawrence Berkeley Laboratory geothermal
program in northern Nevada 06 p0100 N75-20845
- WOOD, L.
New approaches to CTR: General relativistic power
plants
[UCRL-75443] 06 p0073 N75-16362
- WOODBURY, J. R.
Continued development of energy transmission and
conversion systems
[PB-236181/4] 05 p0037 N75-14278
- WOODCOCK, G. R.
Economics analyses of solar energy utilization
05 p0004 A75-10520

- Derivation of a total satellite energy system
[AIAA PAPER 75-640] 06 p0064 A75-29118
- WOODCOCK, W.**
Design and qualification of the CTS solar cell
blanket 06 p0053 A75-24248
- WOODS, J. W.**
Acoustic array methods for instrumentation of in
situ coal gasification
[UCID-16591] 06 p0104 N75-20875
- WOOTERS, L. P.**
Shallow solar pond energy conversion system: An
analysis of a conceptual 10-MWe plant
[UCRL-51533-REV-1] 05 p0028 N75-11467
- WRIGHT, C. H.**
Development of a process for producing an ashless,
low-sulfur fuel from coal. Volume 2:
Laboratory studies. Part 1: Autoclave
experiments
[PB-236305/9] 05 p0040 N75-15169
- WRIGHT, L. O.**
Cost and size estimates for an electrochemical
bulk energy storage concept
[NASA-TM-X-3192] 05 p0039 N75-15161
- WRIGHT, R. R.**
Legal economic, and energy considerations in the
use of underground space
[PB-236755/5] 06 p0080 N75-17749
- WU, C. C.**
Solar sea power
[PB-236997/3] 06 p0082 N75-17821
- WU, Y. C. L.**
The MHD power generation system with directly
fired coal 05 p0009 A75-10577

Y

- YAFFEE, M. L.**
Lasers investigated for space propulsion
06 p0061 A75-28439
- YAHAGUCHI, M.**
Superconductive d.c. generator 06 p0061 A75-27961
- YAHAMOTO, M.**
Superconductive d.c. generator 06 p0061 A75-27961
- YANG, W.-J.**
Dynamic response of solar heat storage systems
[ASME PAPER 74-WA/HT-22] 05 p0018 A75-16867
- YARYMOVICH, M. I.**
Energy-related research and development in the
United States Air Force 06 p0075 N75-16979
- YASUI, R. K.**
Status of JPL solar powered experiments for
terrestrial applications 05 p0005 A75-10530
- YASUMO, T.**
Production of hydrogen from water using nuclear
energy. A review
[JAERI-M-5642] 06 p0093 N75-19824
- YATER, J. C.**
Power conversion of energy fluctuations 05 p0011 A75-11497
- YERSHOV, A. A.**
Solar energy
[NASA-TT-F-16155] 06 p0081 N75-17787
- YIP, P. C.**
A design parameter for assessing wicking
capabilities of heat pipes
[AIAA PAPER 74-1266] 05 p0010 A75-11107
- YOKOTA, M. J.**
Cryogenic properties of Fe-Mn and Fe-Mn-Cr alloys
[LBL-2764] 06 p0066 N75-15781
- YORK, C. I.**
Solar energy program plan for heating and cooling
buildings
[WASH-1337-5-DRAFT] 06 p0077 N75-16993
- YOUNG, H. W.**
Legal economic, and energy considerations in the
use of underground space
[PB-236755/5] 06 p0080 N75-17749
- YOUNG, W. C.**
Wisconsin superconductive energy storage project,
volume 1
[PB-238082/2] 06 p0105 N75-20887

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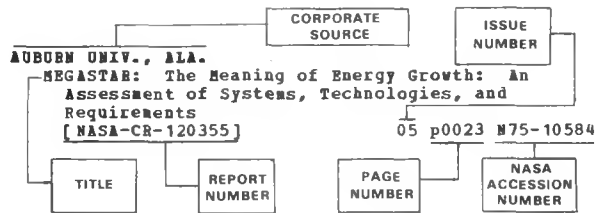
- ZACKAY, V. F.**
Cryogenic properties of Fe-Mn and Fe-Mn-Cr alloys
[LBL-2764] 06 p0066 N75-15781
- ZAKHIDOV, R. A.**
Study of energy distribution in the field of
concentration of a solar power plant with a
hyperboloid counterreflector 05 p0010 A75-11195
- Energy distribution in the concentration field of
a solar installation with a hyperboloidal
counter-reflector 06 p0049 A75-23407
- ZARE, R.**
Workshop in Gas-Phase Molecular Interactions and
the Nation's Energy Problem
[PB-236712/6] 06 p0086 N75-18718
- ZAVRACKY, P. H.**
Transparent heat-mirror films of TiO₂/Ag/TiO₂ for
solar energy collection and radiation insulation
05 p0015 A75-16378
- ZENER, C.**
Site limitations on Solar Sea Power Plants
[AIAA PAPER 75-618] 06 p0062 A75-28594
- Solar sea power
[PB-235469/4] 05 p0038 N75-14284
- Solar sea power
[PB-236997/3] 06 p0082 N75-17821
- ZERHOOT, F. S.**
Interfuel substitution in the consumption of
energy in the United States. Part 1:
Residential and commercial sector
[PB-234536/1] 05 p0040 N75-15178
- ZOSCHAK, R. J.**
A central receiver solar power plant in a hybrid
mode of operation
[AIAA PAPER 75-624] 06 p0062 A75-28596
- ZYGIELBAUM, P. S.**
Potential for large-scale energy storage in
electric utility systems
[ASME PAPER 74-WA/ENER-9] 05 p0016 A75-16840

CORPORATE SOURCE INDEX

ENERGY / A Continuing Bibliography (Issue 6)

OCTOBER 1975

Typical Corporate Source Index Listing



The title of the document is used to provide a brief description of the subject matter. The issue, page number and NASA or AIAA accession number are included in each entry to assist the user in locating the abstract in the abstract section of an individual supplement of *Energy*. If applicable, a report number is also included as an aid in identifying the document.

A

- ADVANCED KINETICS, INC., COSTA MESA, CALIF.**
 Chemical to electromagnetic energy conversion techniques
 [AD-783901] 05 p0026 N75-10609
- ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT, PARIS (FRANCE).**
 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
 [ANCR-1155] 06 p0076 N75-16985
- AIR FORCE AERO PROPULSION LAB., WRIGHT-PATTERSON AFB, OHIO.**
 Evaluation of an ion exchange membrane fuel cell for space power
 [AD-786888] 05 p0037 N75-14274
- AIR FORCE DEPT., WASHINGTON, D.C.**
 Energy-related research and development in the United States Air Force
 06 p0075 N75-16979
- AIR FORCE SYSTEMS COMMAND, WRIGHT-PATTERSON AFB, OHIO.**
 Development of solar engineering in the USSR
 [AD-784708] 05 p0025 N75-10597
 Energy characteristics of coaxial plasma source
 [AD-787419] 06 p0073 N75-16368
- ALABAMA ENERGY MANAGEMENT BOARD, MONTGOMERY.**
 Petroleum in Alabama
 [PB-237353/8] 06 p0085 N75-18442
 Coal in Alabama
 [PB-236583/1] 06 p0088 N75-18736
 Natural gas in Alabama
 [PB-236582/3] 06 p0088 N75-18737
- ALASKA UNIV., COLLEGE.**
 Wind power potential of Alaska. Part 1: Surface wind data from specific coastal sites
 [PB-238507/8] 06 p0105 N75-20885
- ALLIED CHEMICAL CORP., IDAHO FALLS, IDAHO.**
 Possibilities for lithium borohydride recycle
 [ICP-1054] 06 p0074 N75-16651
- AMERICAN CYANAMID CO., STAMFORD, CONN.**
 Research on cadmium stannate selective optical films for solar energy applications
 [PB-236208/5] 06 p0071 N75-16117
- AMERICAN GAS ASSOCIATION, INC., ARLINGTON, VA.**
 A survey of LNG technological needs in the USA: 1974 to beyond 2000
 05 p0030 N75-12435
- APPLIED PHYSICS LAB., JOHNS HOPKINS UNIV., SILVER SPRING, MD.**
 Engine development program for the APL remotely piloted vehicle
 [AD-787507] 06 p0065 N75-15658
 The multirun superflywheel
 [AD-A001081] 06 p0085 N75-18594
- ARGONNE NATIONAL LAB., ILL.**
 Reduction of atmospheric pollution by the application of fluidized-bed combustion
 [PB-235840/6] 06 p0072 N75-16151
 High energy battery program at Argonne National Laboratory
 [ANL-8064] 06 p0076 N75-16984
 Development of high specific energy batteries for electric vehicles
 [ANL-8058] 06 p0076 N75-16990
 Status and outlook for energy conversion via fuel cells
 [CONF-740462-1] 06 p0087 N75-18729
 Development of lithium/sulfur cells for application to electric automobiles
 [CONF-740805-7] 06 p0094 N75-19829
- ARIZONA STATE UNIV., TEMPE.**
 An intercell heat pipe for fuel cell and battery cooling
 [AD-782888] 05 p0027 N75-11226
 Terrestrial photovoltaic power systems with sunlight concentration
 [PB-236180/6] 06 p0072 N75-16120
 Terrestrial photovoltaic power systems with sunlight concentration
 [PB-238582/1] 06 p0105 N75-20886
- ARIZONA UNIV., TUCSON.**
 Chemical vapor deposition research for fabrication of solar energy converters
 [PB-235481/9] 05 p0041 N75-15185
 Research applied to solar-thermal power systems: Chemical vapor deposition research for fabrication of solar energy converters
 [PB-234565/0] 05 p0041 N75-15186
 Chemical vapor deposition research for fabrication of solar energy converters
 [PB-236189/7] 06 p0072 N75-16119
 Regional economics: A subset of simulation of the effects of coal-fired power development in the four corners region
 06 p0107 N75-21153
- ARMY COLD REGIONS RESEARCH AND ENGINEERING LAB., HANOVER, N.H.**
 Management of power plant waste heat in cold regions
 [AD-A003217] 06 p0104 N75-20881
- ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER, CHARLOTTESVILLE, VA.**
 Standardized wind electric power unit
 [AD-783764] 05 p0025 N75-10598
 Devices based on thermoelectrical phenomena
 [AD-783821] 05 p0026 N75-10836
 Geothermal power station
 [AD-785948] 05 p0037 N75-14275
 Wind and solar power engineering
 [AD-786844] 05 p0039 N75-15168
 Thermodynamic analysis and parameter optimization of a solar thermoelectric power unit with radiation heat dissipation
 [AD-A000211] 06 p0082 N75-17819
 The MHD generator: A step toward the energy supply of tomorrow
 [AD-A000087] 06 p0089 N75-18749
 The generator of the future
 [AD-A001515] 06 p0089 N75-18754
 Improving the oil storage system of western Siberia
 [AD-A002717] 06 p0092 N75-19705

ARMY WAR COLL., CARLISLE BARRACKS, PA.

Oil for the free world in the 1970's
[AD-779352] 05 p0031 N75-12448
Economic impact on the free world of the oil
crisis, October 1973 - March 1974
[AD-A003136] 06 p0107 N75-21156

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[TID-3351] 06 p0103 N75-20871

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desulfurization: A bibliography, 1930 - 1974
[TID-3349] 05 p0023 N75-10578
Energy transportation, distribution, and storage
[WASH-1281-4] 05 p0024 N75-10595
DCTR power supply and energy storage review
meeting
[WASH-1310] 05 p0031 N75-12445
Nuclear power growth, 1974 - 2000
[WASH-1139-74] 05 p0031 N75-12723
Fusion power by magnetic confinement
[WASH-1290] 05 p0031 N75-12797
Status and objective of Tokamak systems for
fusion research
[WASH-1295] 05 p0035 N75-13644
Solar energy program plan for heating and
cooling buildings
[WASH-1337-5-DRAFT] 06 p0077 N75-16993
Geothermal research and development program of
the US Atomic Energy Commission
06 p0098 N75-20834

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thermonuclear fusion
[AECL-4840] 06 p0106 N75-21099

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Assessment of Systems, Technologies, and
Requirements
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MEGASTAR: The meaning of growth. An assessment
of systems, technologies, and requirements
[NASA-CR-120338] 05 p0033 N75-13381

B

BATTELLE COLUMBUS LABS., OHIO.

Design installation and operation of a 25
ton-a-day coal gasification process
development unit for the agglomerating
burner-gasification
[PB-237625/9] 06 p0087 N75-18734
Study of potential problems and optimum
opportunities in retrofitting industrial
processes to low and intermediate energy gas
from coal
[PB-237116/9] 06 p0088 N75-18739

BATTELLE MEMORIAL INST., RICHLAND, WASH.
A process for cleaning and removal of sulfur
compounds from low Btu gases
[PB-236522/9] 06 p0065 N75-15768

BATTELLE-NORTHWEST, RICHLAND, WASH.
Methanol from forestry, municipal, and
agricultural organic residues
[BNWL-SA-5053] 06 p0085 N75-18702
Coal structure and reactivity
[TID-26637] 06 p0097 N75-20805
The Marysville, Montana Geothermal Project
06 p0100 N75-20849
Energy and fixed nitrogen from agricultural
residues
[BNWL-SA-5070] 06 p0103 N75-20874

BATTELLE PACIFIC NORTHWEST LABS., RICHLAND, WASH.
Interesting possibilities of fusion-fission
[BNWL-SA-5069] 06 p0096 N75-20106

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resources for a proof of concept facility
06 p0101 N75-20857

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MO.**
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electricity
[NASA-CR-134724] 06 p0066 N75-16079
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receiver POCE project, subsystem
specifications studies
[PB-238002/0] 06 p0087 N75-18733

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Fuel conservation possibilities for terminal
area compatible aircraft
[NASA-CR-132608] 06 p0091 N75-19224

BOEING VERTOL CO., PHILADELPHIA, PA.
Documenting helicopter operations from an energy
standpoint
[NASA-CR-132578] 06 p0084 N75-18220

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[PB-236266/3] 05 p0037 N75-14281
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vehicles
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Energy from the earth's depths
[BLL-M-23516-(5828.4P)] 06 p0074 N75-16968
Dry oil
[BLL-M-23508-(5828.4P)] 06 p0074 N75-16969
Utilizing fuel more efficiently in reheating and
heat treatment furnaces
[BLL-M-21957-(5828.4P)] 06 p0080 N75-17467
Exploration of Antarctica: Past and present
[BLL-M-23343-(5828.4P)] 06 p0080 N75-17722
The action of EDF in the prevention of
atmospheric pollution
[BLL-CE-TRANS-6500-(9022.09)] 06 p0083 N75-17833
Steps into the future. Development of the power
industry in the USSR
[BLL-M-23330-(5828.4P)] 06 p0085 N75-18714
Man-made sun. Thermonuclear engineering
developments
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The gasification of coal: A bibliography
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Applications of fusion power technology to the
chemical industry
[BNL-18815] 05 p0029 N75-11730
Metal hydrides as hydrogen storage media
[BNL-18887] 05 p0030 N75-12440
Iron titanium hydride as a source of hydrogen
fuel for stationary and automotive applications
[BNL-18651] 05 p0030 N75-12441
Survey of applications of fusion power
technology to the chemical and material
processing industry
[BNL-18866] 05 p0031 N75-12443
Energy storage for utilities via hydrogen systems
[BNL-19266] 06 p0086 N75-18725
Energy systems analysis and technology
assessment program
[BNL-18984] 06 p0094 N75-19831
Hydrogen storage and production in utility systems
[BNL-18920] 06 p0097 N75-20580
Hydrogen economy: A utility perspective
[BNL-19267] 06 p0103 N75-20870
Hydrogen storage and production in utility systems
[BNL-19249] 06 p0103 N75-20873
Metal hydrides as a source of hydrogen fuel
[BNL-14804-R] 06 p0104 N75-20876
Synthetic fuels from fusion reactors
[BNL-19351] 06 p0106 N75-21098
Synopsis of studies on synthetic fuels
production by fusion reactors
[BNL-19336] 06 p0106 N75-21104

BUREAU OF MINES, ANCHORAGE, ALASKA.
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[PB-235767/1] 06 p0066 N75-16071

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bench-test properties of re-refined and virgin
lubricating oils
[PB-238124/2] 06 p0097 N75-20746

BUREAU OF MINES, DALLAS, TEX.
Profitability analysis of producing crude oil by
waterflooding using a simulation technique
[PB-237843/8] 06 p0088 N75-18738

- BUREAU OF MINES, LARAMIE, WYO.**
 Preliminary evaluation of underground coal
 gasification at Hanna, Wyoming
 [BM-TPR-82] 05 p0025 N75-10599
 Retorting indexes for oil-shale pyrolyses from
 ethylene-ethane ratios of product gases
 [PB-234050/3] 05 p0034 N75-13399
- BUREAU OF MINES, MORGANTOWN, W.VA.**
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 [PB-234682/3] 05 p0040 N75-15172
 Relationships of earth fracture systems to
 productivity of a gas storage reservoir
 [PB-237894/1] 06 p0089 N75-18759
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 featuring gas combustion retorting
 [PB-237851/1] 06 p0093 N75-19813
- BUREAU OF MINES, PITTSBURGH, PA.**
 Degasification of the Mary Lee coalbed near Oak
 Grove, Jefferson County, Alabama, by vertical
 borehole in advance of mining
 [BM-RI-7968] 05 p0028 N75-11462
 The reserve base of bituminous coal and
 anthracite for underground mining in the
 Eastern United States
 [PB-237815/6] 06 p0085 N75-18713
 Methane in the Pittsburgh coalbed, Washington
 County, Pennsylvania
 [PB-237848/7] 06 p0089 N75-18760
- BUREAU OF MINES, SAN FRANCISCO, CALIF.**
 Solvent stimulation tests in two California
 oilfields
 [PB-237849/5] 06 p0090 N75-18761
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 energy
 [PB-234733/4] 05 p0040 N75-15171
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 and disposal of mineral, metal, and
 energy-based wastes
 [PB-227476/9] 05 p0042 N75-15203
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 and regions, 1972
 [PB-236581/5] 06 p0077 N75-17004
- BUREAU OF NATURAL GAS, WASHINGTON, D.C.**
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 leases, January 1974, phase 1
 05 p0027 N75-11457
 Offshore investigation: Producing shut-in
 leases as of January 1974, phase 2
 05 p0027 N75-11458
- BUREAU OF RECLAMATION, BOULDER CITY, NEV.**
 Overview of Reclamation's geothermal program in
 Imperial Valley, California
 06 p0098 N75-20835
 Heat flow and geothermal potential of the East
 Mesa KGRA, Imperial Valley, California
 06 p0099 N75-20838
- BUREAU OF RECLAMATION, HOLTVILLE, CALIF.**
 Preliminary results of geothermal desalting
 operations at the East Mesa test site Imperial
 Valley, California
 06 p0101 N75-20950
- C**
- CALIFORNIA INST. OF TECH., PASADENA.**
 Caltech seminar series on energy consumption in
 private transportation
 [PB-235348/0] 05 p0040 N75-15179
 Caltech seminar series on energy consumption in
 private transportation: Administrative summary
 [PB-235349/8] 05 p0041 N75-15184
- CALIFORNIA POLYTECHNIC STATE UNIV., SAN LUIS OBISPO.**
 Research on the application of solar energy to
 the food drying industry
 [PB-238073/1] 06 p0105 N75-20888
- CALIFORNIA STATE OFFICE OF SCIENCE AND TECHNOLOGY,
 SACRAMENTO.**
 California energy workshop: Developing a plan
 of action to meet the energy crisis in
 California
 [PB-237045/0] 06 p0082 N75-17822
- CALIFORNIA UNIV., BERKELEY. LAWRENCE BERKELEY LAB.**
 Cryogenic properties of Fe-Mn and Fe-Mn-Cr alloys
 [LBL-2764] 06 p0066 N75-15781
- Comparison of computer programs used for
 modeling solar heating and air conditioning
 systems for buildings
 [LBL-3066] 06 p0079 N75-17279
 The Lawrence Berkeley Laboratory geothermal
 program in northern Nevada
 06 p0100 N75-20845
- CALIFORNIA UNIV., LIVERMORE. LAWRENCE LIVERMORE LAB.**
 US energy flow charts for 1950, 1960, 1970,
 1980, 1985, and 1990
 [UCRL-51487] 05 p0024 N75-10593
 Rationale for setting priorities for new energy
 technology research and development
 [UCRL-51511] 05 p0024 N75-10594
 Review of direct energy conversion of ion beams:
 Experimental results and reactor applications
 [UCRL-75600] 05 p0028 N75-11466
 Shallow solar pond energy conversion system: An
 analysis of a conceptual 10-MWe plant
 [UCRL-51533-REV-1] 05 p0028 N75-11467
 Outlook for fusion energy sources: Remaining
 technological hurdles
 [UCRL-75418] 05 p0029 N75-11745
 Revised cost estimate for the LLL in situ coal
 gasification concept
 [UCRL-51578] 05 p0039 N75-15166
 DART: A simulation code for a direct energy
 converter for fusion reactors
 [UCRL-51557] 05 p0043 N75-15462
 ABC in situ oil shale program
 [UCID-16520] 06 p0068 N75-16090
 New approaches to CTR: General relativistic
 power plants
 [UCRL-75443] 06 p0073 N75-16362
 Materials screening program for the LLL
 geothermal project
 [UCRL-75353] 06 p0082 N75-17815
 LLL-SOHIO solar process heat project
 [UCID-16630-74-1] 06 p0093 N75-19827
 Fracture-induced permeability: Present
 situation and prospects for coal
 [UCID-16593] 06 p0094 N75-19830
 Environmental aspects of methanol as vehicular
 fuel: Health and environmental effects
 [UCRL-76076] 06 p0095 N75-19867
 Methodical approach to temperature and pressure
 measurements for in situ energy-recovery
 processes
 [UCID-16631] 06 p0097 N75-20693
 The total flow concept for geothermal energy
 conversion
 06 p0100 N75-20846
 Acoustic array methods for instrumentation of in
 situ coal gasification
 [UCID-16591] 06 p0104 N75-20875
- CALIFORNIA UNIV., LIVERMORE. LAWRENCE RADIATION LAB.**
 Use of methanol in transportation
 [UCID-16528] 06 p0077 N75-16996
- CALIFORNIA UNIV., RIVERSIDE.**
 Geophysical, geochemical, and geological
 investigations of the Dunes geothermal system,
 Imperial Valley, California
 [IGPP-UCR-74-31] 06 p0098 N75-20836
- CARNEGIE-MELLON UNIV., PITTSBURGH, PA.**
 Solar sea power
 [PB-235469/4] 05 p0038 N75-14284
 Solar sea power
 [PB-236997/3] 06 p0082 N75-17821
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 [NASA-CR-142119] 06 p0078 N75-17188
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 CALIF.**
 Cooperative efforts by industry and government
 to develop geothermal resources
 06 p0102 N75-20861
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 A city invests in its future
 06 p0102 N75-20862
- COLORADO SCHOOL OF MINES, GOLDEN.**
 The Colorado School of Mines Nevada geothermal
 study
 06 p0099 N75-20837
- COLORADO STATE UNIV., PORT COLLINS.**
 Primary data on economic activity and water use
 in prototype oil shale development areas of
 Colorado: An initial inquiry
 [PB-236039/4] 05 p0037 N75-14277

- Solar thermal electric power systems
[PB-235475/1] 05 p0038 N75-14283
- Solar thermal electric power systems
[PB-236368/7] 06 p0071 N75-16118
- Design and construction of a residential solar heating and cooling system
[PB-237042/7] 06 p0082 N75-17823
- COLUMBIA UNIV., NEW YORK.
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[PB-236712/6] 06 p0086 N75-18718
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Low-BTU gasification of coal for electric power generation
[PB-236972/6] 06 p0088 N75-18740
- COMBUSTION POWER CO., INC., MENLO PARK, CALIF.
Energy conversion from coal utilizing CPU-400 technology
[PB-235817/4] 06 p0068 N75-16093
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[PB-237028/6] 06 p0083 N75-17828
- COMITATO NAZIONALE PER L'ENERGIA NUCLEARE, ROME (ITALY).
Beneficial uses of waste heat
[RT/PROT-(74)10] 06 p0068 N75-16091
- COMMITTEE ON APPROPRIATIONS (U. S. HOUSE).
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[GPO-32-403] 05 p0026 N75-10859
- COMMITTEE ON COMMERCE (U. S. SENATE).
Limit lead in gasoline
[GPO-29-660] 05 p0023 N75-10259
- Development of oil and gas on the Continental Shelf
[GPO-31-891] 06 p0075 N75-16973
- COMMITTEE ON INTERIOR AND INSULAR AFFAIRS (U. S. HOUSE).
Oil shale development, part 2
[GPO-30-368] 05 p0027 N75-11455
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[GPO-28-608] 05 p0024 N75-10588
- National Crude Oil Refinery Development Act, part 2
[GPO-35-578] 05 p0027 N75-10860
- The National Coal Conversion Act and the National Crude Oil Refinery Development Act
[GPO-28-964] 05 p0027 N75-10861
- The prospects for gasoline availability: 1974
[GPO-34-969] 05 p0039 N75-15155
- Oversight: Mandatory petroleum allocation programs, part 1
[GPO-30-060] 05 p0039 N75-15158
- Oversight: Mandatory petroleum allocation programs, part 2
[GPO-31-519] 05 p0039 N75-15159
- Prototype oil shale leasing program
[GPO-28-686] 05 p0039 N75-15160
- An assessment and analysis of the energy emergency
[GPO-25-382] 06 p0066 N75-16076
- Market performance and competition in the petroleum industry, part 1
[GPO-28-503] 06 p0066 N75-16077
- Oversight: Mandatory petroleum allocation programs
[GPO-31-027] 06 p0081 N75-17806
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[GPO-31-412] 05 p0023 N75-10581
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[GPO-31-711] 06 p0067 N75-16081
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[GPO-29-802] 06 p0073 N75-16410
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[GPO-27-032] 05 p0023 N75-10580
- Advanced nuclear research
[GPO-41-253] 05 p0026 N75-10764
- Bioconversion
[GPO-37-403] 05 p0028 N75-11463
- Solar sea thermal energy
[GPO-37-476] 05 p0030 N75-12430
- Energy and environmental standards
[GPO-37-171] 05 p0030 N75-12431
- Solar photovoltaic energy
[GPO-39-576] 05 p0032 N75-13379
- Wind energy
[GPO-37-390] 05 p0033 N75-13387
- Conservation and efficient use of energy
[H-REPT-93-1634] 05 p0036 N75-14265
- Energy from US and Canadian tar sands: Technical, environmental, economic, legislative, and policy aspects
[GPO-43-005] 06 p0067 N75-16083
- Synthetic Liquid Fuel Research and Development Act of 1974
[GPO-44-818] 06 p0103 N75-20867
- COMMITTEE ON WAYS AND MEANS (U. S. SENATE).
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[H-REPT-93-998] 05 p0026 N75-10857
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[B-164105] 06 p0075 N75-16975
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[NVO-148] 06 p0094 N75-19833
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Energy and the environment: Electric power
05 p0030 N75-12438
- OCS oil and gas: An environmental assessment, volume 3
06 p0083 N75-17836
- OCS oil and gas: An environmental assessment, Volume 1
06 p0083 N75-17837
- OCS oil and gas: An environmental assessment, Volume 2
06 p0084 N75-17838
- OCS oil and gas: An environmental assessment, volume 4
06 p0084 N75-17839
- OCS oil and gas: An environmental assessment, volume 5
06 p0084 N75-17840

D

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[PB-235254/0] 06 p0070 N75-16105
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[PB-236193/9] 06 p0071 N75-16115
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[PB-238285/1] 06 p0105 N75-20884
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06 p0079 N75-17197
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[PB-237316/5] 06 p0083 N75-17827
- DYNATECH R/D CO., CAMBRIDGE, MASS.
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[PB-238068/1] 06 p0095 N75-19843

E

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Sulfur-based lithium-organic electrolyte secondary batteries
[AD-A003309] 06 p0104 N75-20882

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[OA-TRANS-938-PT-1] 06 p0074 N75-16970
Heat pumps in large buildings
[OA-TRANS-939] 06 p0078 N75-17184

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[PB-236608/6] 06 p0084 N75-17848

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[PB-237696/0] 06 p0091 N75-18797

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06 p0078 N75-17193

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[PB-235474/4] 05 p0038 N75-14282
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[PB-237113/6] 06 p0095 N75-19879

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[ESRO-TT-123] 06 p0104 N75-20878
Problems of the future and potentialities of system engineering
[ESRO-TT-110] 06 p0107 N75-21218

EXXON RESEARCH AND ENGINEERING CO., LINDEN, N.J.
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[PB-235581/6] 05 p0041 N75-15187
Feasibility study of alternative fuels for automotive transportation. Volume 2: Technical section
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Feasibility study of alternative fuels and automotive transportation. Volume 3: Appendices
[PB-235583/2] 05 p0041 N75-15189
Effects of changing the proportions of automotive distillate and gasoline produced by petroleum refining
[PB-236900/7] 06 p0085 N75-18443
Evaluation of pollution control in fossil fuel conversion processes: Gasification. Section 1: Lurgi process
[PB-237694/5] 06 p0096 N75-19880

F

FAIRCHILD SPACE AND ELECTRONICS CO., GERMANTOWN, MD.
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[AEC-SNS-3063-3-VOL-1] 06 p0065 N75-15742

FEDERAL ENERGY ADMINISTRATION, WASHINGTON, D.C.
Project Independence
05 p0029 N75-12428
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[PB-237142/5] 06 p0087 N75-18730
Report to congress on petrochemicals
[PB-238064/0] 06 p0097 N75-20478

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[PB-234490/1] 05 p0040 N75-15174
Total energy supply and demand, volume 1, chapter 6
06 p0067 N75-16082

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[GPO-31-027] 06 p0081 N75-17806

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05 p0032 N75-13378

PMC CORP., PRINCETON, N.J.
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[PB-236631/8] 06 p0071 N75-16113
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[PB-236632/6] 06 p0078 N75-17007
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[PB-236633/4] 06 p0078 N75-17008

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[PB-236247/3] 06 p0071 N75-16114
Summary of results of solar power arrays for the concentration of energy study
[PB-238003/8] 06 p0089 N75-18756

G

GENERAL ELECTRIC CO., CINCINNATI, OHIO.
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[NASA-CR-134696] 06 p0073 N75-16637

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[PB-235433/0] 05 p0042 N75-15191
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[PB-235431/4] 06 p0069 N75-16101
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[PB-235432/2] 06 p0069 N75-16102
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[PB-235434/8] 06 p0070 N75-16108
Multi-hundred watt radioisotope thermoelectric generator program, part 1
[GESP-7107-PT-1] 06 p0092 N75-19354
Multi-hundred watt radioisotope thermoelectric generator program, part 2
[GESP-7107-PT-2] 06 p0092 N75-19355
Evaluation of a fossil fuel fired ceramic regenerative heat exchanger
[PB-236346/3] 06 p0092 N75-19599
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[PB-236068/3] 06 p0072 N75-16124

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Leasing of federal geothermal resources
06 p0099 N75-20841

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Geothermal reservoir simulation
06 p0101 N75-20852

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Measuring ground movement in geothermal areas of Imperial Valley, California
06 p0099 N75-20842

GILBERT ASSOCIATES, INC., READING, PA.
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[PB-235780/4] 06 p0072 N75-16125

GRUMMAN AEROSPACE CORP., BETHPAGE, N.Y.
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[NASA-CR-139140] 05 p0023 N75-10347

GULF GENERAL ATOMIC, SAN DIEGO, CALIF.
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[PB-236156/6] 05 p0037 N75-14279

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[GA-A-12848] 05 p0038 N75-14832

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05 p0030 N75-12432

H

HAMILTON STANDARD DIV., UNITED AIRCRAFT CORP., WINDSOR LOCKS, CONN.
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[NP-20023] 06 p0067 N75-16088

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Hawaii geothermal project
06 p0099 N75-20840

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[PB-236196/2] 06 p0071 N75-16116

HERBERT H. LEHMANN COLL., BRONX, N.Y.
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[PB-238783/5] 06 p0106 N75-21028

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[PB-237151/6] 06 p0088 N75-18744

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[PB-238069/9] 06 p0089 N75-18755

HOLT (BEN) CO., PASADENA, CALIF.
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[PB-236669/8] 06 p0090 N75-18786

Investment and operating costs of binary cycle geothermal power plants
06 p0101 N75-20855

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Dynamic conversion of solar generated heat to electricity
[NASA-CR-134724] 06 p0066 N75-16079

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[PB-238002/0] 06 p0087 N75-18733

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06 p0079 N75-17200

Economic modeling and energy policy planning
06 p0079 N75-17210

The evaluation of surface geometry modification to improve the directional selectivity of solar energy collectors
[PB-236412/3] 06 p0083 N75-17830

Solar thermal power systems based on optical transmission
[PB-237005/4] 06 p0088 N75-18742

Energy recovery from solid waste. Volume 1: Summary report
[NASA-CR-2525] 06 p0098 N75-20830

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[AD-785084] 05 p0032 N75-12857

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[PB-235468/6] 05 p0041 N75-15183

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[PB-235487/6] 06 p0070 N75-16104

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06 p0100 N75-20844

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[PB-237209/2] 06 p0083 N75-17826

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[PB-237215/9] 06 p0084 N75-17853

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[PB-236164/0] 06 p0072 N75-16122

- Low to high temperature energy conversion system
[NASA-CASE-NPO-13510-1] 06 p0074 N75-16972
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photovoltaic power system for large scale
national energy applications
[NSF/RA/N-74-072] 06 p0080 N75-17785
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06 p0101 N75-20856
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industry
[GPO-33-873] 05 p0038 N75-15150
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[JPRS-63514] 05 p0027 N75-10983
Further development of scientific research in
the field of geology and of the survey and
exploration of petroleum and gas
[JPRS-63414] 05 p0027 N75-11410
Prospects for utilization of underwater houses
and chambers in development of marine oil
deposits
05 p0029 N75-11606
First Joint Soviet-American Colloquium on the
Problems of MHD Energy Conversion
[JPRS-63794] 06 p0081 N75-17790
Prospects for magnetohydrodynamic electric power
plants in power engineering
06 p0081 N75-17791
Some developments of industrial
magnetohydrodynamic electric power plants
06 p0081 N75-17792
Experience in the first step of the mastery of
the U-25 device
06 p0081 N75-17793
Electronic model of the U-25 device
06 p0081 N75-17794
Scientific research seeks new sources of energy
06 p0107 N75-21216
- K**
- KANNER (LEO) ASSOCIATES, REDWOOD CITY, CALIF.**
The economics of using wind power for
electricity supply in the Netherlands and for
water supply on Curacao
[NASA-TT-P-15982] 05 p0024 N75-10587
Utilization of solar energy
[NASA-TT-P-16090] 05 p0033 N75-13382
Solar power generating systems as sources of
non-polluting energy (power generation in
space and power generation on the ground)
[NASA-TT-P-16091] 05 p0033 N75-13383
Wind power projects of the French electrical
authority
[NASA-TT-P-16057] 05 p0033 N75-13384
Exploiting wind power for the production of
electricity
[NASA-TT-P-16058] 05 p0033 N75-13385
Report of the Wind Power Committee
[NASA-TT-P-16062] 05 p0039 N75-15154
Wind power machines
[NASA-TT-P-16195] 06 p0080 N75-17786
Solar energy
[NASA-TT-P-16155] 06 p0081 N75-17787
Wind motors: Theory, construction, assembly and
use in drawing water and generating electricity
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The USA: The scientific and technical
revolution and trends in foreign policy
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SNG, and low-Btu gas from coal
[PB-237670/5] 06 p0095 N75-19838
Changes in the global energy balance
[PB-238075/6] 06 p0106 N75-20936
- KENTRON HAWAII LTD., HOUSTON, TEX.**
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natural gas storage vessel
[NASA-CR-141455] 05 p0036 N75-14135
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result by using a high temperature reactor for
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[JUL-1077] 06 p0093 N75-19828
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Technical, environmental, economic,
legislative, and policy aspects
[GPO-43-005] 06 p0067 N75-16083
Development of oil and gas on the Continental
Shelf
[GPO-31-891] 06 p0075 N75-16973
- LITTLE (ARTHUR D.), INC., CAMBRIDGE, MASS.**
Impact of motor gasoline lead additive
regulations on petroleum refineries and energy
resources, 1974-1980, phase 1
[PB-234185/7] 05 p0025 N75-10601
Dependence of the United States on essential
imported materials, year 2000; volume 1
[AD-A000842] 06 p0096 N75-20157
Dependence of the United States on essential
imported materials, year 2000. Volume 2:
Appendices
[AD-A000843] 06 p0096 N75-20158
- LLOYD CORP., LOS ANGELES, CALIF.**
Combining total energy and energy industrial
center concepts to increase utilization
efficiency of geothermal energy
06 p0102 N75-20860
- LOCKHEED AIRCRAFT CORP., BURBANK, CALIF.**
Evaluation of advanced lift concepts and
potential fuel conservation for short-haul
aircraft
[NASA-CR-2502] 06 p0073 N75-16557
- LOCKHEED AIRCRAFT CORP., SUNNYVALE, CALIF.**
Evaluation of advanced lift concepts and fuel
conservative short-haul aircraft, volume 1
[NASA-CR-137525] 06 p0096 N75-20291
Evaluation of advanced lift concepts and fuel
conservative short-haul aircraft, volume 2
[NASA-CR-137526] 06 p0097 N75-20292
- LOCKHEED MISSILES AND SPACE CO., HUNTSVILLE, ALA.**
Solar energy concentrator system for crystal
growth and zone refining in space
[NASA-CR-120623] 06 p0086 N75-18719
- LOCKHEED MISSILES AND SPACE CO., SUNNYVALE, CALIF.**
Test report SEPS solar array root section model
[NASA-CR-120606] 06 p0067 N75-16085
- LOCKHEED-CALIFORNIA CO., BURBANK.**
Study of active cooling for supersonic transports
[NASA-CR-132573] 06 p0079 N75-17336
- LOS ALAMOS SCIENTIFIC LAB., N.MEX.**
Application of technology from the Rover program
and related developments
[LA-5558] 05 p0028 N75-11468
Process environment effects on heat pipes for
fluid-bed gasification of coal
[LA-UR-74-984] 05 p0029 N75-12252
Energy storage for the electric power industry
[LA-UR-74-918] 05 p0031 N75-12447
Superconducting magnetic energy storage
[LA-UR-74-737] 05 p0032 N75-12814
Methods of energy transfer from a magnetic
energy storage system using a transfer
capacitor and a superconducting switch
[LA-5631-M5] 05 p0032 N75-13164
Geothermal energy: A new application of rock
mechanics
[LA-UR-74-821] 06 p0068 N75-16089
Conceptual design of a heat pipe methanator
[LA-5596] 06 p0074 N75-16774
The initiatives of the Los Alamos Scientific
Laboratory in the transfer of a new excavation
technology
06 p0079 N75-17203

Control system design and simulation for solar heated structures
[LA-UR-74-1085] 06 p0082 N75-17813

Energy and cryoengineering
[LA-UR-74-741] 06 p0082 N75-17814

Prospect for geothermal power
[LA-UR-74-1111] 06 p0086 N75-18723

Economic and system aspects of a superconducting magnetic energy storage device and a dc superconducting transmission line
[LA-UR-74-1145] 06 p0091 N75-19080

Progress of the LASL dry hot rock geothermal energy project
06 p0100 N75-20848

Rock melting technology and geothermal drilling
06 p0101 N75-20851

Magnetic Energy Transfer and Storage (METS) program schedules for a Fusion Test Reactor (FTR)
[LA-5748-MS] 06 p0106 N75-21097

M

MARTIN MARIETTA CORP., DENVER, COLO.
Solar power system and component research program
[PB-236159/0] 05 p0037 N75-14280

Solar thermal subsystem specification study
[PB-238005/3] 06 p0083 N75-17829

MARYLAND UNIV., COLLEGE PARK.
Heat Pipe Symposium/Workshop
[PB-236008/9] 05 p0035 N75-14094

Proceedings of the Solar Heating and Cooling for Buildings Workshop. Part 2: Panel sessions, March 23
[PB-235483/5] 06 p0069 N75-16095

MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
Interfuel substitution in the consumption of energy in the United States. Part 1: Residential and commercial sector
[PB-234536/1] 05 p0040 N75-15178

MIT fusion technology program
[COO-2431-1] 06 p0106 N75-21101

MASSACHUSETTS UNIV., AMHERST.
Technical and economic feasibility of the ocean thermal differences process as a solar-driven energy process
[PB-236422/2] 06 p0077 N75-17003

MCDONNELL-DOUGLAS ASTRONAUTICS CO., HUNTINGTON BEACH, CALIF.
Solar thermal power systems based on optical transmission
[PB-237005/4] 06 p0088 N75-18742

MCDOWELL-WELLMAN ENGINEERING CO., CLEVELAND, OHIO.
Large diameter 300 PSI gasifier. Preliminary engineering report. Volume 1: Description
[PB-238360/2] 06 p0105 N75-20889

MICHIGAN STATE UNIV., EAST LANSING.
Energy utilization by households and technology assessment as a way to increase its effectiveness
06 p0097 N75-20829

MICHIGAN UNIV., ANN ARBOR.
Evaluation of coal conversion processes to provide clean fuels, part 1
[PB-234202/0] 05 p0025 N75-10600

Evaluation of coal conversion processes to provide clean fuels, part 2
[PB-234203/8] 05 p0025 N75-10604

MINISTRY OF DEFENCE, PARIS (FRANCE).
Energy problems in a global context
06 p0075 N75-16978

MINNESOTA MINING AND MFG. CO., ST. PAUL.
Manportable thermoelectric generator
[AD-A002042] 06 p0095 N75-19847

MINNESOTA UNIV., MINNEAPOLIS.
Solar Power Array for the Concentration of Energy (SPACE)
[PB-236247/3] 06 p0071 N75-16114

Summary of results of solar power arrays for the concentration of energy study
[PB-238003/8] 06 p0089 N75-18756

MISSOURI UNIV., ROLLA.
Solar kine: Answer to the agricultural energy challenge of our time
06 p0086 N75-18721

Evaluation of thermal methods for recovery of viscous oils in Missouri and Kansas
[PB-237831/3] 06 p0090 N75-18762

MITRE CORP., MCLEAN, VA.
Program plan for environmental effects of energy
[PB-235115/3] 05 p0040 N75-15177

A comparative analysis of the energy consumption for several urban passenger ground transportation systems
[PB-238041/8] 06 p0107 N75-21160

MITRE CORP., WASHINGTON, D.C.
Japanese/United States Symposium on Solar Energy Systems. Volume 1: Summary of proceedings
[NTR-6284-VOL-1] 05 p0036 N75-14264

MONSANTO RESEARCH CORP., DAYTON, OHIO.
Effect of gas turbine efficiency and fuel cost on cost of producing electric power
[PB-234159/2] 05 p0034 N75-13397

Efficiencies in power generation
[PB-234160/0] 05 p0034 N75-13398

MOUND LAB., MIAMISBURG, OHIO.
Advanced heat source concepts
[MLM-2134] 05 p0024 N75-10591

N

NATIONAL ACADEMY OF ENGINEERING, WASHINGTON, D.C.
Evaluation of coal-gasification technology.
Part 1: Pipeline-W quality gas
[PB-234036/2] 05 p0034 N75-13396

Evaluation of coal-gasification technology.
Part 2: Low and intermediate BTU fuel gases
[PB-234042/0] 05 p0036 N75-14273

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. AMES RESEARCH CENTER, MOFFETT FIELD, CALIF.
Transportation vehicle energy intensities. A joint DOT/NASA reference paper
[NASA-TM-X-62404] 05 p0035 N75-13690

United States transportation fuel economics (1975 - 1995)
[NASA-TM-X-3197] 06 p0107 N75-21154

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.
Exploration for fossil and nuclear fuels from orbital altitudes
[NASA-TM-X-70781] 05 p0027 N75-11413

Solar Sea Power Plants (SSPP): A critical review and survey
[NASA-TM-X-70783] 05 p0028 N75-11459

Remote platform power conserving system
[NASA-CASE-GSC-11182-1] 05 p0032 N75-13007

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LANGLEY RESEARCH CENTER, LANGLEY STATION, VA.
Future long-range transports: Prospects for improved fuel efficiency
[NASA-TM-X-72659] 06 p0079 N75-17339

Synthetic fuels for ground transportation with special emphasis on hydrogen
[NASA-TM-X-72652] 06 p0103 N75-20868

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND, OHIO.
Wind energy developments in the 20th century
[NASA-TM-X-71634] 05 p0033 N75-13380

Cost and size estimates for an electrochemical bulk energy storage concept
[NASA-TM-X-3192] 05 p0039 N75-15161

Structural analysis of wind turbine rotors for NSF-NASA Mod-0 wind power system
[NASA-TM-X-3198] 06 p0080 N75-17712

Preliminary study of advanced turbopfans for low energy consumption
[NASA-TM-X-71663] 06 p0084 N75-18241

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEX.
An evaluation: The potential of discarded tires as a source of fuel
[NASA-TM-X-58143] 05 p0038 N75-15153

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, ALA.
Solar energy absorber
[NASA-CASE-MPS-22743-1] 05 p0024 N75-10585

Solar energy trap
[NASA-CASE-MPS-22744-1] 05 p0024 N75-10586

Analytical description of the modern steam automobile
[NASA-TM-X-72199] 05 p0035 N75-14134

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. PASADENA OFFICE, CALIF.
Low to high temperature energy conversion system
[NASA-CASE-NPO-13510-1] 06 p0074 N75-16972

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, WASHINGTON, D.C.
 Our prodigal sun [NASA-EP-118] 05 p0032 N75-12885
 Transfer of space technology to industry 06 p0078 N75-17195
 Nuclear system that burns its own wastes shows promise [NASA-NEWS-RELEASE-75-44] 06 p0085 N75-18716
 Research and technology operating plan summary: Fiscal year 1975 research and technology program [NASA-TM-X-70410] 06 p0096 N75-20155
NATIONAL AEROSPACE LAB., AMSTERDAM (NETHERLANDS).
 Impact of future fuels on military aero-engines 06 p0075 N75-16981
NATIONAL BUREAU OF STANDARDS, BOULDER, COLO.
 Hydrogen future fuel: A literature survey issued quarterly, issue no. 6 05 p0027 N75-11110
NATIONAL CENTER FOR ENERGY MANAGEMENT AND POWER, PHILADELPHIA, PA.
 Latent heat and sensible heat storage for solar heating systems [PB-236190/5] 06 p0077 N75-17005
 Technology for the conversion of solar energy to fuel gas [PB-238103/6] 06 p0104 N75-20883
NATIONAL COMMUNICATIONS SYSTEM, ARLINGTON, VA.
 Legal economic, and energy considerations in the use of underground space [PB-236755/5] 06 p0080 N75-17749
NATIONAL ENVIRONMENTAL RESEARCH CENTER, LAS VEGAS, NEV.
 Radiological surveillance program for the project Gasbuggy production test, 15 May - 6 November 1973 [NERC-LV-539-30] 06 p0073 N75-16337
NATIONAL GAS TURBINE ESTABLISHMENT, PYESTOCK (ENGLAND).
 Energy resources and utilization 06 p0075 N75-16983
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, SILVER SPRING, MD.
 Report and recommendations of the Solar Energy Data Workshop [PB-238066/5] 06 p0089 N75-18757
NATIONAL RESEARCH DEVELOPMENT CORP., LONDON (ENGLAND).
 Pressurized fluidized bed combustion [PB-236498/2] 06 p0065 N75-15769
 Pressurized fluidized bed combustion [PB-235591/5] 06 p0065 N75-15772
NATIONAL SCIENCE FOUNDATION, WASHINGTON, D.C.
 The National Geothermal Energy Research Program 06 p0098 N75-20832
 The NSF/RANN FY 1975 program for geothermal resources research and technology 06 p0098 N75-20833
NATIONAL TRANSPORTATION CENTER, PITTSBURGH, PA.
 Project Clean Air 1972, LNG conversion of GM-71 series diesel engine [PB-236585/6] 06 p0090 N75-18783
NAVAL AIR SYSTEMS COMMAND, WASHINGTON, D.C.
 Energy conversion. 1: Non-propulsive aspects [AD-A000077] 06 p0079 N75-17454
NAVAL CIVIL ENGINEERING LAB., PORT HUENEME, CALIF.
 Heat transfer design and proof tests of a radioisotope thermoelectric generator [AD-A002218] 06 p0092 N75-19608
NEDERLANDS SCHEEPS-STUDIECENTRUM TNO, DELFT.
 On the potentialities of polyphenylene oxide (PPO) as a wet-insulation material for cargo tanks of LNG-carriers [REPT-194-N] 05 p0035 N75-14002
NEW SOUTH WALES UNIV., KENSINGTON (AUSTRALIA).
 Comparison of the environmental aspects of nuclear and fossil fueled power stations [CONF-740555-1] 06 p0077 N75-16995
NEW YORK STATE ASSEMBLY SCIENTIFIC STAFF, ALBANY.
 Economic and energy conservation relationship relevant to state of New York building design and contract awards [PB-237006/2] 06 p0082 N75-17824
 Use of solar energy in buildings in New York state [PB-236974/2] 06 p0083 N75-17825
 Proceedings of the New York State Assembly/AISLE Conference on Energy and the Environment, Volume 1 [PB-237936/0] 06 p0091 N75-18801

NORTHERN STATES POWER CO., MINNEAPOLIS, MINN.
 Solar Power Array for the Concentration of Energy (SPACE) [PB-236247/3] 06 p0071 N75-16114
 Summary of results of solar power arrays for the concentration of energy study [PB-238003/8] 06 p0089 N75-18756

O

OAK RIDGE NATIONAL LAB., TENN.
 Total energy use for commercial aviation in the US [ORNL-NSF-EP-68] 05 p0023 N75-10039
 NSF-Rann energy abstracts: A monthly abstract journal of energy research [ORNL-EIS-74-52-VOL-2-NO-1] 05 p0024 N75-10592
 NSF-RANN energy abstracts. A monthly abstract journal of energy research, volume 2, no. 4 [ORNL-EIS-74-52-VOL-2-4] 05 p0029 N75-11469
 Residential energy conservation [TID-26534] 05 p0031 N75-12442
 NSF-RANN energy abstracts [ORNL-EIS-74-52-VOL-2-5] 06 p0068 N75-16092
 Recommended research program in geothermal chemistry [WASH-1344] 06 p0077 N75-16997
 Coal refining [ORNL-TR-2827] 06 p0086 N75-18724
 Survey of gas and oil burners for use with NSF/RANN-ORNL potassium boiler [ORNL-NSF-EP-45] 06 p0087 N75-18728
 Operational, maintenance, and environmental problems associated with a fossil fuel-fired potassium steam binary vapor cycle [ORNL-NSF-EP-30] 06 p0090 N75-18769
 Comparative performance characteristics of cylindrical parabolic focusing and flat plate solar energy collectors [CONF-741104-3] 06 p0103 N75-20872
OKLAHOMA INDUSTRIAL DEVELOPMENT AND PARK PLANNING, OKLAHOMA CITY.
 Application study of a nuclear coal solution gasification process for Oklahoma coal, volume 1 [PB-236156/6] 05 p0037 N75-14279
OSLO LYSVERKER (NORWAY).
 Oslo's future power supply [NP-20121] 06 p0067 N75-16087

P

PACIFIC GAS AND ELECTRIC CO., SAN RAMON, CALIF.
 The hydrogen sulfide emissions abatement program at the Geysers Geothermal Power Plant 06 p0102 N75-20859
PEAT, MARWICK, MITCHELL AND CO., WASHINGTON, D.C.
 Industrial energy studies of ground freight transportation, volume 1 [PB-236016/2] 06 p0069 N75-16099
 Industrial energy studies of ground freight transportation. Volume 2: Appendices [PB-236017/0] 06 p0069 N75-16100
PINKEL (I. IRVING), FAIRVIEW PARK, OHIO.
 Alternative fuels for aviation 06 p0075 N75-16980
PITTSBURG AND MIDWAY COAL MINING CO., KANSAS CITY, MO.
 Development of a process for producing an ashless, low-sulfur fuel from coal. Volume 2: Laboratory studies. Part 1: Autoclave experiments [PB-236305/9] 05 p0040 N75-15169
 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 [PB-237763/8] 06 p0095 N75-19839
 Development of a process for producing an ashless, low-sulfur fuel from coal. Volume 4. Product studies. Part 3 Products from coal minerals [PB-237764/6] 06 p0095 N75-19840
 Development of a process for producing an ashless, low-sulfur fuel from coal. Volume 4. Product studies. Part 4. Sulfur removal from coal minerals [PB-237765/3] 06 p0095 N75-19841

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 [PB-237766/1] 06 p0095 N75-19842

POPE, EVANS, AND ROEBINS, INC., ALEXANDRIA, VA.
Development of coal fired fluidized-bed boilers [PB-235899/2] 06 p0065 N75-15668
Development of coal fired fluidized-bed boilers [PB-235898/4] 06 p0065 N75-15669

PRATT AND WHITNEY AIRCRAFT, SOUTH WINDSOR, CONN.
Development of advanced fuel cell system, phase 2 [NASA-CR-134721] 06 p0067 N75-16084

PRINCETON UNIV., N.J.
Utilization of plasma exhaust energy for fuel production [COO-3028-7] 05 p0028 N75-11465
Summary report of workshop on Energy Related Basic Combustion Research [PB-236714/2] 06 p0079 N75-17456

PURDUE UNIV., LAFAYETTE, IND.
Novel materials for power systems. Part 3: Selective emitters for energy conversion [AD-784449] 05 p0026 N75-10608

Q

QUEEN (DOUGLAS M.), INC., NEW CANAAN, CONN.
Industrial energy study of the hydraulic cement industry [PB-237142/5] 06 p0087 N75-18730

R

RADIATION, INC., MELBOURNE, FLA.
Remote platform power conserving system [NASA-CASE-GSC-11182-1] 05 p0032 N75-13007

RAND CORP., SANTA MONICA, CALIF.
Energy consumption by industries in support of national defense: An energy demand model [AD-784964] 05 p0031 N75-12449
Electricity conservation measures in the commercial sector: The Los Angeles experience [R-1592-FEA] 05 p0034 N75-13388

RENSSELAER POLYTECHNIC INST., TROY, N.Y.
Electrochemical power sources [AD-A001610] 06 p0094 N75-19836

RESOURCES FOR THE FUTURE, INC., WASHINGTON, D.C.
US energy R and D policy: The role of economics [RFP-WORKING-PAPER-EN-4] 06 p0080 N75-17783

RICE UNIV., HOUSTON, TEX.
Proceedings of the Workshop on Needs for Fundamental Research in Catalysis as Related to the Energy Problem [PB-236683/9] 06 p0078 N75-17006

ROCKWELL INTERNATIONAL CORP., CANOGA PARK, CALIF.
Solar electric propulsion system thermal analysis [NASA-CR-120622] 06 p0085 N75-18319

ROCKWELL INTERNATIONAL CORP., EL SEGUNDO, CALIF.
Technology application at Rockwell International 06 p0078 N75-17189

ROYAL AIRCRAFT ESTABLISHMENT, FARNBOROUGH (ENGLAND).
A generalised analysis of the performance of a variety of drive systems for high Reynolds number, transonic wind tunnels [RAE-TR-73134] 06 p0073 N75-16572

RUTGERS UNIV., NEW BRUNSWICK, N.J.
Benthal decomposition of adsorbed octadecane 06 p0106 N75-20891

S

SAN DIEGO GAS AND ELECTRIC CO., CALIF.
San Diego Gas and Electric Company Imperial Valley geothermal activities 06 p0100 N75-20847
Utility company views of geothermal development 06 p0102 N75-20864

SANDIA LABS., ALBUQUERQUE, N.MEX.
Solar incidence factor and other geometric considerations of solar energy collection [SAND-74-26] 05 p0034 N75-13390
Solar energy: Sandia's photovoltaic research program [SLA-74-281] 05 p0034 N75-13392
Axial temperature differential analysis of linear focused collectors for solar power [SLA-74-5078] 05 p0036 N75-14268

Sensible heat storage in liquids [SL-73-0263] 06 p0074 N75-16773
Design analysis of asymmetric solar receivers [SAND-74-0124] 06 p0076 N75-16986
Development and performance of a miniature, high-voltage thermal battery [SLA-74-5363] 06 p0076 N75-16988
Review of thermal battery technology [SLA-74-5381] 06 p0076 N75-16989
Pellet type thermal battery [SAND-74-0007] 06 p0076 N75-16991
Integration of photovoltaic and solar thermal energy conversion systems [SAND-74-0093] 06 p0076 N75-16992
Sixty minute thermal battery: A feasibility study [SLA-73-5888] 06 p0077 N75-16994
A practical model law for chemical explosive fracture of oil shale 06 p0078 N75-17023

Solar total energy program [SAND-74-0208] 06 p0081 N75-17810
In situ oil shale: A cost sensitivity analysis [SAND-74-0146] 06 p0087 N75-18727
Mechanical properties of oil shale from Anvil Point under conditions of uniaxial compression [SAND-74-0035] 06 p0092 N75-19390
In situ oil shale conversion and recovery [SLA-74-0162] 06 p0093 N75-19825
Sizing of focused solar collector fields with specified collector tube inlet temperature [SLA-74-5288] 06 p0094 N75-19832
Fuel cells: Direct conversion of electrochemical energy into electricity [SAND-74-0125] 06 p0103 N75-20869

SANDIA LABS., LIVERMORE, CALIF.
Prospects for solar energy utilization [SAND-74-8604] 05 p0034 N75-13389
Survey of hydrogen compatibility problems in energy storage and energy transmission applications [SAND-74-8219] 06 p0087 N75-18726

SCIENCE COMMUNICATION, INC., MCLEAN, VA.
Intra industry capability to substitute fuels [PB-237605/1] 06 p0093 N75-19814

SCIENTIFIC TRANSLATION SERVICE, SANTA BARBARA, CALIF.
A system utilizing solar energy [NASA-TT-F-16089] 05 p0033 N75-13386
Mission and organization of the DFLR: Two years of integrated society of German aeronautical and space flight research [NASA-TT-F-16086] 05 p0035 N75-13882
Solar energy [NASA-TT-F-16092] 05 p0038 N75-15149

SHELDahl CO., NORTHFIELD, MINN.
Solar Power Array for the Concentration of Energy (SPACE) [PB-236247/3] 06 p0071 N75-16114
Summary of results of solar power arrays for the concentration of energy study [PB-238003/8] 06 p0089 N75-18756

SOUTHERN METHODIST UNIV., DALLAS, TEX.
A brief description of geological and geophysical exploration of the Marysville geothermal area 06 p0099 N75-20839

SOUTHWEST RESEARCH INST., SAN ANTONIO, TEX.
A practical model law for chemical explosive fracture of oil shale 06 p0078 N75-17023
The collaborative study of EPA methods, 5, 6, and 7 in fossil fuel-fired steam generators [PB-237695/2] 06 p0091 N75-18788

SPECTROLAB, INC., SYLMAR, CALIF.
Terrestrial photovoltaic power systems with sunlight concentration [PB-236180/6] 06 p0072 N75-16120

SPERRY RAND RESEARCH CENTER, SUDBURY, MASS.
Geothermal down well pumping system 06 p0101 N75-20854

STANFORD RESEARCH INST., MENLO PARK, CALIF.
Effective utilization of solar energy to produce clean fuel [PB-233956/2] 05 p0026 N75-10605
Continued development of energy transmission and conversion systems [PB-236181/4] 05 p0037 N75-14278
Pollution-free electrochemical power generation from low grade coal [PB-236162/4] 06 p0070 N75-16109

STANFORD UNIV., CALIF.

- Statistical estimation of wildcat well outcome probabilities by visual analysis of structure contour maps of Stafford County, Kansas
06 p0092 N75-19778
- Geothermal reservoir engineering research
06 p0101 N75-20853

STEVENS INST. OF TECH., HOBOKEN, N.J.

- Hydrogen as a fuel
[AD-787484] 06 p0066 N75-15818

STONE AND WEBSTER ENGINEERING CORP., BOSTON, MASS.

- Application study of a nuclear coal solution gasification process for Oklahoma coal, volume 1
[PB-236156/6] 05 p0037 N75-14279

SUNDSTRAND AVIATION-ROCKFORD, ILL.

- Organic Rankine cycle silent power plant 1.5 kW, 28 volts dc
[AD-A000900] 06 p0088 N75-18745

SYRACUSE UNIV., N.Y.

- Economic and energy conservation relationship relevant to state of New York building design and contract awards
[PB-237006/2] 06 p0082 N75-17824
- Use of solar energy in buildings in New York state
[PB-236974/2] 06 p0083 N75-17825

T

TECHNICAL RESEARCH CENTRE OF FINLAND, HELSINKI.

- Technology and community development materials processing, and electrical and nuclear technology
05 p0031 N75-12695

TECHNISCHE HOCHSCHULE, DARMSTADT (WEST GERMANY).

- Impact on aerodynamic design
06 p0075 N75-16982

TECHNISCHE UNIV., BERLIN (WEST GERMANY).

- The modular solar energy satellite:
Investigation on large solar cell surfaces in space for the purpose of earth power supply
[ILR-17-1974] 05 p0036 N75-14271

TELEDYNE ISOTOPIES, TIMONIUM, MD.

- Economic radioisotope thermoelectric generator program: Program plan
[IESD-3112-3] 05 p0034 N75-13393
- Economic radioisotope thermoelectric generator study program
[IESD-3112-1] 05 p0036 N75-14269
- Economic radioisotope thermoelectric generator study program: Appendices.
[IESD-3112-2] 05 p0036 N75-14270

TENNESSEE UNIV. SPACE INST., TULLAHOMA.

- MHD energy conversion
[AD-785419] 05 p0032 N75-12807

TEXAS INSTRUMENTS, INC., DALLAS.

- Development of low cost thin film polycrystalline silicon solar cells for terrestrial applications
[PB-238505/2] 06 p0105 N75-20890

TEXAS SOUTHERN UNIV., HOUSTON.

- Collection and concentration of solar energy using Fresnel type lenses
[NASA-CR-142194] 06 p0080 N75-17784

TEXAS UNIV., AUSTIN.

- Basic research needs for tertiary oil recovery: Proceedings of a National Science Foundation Workshop
[PB-236726/6] 06 p0066 N75-16072

TEXTRON ELECTRONICS, INC., SYLMAR, CALIF.

- Terrestrial photovoltaic power systems with sunlight concentration
[PB-238582/1] 06 p0105 N75-20886

THE FUTURES GROUP, GLASTONBURY, CONN.

- Institutional and environmental problems in geothermal resource development
06 p0100 N75-20843

TORONTO UNIV. (ONTARIO).

- A review of the status of MHD power generation technology including suggestions for a Canadian MHD research program
[UTIAS-39] 05 p0035 N75-13641

TRW SYSTEMS GROUP, REDONDO BEACH, CALIF.

- Solar heating and cooling of buildings, phase 0. Volume 2: Final report
[PB-235423/1] 05 p0042 N75-15190
- Solar heating and cooling of buildings, phase 0. Volume 3: Appendices
[PB-235424/9] 06 p0070 N75-16103

Solar heating and cooling of buildings, phase 0.

- Volume 1: Executive summary
[PB-235422/3] 06 p0070 N75-16107
- Phase 0 study for a geothermal superheated water proof of concept facility
06 p0102 N75-20858

U

UNION OIL CO. OF CALIFORNIA, SANTA ROSA.

- Geothermal steam condensate reinjection
06 p0102 N75-20863

UNITED AIR LINES, INC., SAN FRANCISCO, CALIF.

- Fuel conservation capability and effort by commercial air carriers
[NASA-CR-137624] 05 p0039 N75-15157

V

VOORHEES (ALAN M.) AND ASSOCIATES, INC., MCLEAN, VA.

- Guidelines to reduce energy consumption through transportation actions
[PB-235983/4] 06 p0068 N75-16094

W

WASHINGTON UNIV., SEATTLE.

- The effect of Alaskan crude oil and selected hydrocarbon compounds on embryonic development of the Pacific oyster, Crassostrea gigas
06 p0090 N75-18764

WASHINGTON UNIV., ST. LOUIS, MO.

- The effect of recent energy price increases on field crop production costs
[PB-238659/7] 06 p0107 N75-21155

WEST VIRGINIA UNIV., MORGANTOWN.

- The design and development of an interactive energy model
[PB-236144/2] 06 p0070 N75-16110

WESTERN GEAR CORP., LYNWOOD, CALIF.

- Energy plantations: Should we grow trees for power plant fuel?
[WP-X-129] 05 p0030 N75-12436

WESTINGHOUSE ELECTRIC CORP., BALTIMORE, MD.

- Solar heating and cooling of buildings. Phase 0: Final report, volume 1
[PB-235427/2] 05 p0042 N75-15192

Solar heating and cooling of buildings. Phase 0:

- Final report. Volume 2: Appendices A-N
[PB-235428/0] 05 p0042 N75-15193

Solar heating and cooling of buildings. Phase 0:

- Final report. Volume 3: Appendices O-Y
[PB-235429/8] 05 p0042 N75-15194

Solar heating and cooling of buildings. Phase 0:

- Final report. Executive summary
[PB-235426/4] 05 p0042 N75-15195

WESTINGHOUSE ELECTRIC CORP., BOULDER, COLO.

- Solar thermal electric power systems
[PB-235475/1] 05 p0038 N75-14283

Solar thermal electric power systems

- [PB-236368/7] 06 p0071 N75-16118

WESTINGHOUSE ELECTRIC CORP., LESTER, PA.

- Advanced coal gasification system for electric power generation
[PB-236971/8] 06 p0089 N75-18747

WESTINGHOUSE ELECTRIC CORP., MADISON, PA.

- Clinch River Breeder Reactor: A combined power and fuel source
[CONF-740609-4] 05 p0038 N75-14593

WESTINGHOUSE ELECTRIC CORP., PITTSBURGH, PA.

- Clean power generation from coal
[PB-234188/1] 05 p0035 N75-13401

WISCONSIN UNIV., MADISON.

- Wisconsin superconductive energy storage project, volume 1
[PB-238082/2] 06 p0105 N75-20887

X

XEROX ELECTRO-OPTICAL SYSTEMS, PASADENA, CALIF.

- Solar collector thermal power system. Volume 1: Preliminary technology systems study
[AD-A000940] 06 p0091 N75-19339
- Solar collector thermal power system. Volume 2: Development, fabrication, and testing of fifteen foot heat pipes
[AD-A000941] 06 p0091 N75-19340

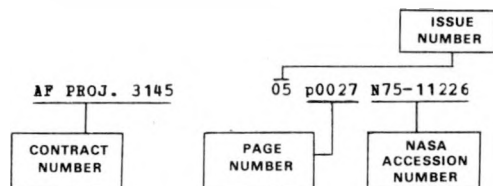
Solar collector thermal power system. Volume 3:
Basic study and experimental evaluation of
thermal train components
[AD-A000942] 06 p0091 N75-19341

CONTRACT NUMBER INDEX

ENERGY / A Continuing Bibliography (Issue 6)

OCTOBER 1975

Typical Contract Number Index Listing



Listings in this index are arranged alphanumerically by contract number. Under each contract number, the accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order with the IAA accession numbers appearing first. The accession number denotes the number by which the citation is identified in either the IAA or STAR section. Preceding the accession number are the issue and page number in the particular supplement in which the citation may be found.

AF PROJ. 3145
 05 p0027 N75-11226
 05 p0037 N75-14274
 06 p0091 N75-19339
 06 p0091 N75-19340
 06 p0091 N75-19341
 AF PROJ. 4506
 05 p0026 N75-10609
 AF PROJ. 6813
 05 p0032 N75-12807
 AF PROJ. 9752
 05 p0032 N75-12807
 AF PROJECT 3012-14
 05 p0018 A75-16869
 ARPA ORDER 189-1
 05 p0031 N75-12449
 ARPA ORDER 2338
 05 p0026 N75-10608
 ARPA ORDER 2615
 06 p0066 N75-15818
 AT (03-4)-959
 05 p0002 A75-10503
 AT (04-3)-943
 05 p0038 N75-14832
 AT (10-1)-1375
 06 p0074 N75-16651
 06 p0076 N75-16985
 AT (11-1)-2431
 06 p0106 N75-21101
 AT (11-1)-3073
 05 p0014 A75-12996
 AT (26-1)-539
 06 p0073 N75-16337
 AT (29-1)-789
 05 p0034 N75-13389
 05 p0034 N75-13390
 05 p0034 N75-13392
 06 p0074 N75-16773
 06 p0076 N75-16986
 06 p0076 N75-16991
 06 p0076 N75-16992
 06 p0081 N75-17810
 06 p0087 N75-18726
 06 p0087 N75-18727
 06 p0092 N75-19390
 06 p0093 N75-19825
 06 p0103 N75-20869
 AT (29-2)-2831
 06 p0092 N75-19354
 06 p0092 N75-19355
 AT (29-2)-2960
 05 p0003 A75-10505
 AT (33-1)-1-GEN-53
 05 p0024 N75-10591

AT (49-15)-3063
 05 p0003 A75-10508
 06 p0065 N75-15742
 BMPT-RV11-V59/73(2)-TO-20
 06 p0051 A75-24216
 CNES-71-279
 06 p0053 A75-24252
 DA PROJ. 1S7-62705-AH-94
 06 p0095 N75-19847
 DA PROJ. 1T1-61102-A-34A
 06 p0104 N75-20882
 DA PROJ. 1T6-62705-A-053
 06 p0094 N75-19836
 DA PROJ. 4A0-62103-A-896
 06 p0104 N75-20881
 DA PROJ. 4A1-62121-A-896
 06 p0104 N75-20881
 DAAB07-69-C-0063
 06 p0094 N75-19836
 DAAB07-72-C-0317
 05 p0008 A75-10567
 DAAB07-73-C-0138
 06 p0095 N75-19847
 DAAB07-73-C-0227
 05 p0008 A75-10565
 DAAB07-74-C-0072
 06 p0104 N75-20882
 DAAK02-72-C-0472
 06 p0088 N75-18745
 DAHC15-73-C-0181
 05 p0031 N75-12449
 DAHC15-73-C-0246
 05 p0032 N75-12857
 DAHC15-73-G-11
 05 p0026 N75-10608
 DI-BM-IC-8647
 06 p0077 N75-17004
 DI-14-01-001-1670
 06 p0069 N75-16099
 06 p0069 N75-16100
 DI-14-01-0001-478
 06 p0065 N75-15668
 06 p0065 N75-15669
 DI-14-01-0001-479
 06 p0088 N75-18743
 DI-14-01-0001-496
 05 p0040 N75-15169
 06 p0095 N75-19839
 06 p0095 N75-19840
 06 p0095 N75-19841
 06 p0095 N75-19842
 DI-14-01-0001-498
 05 p0025 N75-10603
 DI-14-01-0001-1652
 06 p0083 N75-17827

DI-14-01-0001-1654
 06 p0071 N75-16111
 06 p0087 N75-18732
 DI-14-01-0001-1659
 06 p0088 N75-18744
 DI-14-01-0001-1665
 06 p0087 N75-18730
 DI-14-01-0001-2051
 06 p0083 N75-17826
 DI-14-01-0001-4006
 05 p0037 N75-14277
 DI-14-32-001-1511
 06 p0065 N75-15772
 DI-14-32-0001-1212
 05 p0040 N75-15173
 DI-14-32-0001-1213
 05 p0009 A75-10577
 DI-14-32-0001-1216
 05 p0034 N75-13396
 05 p0036 N75-14273
 DI-14-32-0001-1219
 05 p0037 N75-14279
 DI-14-32-0001-1223
 05 p0035 N75-13401
 DI-14-32-0001-1236
 06 p0072 N75-16125
 DI-14-32-0001-1509
 06 p0071 N75-16113
 06 p0078 N75-17007
 06 p0078 N75-17008
 DI-14-32-0001-1511
 06 p0065 N75-15769
 DI-14-32-0001-1512
 06 p0088 N75-18740
 DI-14-32-0001-1513
 06 p0087 N75-18734
 DI-14-32-0001-1514
 06 p0089 N75-18747
 DI-14-32-0001-1519
 06 p0065 N75-15768
 DI-14-32-0001-1524
 06 p0105 N75-20889
 DI-14-32-0001-1533
 06 p0092 N75-19599
 DI-14-32-0001-1536
 06 p0068 N75-16093
 06 p0083 N75-17828
 DI-14-32-0001-1543
 06 p0072 N75-16151
 DOT-OS-30119
 05 p0040 N75-15179
 05 p0041 N75-15184
 EPA-68-01-2112
 05 p0041 N75-15187
 05 p0041 N75-15188
 05 p0041 N75-15189
 06 p0085 N75-18443
 EPA-68-02-0623
 06 p0091 N75-18788
 EPA-68-02-0629
 06 p0095 N75-19879
 06 p0096 N75-19880
 EPA-68-02-0643
 06 p0084 N75-17853
 EPA-68-02-0645
 06 p0090 N75-18786
 EPA-68-02-1099
 05 p0010 A75-11286
 EPA-68-02-1308
 06 p0095 N75-19838
 06 p0106 N75-20936
 EPA-68-02-1320
 05 p0034 N75-13397
 05 p0034 N75-13398
 EPA-68-02-1323
 06 p0088 N75-18739
 EPA-68-02-1332
 05 p0025 N75-10601
 EQC-322
 06 p0070 N75-16105
 FEA-C-03-50034-00
 06 p0093 N75-19814

FEA-14-01-0001-1715
 05 p0034 N75-13388
 FTD PROJ. T74-04-03
 06 p0073 N75-16368
 F30602-72-C-0401
 05 p0026 N75-10609
 F30602-72-C-0418
 05 p0018 A75-16869
 05 p0027 N75-11226
 F33615-71-C-1591
 06 p0060 A75-27960
 F33615-72-C-1092
 06 p0091 N75-19339
 06 p0091 N75-19340
 06 p0091 N75-19341
 F44620-69-C-0031
 05 p0032 N75-12807
 G0133100
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 NASW-2481
 05 p0024 N75-10587
 05 p0033 N75-13382
 05 p0033 N75-13383
 05 p0033 N75-13384
 05 p0033 N75-13385
 05 p0039 N75-15154
 06 p0080 N75-17786
 06 p0081 N75-17787
 06 p0093 N75-19821
 06 p0096 N75-20160
 NASW-2483
 05 p0033 N75-13386
 05 p0035 N75-13882
 05 p0038 N75-15149
 NAS1-12018
 06 p0091 N75-19224
 NAS1-13142
 06 p0084 N75-18220
 NAS1-13226
 06 p0079 N75-17336
 NAS1-13291
 05 p0010 A75-11281
 NAS2-6473
 06 p0055 A75-25013
 NAS2-6995
 06 p0073 N75-16557
 06 p0096 N75-20291
 06 p0097 N75-20292
 NAS2-7208
 05 p0039 N75-15157
 NAS3-15339
 06 p0067 N75-16084
 NAS3-17775
 06 p0073 N75-16637
 NAS3-18014
 05 p0021 A75-17504
 06 p0066 N75-16079
 NAS3-18886
 06 p0055 A75-24957
 NAS5-23156
 05 p0023 N75-10347
 NAS7-100
 05 p0002 A75-10481
 05 p0002 A75-10503
 05 p0005 A75-10530
 05 p0007 A75-10556
 05 p0008 A75-10571
 05 p0008 A75-10574
 05 p0010 A75-11283
 05 p0010 A75-11284
 05 p0029 N75-12064
 06 p0069 N75-16097
 06 p0074 N75-16972
 06 p0080 N75-17785
 06 p0098 N75-20831
 NAS8-30268
 06 p0086 N75-18719
 NAS8-30315
 06 p0067 N75-16085
 NAS8-30542
 06 p0085 N75-18319

CONTRACT NUMBER INDEX

NAS9-13413
05 p0036 N75-14135
NAS9-14306
06 p0086 N75-18722
NGL-14-001-001
06 p0064 A75-29137
NGR-18-001-086
05 p0005 A75-10532
NGT-01-003-004
05 p0033 N75-13381
NGT-01-003-044
05 p0023 N75-10584
NGT-44-005-114
06 p0098 N75-20830
NR PROJ. 462-082
06 p0096 N75-20157
06 p0096 N75-20158
NSP AER-74-07570
06 p0062 A75-28595
NSP AG-398
05 p0023 N75-10039
05 p0029 N75-11469
NSP AG-485
06 p0069 N75-16097
06 p0069 N75-16098
06 p0072 N75-16121
06 p0072 N75-16122
06 p0080 N75-17785
NSP AG-495
06 p0089 N75-18757
NSP AG-545
06 p0098 N75-20831
NSP ATA-73-07742-A02
06 p0080 N75-17783
NSP C-84
05 p0042 N75-15195
NSP C-310
06 p0080 N75-17749
NSP C-827
06 p0062 A75-28598
06 p0095 N75-19843
NSP C-836
06 p0100 N75-20843
NSP C-853
05 p0042 N75-15190
06 p0070 N75-16103
06 p0070 N75-16107
NSP C-854
05 p0019 A75-16891
05 p0042 N75-15192
05 p0042 N75-15193
05 p0042 N75-15194
NSP C-855
05 p0042 N75-15191
06 p0070 N75-16108
NSP C-858
05 p0019 A75-16890
06 p0089 N75-18755
NSP GP-41575
06 p0049 A75-23291
NSP GI-2729
06 p0104 N75-20883
NSP GI-04389
06 p0107 N75-21155
NSP GI-27976
05 p0007 A75-10553
06 p0077 N75-17005
NSP GI-29729
05 p0016 A75-16836
05 p0017 A75-16842
06 p0054 A75-24259
NSP GI-32488
06 p0069 N75-16095
NSP GI-32724
06 p0070 N75-16110
NSP GI-34027
06 p0070 N75-16109
NSP GI-34029
06 p0048 A75-23018
NSP GI-34872
06 p0071 N75-16115
06 p0105 N75-20884
NSP GI-34979
06 p0077 N75-17003
NSP GI-34991
05 p0017 A75-16842
06 p0104 N75-20883
NSP GI-35179X
06 p0070 N75-16104
NSP GI-36371
05 p0041 N75-15186

NSP GI-36731
05 p0041 N75-15185
06 p0072 N75-16119
NSP GI-37815
05 p0018 A75-16884
05 p0038 N75-14283
06 p0071 N75-16118
NSP GI-38103
05 p0037 N75-14281
05 p0038 N75-14282
06 p0070 N75-16106
NSP GI-38319
05 p0009 A75-11069
NSP GI-38723
05 p0026 N75-10605
NSP GI-38981
06 p0105 N75-20890
NSP GI-39114
06 p0062 A75-28594
05 p0038 N75-14284
06 p0082 N75-17821
NSP GI-39150
06 p0055 A75-24750
NSP GI-39151
05 p0040 N75-15178
NSP GI-39191
05 p0041 N75-15183
NSP GI-39241
06 p0082 N75-17822
NSP GI-39415
05 p0004 A75-10518
NSP GI-39456
06 p0088 N75-18742
NSP GI-39457
05 p0013 A75-12988
NSP GI-39539
06 p0071 N75-16117
NSP GI-40253
06 p0069 N75-16096
NSP GI-40457
06 p0082 N75-17823
NSP GI-41003
06 p0083 N75-17830
NSP GI-41019
06 p0071 N75-16114
06 p0089 N75-18756
NSP GI-41305
06 p0059 A75-27786
05 p0037 N75-14280
06 p0083 N75-17829
NSP GI-41894
06 p0072 N75-16120
06 p0105 N75-20886
NSP GI-41895
06 p0071 N75-16116
NSP GI-42944
06 p0105 N75-20888
NSP GI-43098
06 p0105 N75-20885
NSP GI-43866
06 p0099 N75-20837
NSP GI-44066
05 p0036 N75-14264
NSP GK-38697
05 p0035 N75-14094
NSP GP-37166
06 p0056 A75-25831
NSP GP-43738
06 p0086 N75-18718
NSP GP-44105
06 p0079 N75-17456
NSP GP-44165
06 p0066 N75-16072
NSP GP-44178
06 p0078 N75-17006
NSP GT-32162
06 p0082 N75-17824
06 p0083 N75-17825
NSP GY-11543
06 p0106 N75-21028
NSP ISR-72-05606-A02
06 p0082 N75-17824
06 p0083 N75-17825
NSP SSH-73-07142
06 p0080 N75-17749
NSP 29726
06 p0059 A75-27780
NSG-9009
06 p0080 N75-17784
N01-HT-2907
05 p0037 N75-14278

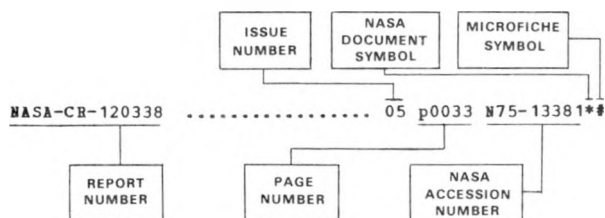
N00014-67-A-0202-0046
06 p0066 N75-15818
N00014-70-C-0133
06 p0056 A75-25831
N00014-74-C-0253
06 p0096 N75-20157
06 p0096 N75-20158
N00017-72-C-4401
06 p0064 A75-29116
06 p0065 N75-15658
06 p0085 N75-18594
PROJ. NSP/RANN
05 p0040 N75-15176
SNSO-3
05 p0034 N75-13393
05 p0036 N75-14269
05 p0036 N75-14270
SWRI PROJ. 02-4003
06 p0078 N75-17023
W-31-109-ENG-38
06 p0076 N75-16984
06 p0076 N75-16990
W-7405-ENG-26
05 p0023 N75-10039
05 p0024 N75-10592
05 p0029 N75-11469
06 p0068 N75-16092
06 p0087 N75-18728
06 p0090 N75-18769
W-7405-ENG-36
05 p0028 N75-11468
05 p0032 N75-12814
05 p0032 N75-13164
06 p0074 N75-16774
06 p0082 N75-17813
06 p0086 N75-18723
06 p0106 N75-21097
W-7405-ENG-48
05 p0024 N75-10593
05 p0024 N75-10594
05 p0028 N75-11467
05 p0039 N75-15166
05 p0043 N75-15462
06 p0066 N75-15781
06 p0068 N75-16090
06 p0077 N75-16996
06 p0079 N75-17279
06 p0093 N75-19827
06 p0094 N75-19830
06 p0097 N75-20693
06 p0104 N75-20875
506-23
05 p0039 N75-15161
778-00
06 p0080 N75-17712
791-40-08-06
06 p0103 N75-20868
791-40-24-1
06 p0107 N75-21154
791-40-2301
05 p0035 N75-13690
982-42-01-00-72
05 p0038 N75-15153

REPORT/ACCESSION INDEX

ENERGY / A Continuing Bibliography (Issue 6)

OCTOBER 1975

Typical Report/ Accession Number Index Listing



Listings in this index are arranged alphanumerically by report number. The issue and page number indicate the actual Supplement and page where the citation may be located. The accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche. A plus sign (+) indicates a document that cannot be microfiched but for which one-to-one facsimile is available.

A-5878 06 p0107 N75-21154**

AD-A000077 06 p0079 N75-17454 #
 AD-A000087 06 p0089 N75-18749 #
 AD-A000211 06 p0082 N75-17819 #
 AD-A000842 06 p0096 N75-20157 #
 AD-A000843 06 p0096 N75-20158 #
 AD-A000900 06 p0088 N75-18745 #
 AD-A000940 06 p0091 N75-19339 #
 AD-A000941 06 p0091 N75-19340 #
 AD-A000942 06 p0091 N75-19341 #
 AD-A001081 06 p0085 N75-18594 #
 AD-A001515 06 p0089 N75-18754 #
 AD-A001610 06 p0094 N75-19836 #
 AD-A002042 06 p0095 N75-19847 #
 AD-A002218 06 p0092 N75-19608 #
 AD-A002563 06 p0104 N75-20880 #
 AD-A002576 06 p0104 N75-20879 #
 AD-A002717 06 p0092 N75-19705 #
 AD-A003136 06 p0107 N75-21156 #
 AD-A003217 06 p0104 N75-20881 #
 AD-A003309 06 p0104 N75-20882 #

AD-779352 05 p0031 N75-12448 #
 AD-782888 05 p0027 N75-11226 #
 AD-783764 05 p0025 N75-10598 #
 AD-783821 05 p0026 N75-10836 #
 AD-783901 05 p0026 N75-10609 #
 AD-784449 05 p0026 N75-10608 #
 AD-784708 05 p0025 N75-10597 #
 AD-784964 05 p0031 N75-12449 #
 AD-785084 05 p0032 N75-12857 #
 AD-785419 05 p0032 N75-12807 #
 AD-785948 05 p0037 N75-14275 #
 AD-786844 05 p0039 N75-15168 #
 AD-786888 05 p0037 N75-14274 #
 AD-787419 06 p0073 N75-16368 #
 AD-787484 06 p0066 N75-15818 #
 AD-787507 06 p0065 N75-15658 #

ADL-C-76732-VOL-1 06 p0096 N75-20157 #
 ADL-C-76732-VOL-2 06 p0096 N75-20158 #

AEC-SNS-3063-3-VOL-1 06 p0065 N75-15742 #

AEC-4840 06 p0106 N75-21099 #

AFAPL-TR-74-5 05 p0027 N75-11226 #
 AFAPL-TR-74-27 05 p0037 N75-14274 #
 AFAPL-TR-74-89-1 06 p0091 N75-19339 #
 AFAPL-TR-74-89-2 06 p0091 N75-19340 #
 AFAPL-TR-74-89-3 06 p0091 N75-19341 #

AFOSR-74-1503TR 05 p0032 N75-12807 #

AIAA PAPER 74-1066 05 p0001 A75-10259 #
 AIAA PAPER 74-1069 05 p0001 A75-10262 #
 AIAA PAPER 74-1071 05 p0001 A75-10263 #
 AIAA PAPER 74-1072 05 p0001 A75-10264 #
 AIAA PAPER 74-1074 05 p0010 A75-11281**
 AIAA PAPER 74-1084 05 p0010 A75-11283**
 AIAA PAPER 74-1085 05 p0010 A75-11284**
 AIAA PAPER 74-1114 05 p0010 A75-11286 #
 AIAA PAPER 74-1266 05 p0010 A75-11107 #
 AIAA PAPER 75-30 05 p0021 A75-18269 #
 AIAA PAPER 75-264 06 p0055 A75-25005 #
 AIAA PAPER 75-303 06 p0047 A75-22508**
 AIAA PAPER 75-304 06 p0049 A75-23251 #
 AIAA PAPER 75-314 06 p0047 A75-22513 #
 AIAA PAPER 75-315 06 p0055 A75-25013**
 AIAA PAPER 75-316 06 p0047 A75-22514**
 AIAA PAPER 75-319 06 p0047 A75-22515**
 AIAA PAPER 75-350 06 p0055 A75-24957**
 AIAA PAPER 75-609 06 p0062 A75-28590 #
 AIAA PAPER 75-611 06 p0062 A75-28591 #
 AIAA PAPER 75-615 06 p0062 A75-28593 #
 AIAA PAPER 75-616 06 p0064 A75-29115 #
 AIAA PAPER 75-617 06 p0064 A75-29116 #
 AIAA PAPER 75-618 06 p0062 A75-28594 #
 AIAA PAPER 75-619 06 p0064 A75-29117 #
 AIAA PAPER 75-623 06 p0062 A75-28595 #
 AIAA PAPER 75-624 06 p0062 A75-28596 #
 AIAA PAPER 75-628 06 p0062 A75-28597**
 AIAA PAPER 75-632 06 p0062 A75-28598 #
 AIAA PAPER 75-635 06 p0063 A75-28599 #
 AIAA PAPER 75-637 06 p0063 A75-28600 #
 AIAA PAPER 75-640 06 p0064 A75-29118 #
 AIAA PAPER 75-641 06 p0063 A75-28601**
 AIAA PAPER 75-642 06 p0063 A75-28602 #
 AIAA PAPER 75-643 06 p0063 A75-28603 #
 AIAA PAPER 75-649 06 p0063 A75-28604 #

ALA-EMB-X996-149R-01 06 p0088 N75-18736 #
 ALA-EMB-X996-149R-03 06 p0088 N75-18737 #
 ALA-EMB-X996-149R-04 06 p0085 N75-18442 #

AMS-1177 06 p0079 N75-17456 #

ANCR-1155 06 p0076 N75-16985 #

ANL-8058 06 p0076 N75-16990 #
 ANL-8064 06 p0076 N75-16984 #

ANL/ES-CEN-F062 06 p0072 N75-16151 #

AP-42-SUPPL-3 06 p0073 N75-16152 #

APL-TG-1249 06 p0065 N75-15658 #

APL/JHU-TG-1240 06 p0085 N75-18594 #

AR-1 06 p0103 N75-20873 #

ASME PAPER 74-WA/ENER-2 05 p0015 A75-16834 #
 ASME PAPER 74-WA/ENER-3 05 p0016 A75-16835 #
 ASME PAPER 74-WA/ENER-4 05 p0016 A75-16836 #
 ASME PAPER 74-WA/ENER-5 05 p0016 A75-16837 #
 ASME PAPER 74-WA/ENER-6 05 p0016 A75-16838 #
 ASME PAPER 74-WA/ENER-7 05 p0016 A75-16839 #
 ASME PAPER 74-WA/ENER-9 05 p0016 A75-16840 #
 ASME PAPER 74-WA/ENER-10 05 p0016 A75-16841 #
 ASME PAPER 74-WA/ENER-11 05 p0017 A75-16842 #
 ASME PAPER 74-WA/HT-12 05 p0017 A75-16860 #
 ASME PAPER 74-WA/HT-13 05 p0017 A75-16857 #
 ASME PAPER 74-WA/HT-14 05 p0017 A75-16861 #
 ASME PAPER 74-WA/HT-16 05 p0017 A75-16862 #
 ASME PAPER 74-WA/HT-17 05 p0017 A75-16863 #

REPORT/ACCESSION NUMBER INDEX

ASME PAPER 74-WA/HT-18	05	p0017	A75-16864	#	CONF-740335	05	p0031	N75-12445	#
ASME PAPER 74-WA/HT-20	05	p0017	A75-16865	#	CONF-740402-23	05	p0028	N75-11466	#
ASME PAPER 74-WA/HT-22	05	p0018	A75-16867	#	CONF-740407-4	05	p0030	N75-12441	#
ASME PAPER 74-WA/HT-61	05	p0018	A75-16869	#	CONF-740462-1	06	p0087	N75-18729	#
ASME PAPER 74-WA/PWR-5	05	p0018	A75-16879	#	CONF-740509-7	05	p0032	N75-12814	#
ASME PAPER 74-WA/PWR-6	05	p0018	A75-16880	#	CONF-740509-8	06	p0082	N75-17814	#
ASME PAPER 74-WA/PWR-7	05	p0018	A75-16881	#	CONF-740543-1	05	p0030	N75-12440	#
ASME PAPER 74-WA/PWR-10	05	p0018	A75-16882	#	CONF-740549-1	06	p0066	N75-15781	#
ASME PAPER 74-WA/PWR-11	05	p0018	A75-16883	#	CONF-740555-1	06	p0077	N75-16995	#
ASME PAPER 74-WA/SOL-1	05	p0018	A75-16884	#	CONF-740609-2	05	p0029	N75-11730	#
ASME PAPER 74-WA/SOL-2	05	p0018	A75-16885	#	CONF-740609-4	05	p0038	N75-14593	#
ASME PAPER 74-WA/SOL-3	05	p0019	A75-16886	#	CONF-740639-1	05	p0034	N75-13389	#
ASME PAPER 74-WA/SOL-5	05	p0019	A75-16888	#	CONF-740641-1	05	p0031	N75-12447	#
ASME PAPER 74-WA/SOL-6	05	p0019	A75-16889	#	CONF-740709-2	06	p0086	N75-18723	#
ASME PAPER 74-WA/SOL-7	05	p0019	A75-16890	#	CONF-740727-2	06	p0085	N75-18702	#
ASME PAPER 74-WA/SOL-8	05	p0019	A75-16891	#	CONF-740727-3	06	p0095	N75-19867	#
B-164105	06	p0075	N75-16975	#	CONF-740732	06	p0103	N75-20874	#
BLL-CE-TRANS-6500- (90 22.09)	06	p0083	N75-17833		CONF-740805-1	05	p0029	N75-12252	#
BLL-M-21957- (5828.4 F)	06	p0080	N75-17467		CONF-740805-3	05	p0036	N75-14268	#
BLL-M-23330- (5828.4 F)	06	p0085	N75-18714		CONF-740805-4	06	p0076	N75-16989	#
BLL-M-23333- (5828.4 F)	06	p0091	N75-19014		CONF-740805-5	06	p0076	N75-16988	#
BLL-M-23343- (5828.4 F)	06	p0080	N75-17722		CONF-740805-7	06	p0094	N75-19829	#
BLL-M-23508- (5828.4 F)	06	p0074	N75-16969		CONF-740805-8	06	p0086	N75-18725	#
BLL-M-23516- (5828.4 F)	06	p0074	N75-16968		CONF-740811-1	06	p0079	N75-17279	#
BLL-OA-TRANS-1250- (6196.3)	06	p0074	N75-16712		CONF-740811-4	06	p0082	N75-17813	#
BLL-TRANS-2943- (9022.81)	06	p0074	N75-16967		CONF-740908-1	06	p0077	N75-16994	#
BM-IC-8595	05	p0042	N75-15203	#	CONF-740909-2	06	p0068	N75-16089	#
BM-IC-8647	06	p0077	N75-17004	#	CONF-741104-2	06	p0094	N75-19832	#
BM-IC-8651	05	p0040	N75-15172	#	CONF-741104-3	06	p0103	N75-20872	#
BM-IC-8652	06	p0088	N75-18738	#	CONF-741105-2	06	p0096	N75-20106	#
BM-IC-8655	06	p0085	N75-18713	#	CONF-741130-1	06	p0091	N75-19080	#
BM-OF-35-74	06	p0066	N75-16071	#	CONF-7210122-1	06	p0068	N75-16091	#
BM-OF-60-74	06	p0090	N75-18762	#	COO-2431-1	06	p0106	N75-21101	#
BM-RI-7921	05	p0034	N75-13399	#	COO-3028-7	05	p0028	N75-11465	#
BM-RI-7952	06	p0089	N75-18759	#	CR-53-INT-6	05	p0040	N75-15169	#
BM-RI-7968	05	p0028	N75-11462	#	CRREL-257	06	p0104	N75-20881	#
BM-RI-7969	06	p0089	N75-18760	#	DLR-FB-74-23	06	p0104	N75-20878	#
BM-RI-7973	06	p0097	N75-20746	#	DLR-HITT-74-13	06	p0107	N75-21218	#
BM-RI-7978	06	p0090	N75-18761	#	DOC-74SD4219-VOL-1	06	p0069	N75-16101	#
BM-SP-1-74	05	p0040	N75-15171	#	DOC-74SD4219-VOL-2	06	p0069	N75-16102	#
BM-TPR-81	06	p0093	N75-19813	#	DOC-74SD4219-VOL-3-BK-1	05	p0042	N75-15191	#
BM-TPR-82	05	p0025	N75-10599	#	DOC-74SD4219-VOL-3-BK-2-APP-C	06	p0070	N75-16108	#
BNL-14804-R	06	p0104	N75-20876	#	DOC-74SD4226-VOL-1	06	p0104	N75-20879	#
BNL-18651	05	p0030	N75-12441	#	DOC-74SD4226-VOL-2	06	p0104	N75-20880	#
BNL-18815	05	p0029	N75-11730	#	DOT-TST-74-13-1	05	p0035	N75-13690*	#
BNL-18866	05	p0031	N75-12443	#	DOT-TST-75-6	05	p0041	N75-15184	#
BNL-18887	05	p0030	N75-12440	#	DOT-TST-75-7	05	p0040	N75-15179	#
BNL-18920	06	p0097	N75-20580	#	D6-22421	06	p0091	N75-19224*	#
BNL-18984	06	p0094	N75-19831	#	D210-10901-1	06	p0084	N75-18220*	#
BNL-19249	06	p0103	N75-20873	#	E-8133	06	p0080	N75-17712*	#
BNL-19266	06	p0086	N75-18725	#	E-8138	05	p0039	N75-15161*	#
BNL-19267	06	p0103	N75-20870	#	E-8172	05	p0033	N75-13380*	#
BNL-19336	06	p0106	N75-21104	#	E-8241	06	p0084	N75-18241*	#
BNL-19351	06	p0106	N75-21098	#	ECOM-69-0063-F	06	p0094	N75-19836	#
BNW-211B01284	06	p0065	N75-15768	#	ECOM-73-0138-F	06	p0095	N75-19847	#
BNWL-SA-5053	06	p0085	N75-18702	#	ECOM-74-0072-3	06	p0104	N75-20882	#
BNWL-SA-5069	06	p0096	N75-20106	#	EPA-450/2-74-005	06	p0090	N75-18784	#
BNWL-SA-5070	06	p0103	N75-20874	#	EPA-450/2-74-021-B	06	p0091	N75-18797	#
BR39686	06	p0073	N75-16572	#	EPA-450/3-74-032-A	05	p0025	N75-10601	#
C-405-3	06	p0104	N75-20882	#	EPA-460/3-74-009-A-VOL-1	05	p0041	N75-15187	#
CBNS-AE-1	06	p0107	N75-21155	#	EPA-460/3-74-009-B-VOL-2	05	p0041	N75-15188	#
CEL-TN-1359	06	p0092	N75-19608	#	EPA-460/3-74-009-C-VOL-3	05	p0041	N75-15189	#
CEM-10R	05	p0023	N75-10347*	#	EPA-460/3-74-018	06	p0085	N75-18443	#
CERL-TR-E-65-VOL-1	06	p0104	N75-20879	#	EPA-650/2-74-009-B	06	p0095	N75-19879	#
CERL-TR-E-65-VOL-2	06	p0104	N75-20880	#	EPA-650/2-74-009-C	06	p0096	N75-19880	#
CONF-700911-4	06	p0104	N75-20876	#	EPA-650/2-74-021	05	p0034	N75-13398	#
CONF-740213-6	05	p0029	N75-11745	#	EPA-650/2-74-041	05	p0034	N75-13397	#
CONF-740222-2	06	p0082	N75-17815	#	EPA-650/2-74-052	06	p0088	N75-18739	#
CONF-740316-6	06	p0073	N75-16362	#	EPA-650/2-74-072	06	p0095	N75-19838	#
CONF-740335	05	p0031	N75-12445	#	EPA-650/2-74-116	06	p0106	N75-20936	#
CONF-740402-23	05	p0028	N75-11466	#	EPA-650/4-74-013	06	p0091	N75-18788	#
CONF-740407-4	05	p0030	N75-12441	#	EPA-660/2-74-067	06	p0084	N75-17848	#
CONF-740462-1	06	p0087	N75-18729	#	EPA-660/3-74-011	06	p0090	N75-18782	#
CONF-740509-7	05	p0032	N75-12814	#	EPRI-SR-1	06	p0087	N75-18735	#
CONF-740509-8	06	p0082	N75-17814	#	EPRI-206-0-0-1	05	p0025	N75-10600	#
CONF-740543-1	05	p0030	N75-12440	#	EPRI-206-0-0-2	05	p0025	N75-10604	#
CONF-740549-1	06	p0066	N75-15781	#					
CONF-740555-1	06	p0077	N75-16995	#					
CONF-740609-2	05	p0029	N75-11730	#					
CONF-740609-4	05	p0038	N75-14593	#					
CONF-740639-1	05	p0034	N75-13389	#					
CONF-740641-1	05	p0031	N75-12447	#					
CONF-740709-2	06	p0086	N75-18723	#					
CONF-740727-2	06	p0085	N75-18702	#					
CONF-740727-3	06	p0095	N75-19867	#					
CONF-740732	06	p0103	N75-20874	#					
CONF-740805-1	05	p0029	N75-12252	#					
CONF-740805-3	05	p0036	N75-14268	#					
CONF-740805-4	06	p0076	N75-16989	#					
CONF-740805-5	06	p0076	N75-16988	#					
CONF-740805-7	06	p0094	N75-19829	#					
CONF-740805-8	06	p0086	N75-18725	#					
CONF-740811-1	06	p0079	N75-17279	#					
CONF-740811-4	06	p0082	N75-17813	#					
CONF-740908-1	06	p0077	N75-16994	#					
CONF-740909-2	06	p0068	N75-16089	#					
CONF-741104-2	06	p0094	N75-19832	#					
CONF-741104-3	06	p0103	N75-20872	#					
CONF-741105-2	06	p0096	N75-20106	#					
CONF-741130-1	06	p0091	N75-19080	#					
CONF-7210122-1	06	p0068	N75-16091	#					
COO-2431-1	06	p0106	N75-21101	#					
COO-3028-7	05	p0028	N75-11465	#					
CR-53-INT-6	05	p0040	N75-15169	#					
CRREL-257	06	p0104	N75-20881	#					
DLR-FB-74-23	06	p0104	N75-20878	#					
DLR-HITT-74-13	06	p0107	N75-21218	#					
DOC-74SD4219-VOL-1	06	p0069	N75-16101	#					
DOC-74SD4219-VOL-2	06	p0069	N75-16102	#					
DOC-74SD4219-VOL-3-BK-1	05	p0042	N75-15191	#					
DOC-74SD4219-VOL-3-BK-2-APP-C	06	p0070	N75-16108	#					
DOC-74SD4226-VOL-1	06	p0104	N75-20879	#					
DOC-74SD4226-VOL-2	06	p0104	N75-20880	#					
DOT-TST-74-13-1	05	p0035	N75-13690*	#					
DOT-TST-75-6	05	p0041	N75-15184	#					
DOT-TST-75-7	05	p0040	N75-15179	#					
D6-22421	06	p0091	N75-19224*	#					
D210-10901-1	06	p0084	N75-18220*	#					
E-8133	06	p0080	N75-17712*	#					
E-8138	05	p0039	N75-15161*	#					
E-8172	05	p0033	N75-13380*	#					
E-8241	06	p0084	N75-18241*	#					
ECOM-69-0063-F	06	p0094	N75-19836	#					
ECOM-73-0138-F	06	p0095	N75-19847	#					
ECOM-74-0072-3	06	p0104	N75-20882	#					
EPA-450/2-74-005	06	p0090	N75-18784	#					
EPA-450/2-74-021-B	06	p0091	N75-18797	#					
EPA-450/3-74-032-A	05	p0025	N75-10601	#					
EPA-460/3-74-009-A-VOL-1	05	p0041	N75-15187	#					
EPA-460/3-74-009-B-VOL-2	05	p0041	N75-15188	#					
EPA-460/3-74-009-C-VOL-3	05	p0041	N75-15189	#					
EPA-460/3-74-018	06	p0085	N75-18443	#					
EPA-650/2-74-009-B	06	p0095	N75-19879	#					
EPA-650/2-74-009-C	06	p0096	N75-19880	#					
EPA-650/2-74-021									

REPORT/ACCESSION NUMBER INDEX

ERC-R-74010	06	p0072	N75-16120 #	IESD-3112-1	05	p0036	N75-14269 #
ESRO-TT-110	06	p0107	N75-21218 #	IESD-3112-2	05	p0036	N75-14270 #
ESRO-TT-123	06	p0104	N75-20878 #	IESD-3112-3	05	p0034	N75-13393 #
FEA/EI-1652	06	p0083	N75-17827 #	IGPP-UCR-74-31	06	p0098	N75-20836*
FEA/EI-1659	06	p0088	N75-18744 #	ILR-17-1974	05	p0036	N75-14271 #
FEA/EI-1665	06	p0087	N75-18730 #	IR-6	05	p0040	N75-15169 #
FEA/EI-1670	06	p0069	N75-16099 #	IRT-342-R	06	p0071	N75-16111 #
FEA/EI-1670-A	06	p0069	N75-16100 #	IRT-352-R	06	p0087	N75-18732 #
FEA/EI-50034	06	p0093	N75-19814 #	JAERI-M-5642	06	p0093	N75-19824 #
FSTC-HT-23-45-74	05	p0026	N75-10836 #	JPL-TM-33-705	05	p0029	N75-12064**
FSTC-HT-23-0402-74	05	p0039	N75-15168 #	JPRS-63414	05	p0027	N75-11410 #
FSTC-HT-23-0854-74	06	p0089	N75-18754 #	JPRS-63514	05	p0027	N75-10983 #
FSTC-HT-23-1473-73	06	p0092	N75-19705 #	JPRS-63794	06	p0081	N75-17790 #
FSTC-HT-23-1592-73	06	p0082	N75-17819 #	JSC-09233	05	p0036	N75-14135**
FSTC-HT-23-1674-73	05	p0037	N75-14275 #	JSC-09243	05	p0038	N75-15153**
FSTC-HT-23-1824-73	05	p0025	N75-10598 #	JUL-1017-RG	05	p0029	N75-11470 #
FSTC-HT-23-2518-72	06	p0089	N75-18749 #	JUL-1077	06	p0093	N75-19828 #
FTD-HT-23-792-74	05	p0025	N75-10597 #	KFK-1966-UF	05	p0030	N75-12439 #
FTD-HT-23-1076-74	06	p0073	N75-16368 #	LA-UR-74-737	05	p0032	N75-12814 #
GA-A-12068	05	p0037	N75-14279 #	LA-UR-74-741	06	p0082	N75-17814 #
GA-A-12848	05	p0038	N75-14832 #	LA-UR-74-821	06	p0068	N75-16089 #
GCV-R-128	05	p0024	N75-10587**	LA-UR-74-918	05	p0031	N75-12447 #
GEMS-418-PT-1	06	p0092	N75-19354 #	LA-UR-74-984	05	p0029	N75-12252 #
GEMS-418-PT-2	06	p0092	N75-19355 #	LA-UR-74-1085	06	p0082	N75-17813 #
GESP-7107-PT-1	06	p0092	N75-19354 #	LA-UR-74-1111	06	p0086	N75-18723 #
GESP-7107-PT-2	06	p0092	N75-19355 #	LA-UR-74-1145	06	p0091	N75-19080 #
GPO-25-382	06	p0066	N75-16076 #	LA-5558	05	p0028	N75-11468 #
GPO-27-032	05	p0023	N75-10580 #	LA-5596	06	p0074	N75-16774 #
GPO-27-765	05	p0026	N75-10850 #	LA-5631-MS	05	p0032	N75-13164 #
GPO-28-503	06	p0066	N75-16077 #	LA-5748-MS	06	p0106	N75-21097 #
GPO-28-608	05	p0024	N75-10588 #	LBL-2764	06	p0066	N75-15781 #
GPO-28-686	05	p0039	N75-15160 #	LBL-3066	06	p0079	N75-17279 #
GPO-28-964	05	p0027	N75-10861 #	LMSC-D384268	06	p0067	N75-16085**
GPO-29-660	05	p0023	N75-10259 #	LMSC-HREC-TR-D390666	06	p0086	N75-18719**
GPO-29-802	06	p0073	N75-16410 #	M-TU-74-7	05	p0035	N75-14134**
GPO-30-060	05	p0039	N75-15158 #	MCR-74-185	05	p0037	N75-14280 #
GPO-30-368	05	p0027	N75-11455 #	ME-RT-74011	06	p0066	N75-15818 #
GPO-31-027	06	p0081	N75-17806 #	MIT-EL-74-002	05	p0040	N75-15178 #
GPO-31-412	05	p0023	N75-10581 #	MLM-2134	05	p0024	N75-10591 #
GPO-31-519	05	p0039	N75-15159 #	MPR-32-44	06	p0065	N75-15669 #
GPO-31-711	06	p0067	N75-16081 #	MPR-45-54	06	p0065	N75-15668 #
GPO-31-891	06	p0075	N75-16973 #	MPR-62	06	p0072	N75-16151 #
GPO-32-403	05	p0026	N75-10859 #	MR-19	05	p0025	N75-10603 #
GPO-33-873	05	p0038	N75-15150 #	MR-20	05	p0025	N75-10603 #
GPO-34-969	05	p0039	N75-15155 #	MR-21	05	p0025	N75-10603 #
GPO-35-578	05	p0027	N75-10860 #	MR-22	05	p0025	N75-10603 #
GPO-37-171	05	p0030	N75-12431 #	MR-23	05	p0025	N75-10603 #
GPO-37-390	05	p0033	N75-13387 #	MR-24	05	p0025	N75-10603 #
GPO-37-403	05	p0028	N75-11463 #	MR-25	05	p0025	N75-10603 #
GPO-37-476	05	p0030	N75-12430 #	MR-26	05	p0025	N75-10603 #
GPO-38-968	05	p0036	N75-14265 #	MR-27	05	p0025	N75-10603 #
GPO-39-576	05	p0032	N75-13379 #	MR-28	05	p0025	N75-10603 #
GPO-41-253	05	p0026	N75-10764 #	MR-29	05	p0025	N75-10603 #
GPO-43-005	06	p0067	N75-16083 #	MR-30	05	p0025	N75-10603 #
GPO-44-818	06	p0103	N75-20867 #	MR-31	05	p0025	N75-10603 #
GPO-99-081	05	p0026	N75-10857 #	MR-32	05	p0025	N75-10603 #
GRU-4DJ-74	06	p0095	N75-19879 #	MR-33	05	p0025	N75-10603 #
GRU-5DJ-74	06	p0096	N75-19880 #	MR-34	05	p0025	N75-10603 #
H-REPT-93-998	05	p0026	N75-10857 #	MR-35	05	p0025	N75-10603 #
H-REPT-93-1634	05	p0036	N75-14265 #	MR-36	05	p0025	N75-10603 #
HI-1884/2-RR	05	p0032	N75-12857 #	MR-37	05	p0025	N75-10603 #
HIT-575	06	p0088	N75-18744 #	MRC-DA-404	05	p0034	N75-13398 #
HIT-581	06	p0089	N75-18755 #	MRC-DA-434	05	p0034	N75-13397 #
HONEYWELL-2852-41432- FR	06	p0087	N75-18733 #	MTR-6284-VOL-1	05	p0036	N75-14264 #
IAP PAPER 74-082	05	p0014	A75-13714				
IAP PAPER 74-083	05	p0014	A75-13715				
IAP PAPER 74-084	05	p0014	A75-13716 #				
IAP PAPER 74-086	05	p0015	A75-13718				
IAP PAPER 74-087	05	p0015	A75-13719**				
ICEC-5	05	p0032	N75-12814 #				
ICP-1054	06	p0074	N75-16651 #				

REPORT/ACCESSION NUMBER INDEX

MTR-6606	06	p0107	N75-21160 #	NSF/RA/N-74-014	06	p0069	N75-16095 #
MTR-6726	05	p0040	N75-15177 #	NSF/RA/N-74-021A	06	p0069	N75-16101 #
NAS/TT-74-01	06	p0080	N75-17749 #	NSF/RA/N-74-021B	06	p0069	N75-16102 #
NASA-CASE-GSC-11182-1	05	p0032	N75-13007*	NSF/RA/N-74-021C	05	p0042	N75-15191 #
NASA-CASE-MPS-22743-1	05	p0024	N75-10585*#	NSF/RA/N-74-021D-VOL-3-BK-2	06	p0070	N75-16108 #
NASA-CASE-MPS-22744-1	05	p0024	N75-10586*#	NSF/RA/N-74-022A	06	p0070	N75-16107 #
NASA-CASE-NPO-13510-1	06	p0074	N75-16972*#	NSF/RA/N-74-022C	06	p0070	N75-16103 #
NASA-CR-2502	06	p0073	N75-16557*#	NSF/RA/N-74-023A	05	p0042	N75-15195 #
NASA-CR-2525	06	p0098	N75-20830*#	NSF/RA/N-74-023B	05	p0042	N75-15192 #
NASA-CR-120338	05	p0033	N75-13381*#	NSF/RA/N-74-023C	05	p0042	N75-15193 #
NASA-CR-120355	05	p0023	N75-10584*#	NSF/RA/N-74-023D	05	p0042	N75-15194 #
NASA-CR-120606	06	p0067	N75-16085*#	NSF/RA/N-74-028	06	p0070	N75-16109 #
NASA-CR-120622	06	p0085	N75-18319*#	NSF/RA/N-74-036	05	p0026	N75-16065 #
NASA-CR-120623	06	p0086	N75-18719*#	NSF/RA/N-74-041	06	p0069	N75-16096 #
NASA-CR-132573	06	p0079	N75-17336*#	NSF/RA/N-74-043	05	p0038	N75-14284 #
NASA-CR-132578	06	p0084	N75-18220*#	NSF/RA/N-74-045	05	p0038	N75-14283 #
NASA-CR-132608	06	p0091	N75-19224*#	NSF/RA/N-74-048	05	p0038	N75-14282 #
NASA-CR-134696	06	p0073	N75-16637*#	NSF/RA/N-74-053	06	p0071	N75-16117 #
NASA-CR-134721	06	p0067	N75-16084*#	NSF/RA/N-74-055	06	p0105	N75-20886 #
NASA-CR-134724	06	p0066	N75-16079*#	NSF/RA/N-74-057	06	p0070	N75-16104 #
NASA-CR-137525	06	p0096	N75-20291*#	NSF/RA/N-74-059	06	p0077	N75-17005 #
NASA-CR-137526	06	p0097	N75-20292*#	NSF/RA/N-74-062	06	p0089	N75-18757 #
NASA-CR-137624	05	p0039	N75-15157*#	NSF/RA/N-74-065-VOL-1	06	p0105	N75-20887 #
NASA-CR-138193	06	p0069	N75-16098*#	NSF/RA/N-74-068	05	p0041	N75-15183 #
NASA-CR-138209	06	p0069	N75-16097*#	NSF/RA/N-74-072	06	p0080	N75-17785*#
NASA-CR-139140	05	p0023	N75-10347*#	NSF/RA/N-74-076	06	p0072	N75-16120 #
NASA-CR-140842	05	p0029	N75-12064*#	NSF/RA/N-74-077	06	p0072	N75-16119 #
NASA-CR-141455	05	p0036	N75-14135*#	NSF/RA/N-74-081	05	p0037	N75-14280 #
NASA-CR-141664	06	p0086	N75-18722*#	NSF/RA/N-74-082	06	p0071	N75-16118 #
NASA-CR-142119	06	p0078	N75-17188*#	NSF/RA/N-74-083	06	p0071	N75-16115 #
NASA-CR-142172	06	p0080	N75-17785*#	NSF/RA/N-74-086	06	p0077	N75-17003 #
NASA-CR-142194	06	p0080	N75-17784*#	NSF/RA/N-74-087	05	p0037	N75-14281 #
NASA-CR-142566	06	p0098	N75-20831*#	NSF/RA/N-74-090	06	p0071	N75-16114 #
NASA-EP-118	05	p0032	N75-12885*#	NSF/RA/N-74-093	06	p0083	N75-17830 #
NASA-NEWS-RELEASE-75-44	06	p0085	N75-18716*	NSF/RA/N-74-094	06	p0070	N75-16110 #
NASA-TM-X-3192	05	p0039	N75-15161*#	NSF/RA/N-74-095	06	p0071	N75-16116 #
NASA-TM-X-3197	06	p0107	N75-21154*#	NSF/RA/N-74-104	06	p0082	N75-17823 #
NASA-TM-X-3198	06	p0080	N75-17712*#	NSF/RA/N-74-108	06	p0089	N75-18755 #
NASA-TM-X-58143	05	p0038	N75-15153*#	NSF/RA/N-74-111	06	p0089	N75-18755 #
NASA-TM-X-62404	05	p0035	N75-13690*#	NSF/RA/N-74-115	06	p0095	N75-19843 #
NASA-TM-X-70410	06	p0096	N75-20155*#	NSF/RA/N-74-127	06	p0088	N75-18742 #
NASA-TM-X-70781	05	p0027	N75-11413*#	NSF/RA/N-74-130	06	p0105	N75-20885 #
NASA-TM-X-70783	05	p0028	N75-11459*#	NSF/RA/N-74-144	06	p0105	N75-20888 #
NASA-TM-X-71634	05	p0033	N75-13380*#	NSF/RA/N-74-153	06	p0104	N75-20889 #
NASA-TM-X-71663	06	p0084	N75-18241*#	NSF/RA/N-74-155	06	p0104	N75-20883 #
NASA-TM-X-72199	05	p0035	N75-14134*#	NSF/RA/N-74-156	06	p0087	N75-18733 #
NASA-TM-X-72652	06	p0103	N75-20868*#	NSF/RA/N-74-158	06	p0089	N75-18756 #
NASA-TM-X-72659	06	p0079	N75-17339*#	NSF/RA/N-74-159	06	p0083	N75-17829 #
NASA-TT-F-15982	05	p0024	N75-10587*#	NSF/RA/N-74-002	06	p0098	N75-20831*#
NASA-TT-F-16057	05	p0033	N75-13384*#	NSF/RA/S-74-002	06	p0080	N75-17749 #
NASA-TT-F-16058	05	p0033	N75-13385*#	NSF/RANN/SE/GI-27976/TR-72-20	06	p0077	N75-17005 #
NASA-TT-F-16062	05	p0039	N75-15154*#	NSF/RANN/SE/GI-32488/PR-73	06	p0069	N75-16095 #
NASA-TT-F-16086	05	p0035	N75-13882*#	NSF/RANN/SE/GI-34872/TR-73-5	06	p0105	N75-20884 #
NASA-TT-F-16089	05	p0033	N75-13386*#	NSF/RANN/SE/GI-34979/PR-74-2	06	p0077	N75-17003 #
NASA-TT-F-16090	05	p0033	N75-13382*#	NSF/RANN/SE/GI-34991/PR-73-4	06	p0104	N75-20883 #
NASA-TT-F-16091	05	p0033	N75-13383*#	NSF/RANN/SE/GI-36731/PR-74-2	06	p0072	N75-16119 #
NASA-TT-F-16092	05	p0038	N75-15149*#	NSF/RANN/SE/GI-37815/PR-74-1	05	p0038	N75-14283 #
NASA-TT-F-16102	06	p0096	N75-20160*#	NSF/RANN/SE/GI-37815/PR-74-2	06	p0071	N75-16118 #
NASA-TT-F-16155	06	p0081	N75-17787*#	NSF/RANN/SE/GI-38103/PR-73-4	05	p0038	N75-14282 #
NASA-TT-F-16195	06	p0080	N75-17786*#	NSF/RANN/SE/GI-38103/PR-74-1	06	p0070	N75-16106 #
NASA-TT-F-16201	06	p0093	N75-19821*#	NSF/RANN/SE/GI-38981/PR-74-3	06	p0105	N75-20890 #
NERC-LV-539-30	06	p0073	N75-16337 #	NSF/RANN/SE/GI-39114/PR-74-3	05	p0038	N75-14284 #
NIH/NHLI-N01-HT-4-2907-1	05	p0037	N75-14278 #	NSF/RANN/SE/GI-39114/PR-74-4	06	p0082	N75-17821 #
NP-20023	06	p0067	N75-16088 #	NSF/RANN/SE/GI-39117/PR-74-2	05	p0041	N75-15183 #
NP-20121	06	p0067	N75-16087 #	NSF/RANN/SE/GI-39456/PR-73-4	06	p0088	N75-18742 #
NSF/RA/G-73/042	06	p0082	N75-17822 #	NSF/RANN/SE/GI-39539/PR-74-2	06	p0071	N75-16117 #
NSF/RA/G-74/013	06	p0083	N75-17825 #	NSF/RANN/SE/GI-40457/PR-74-2	06	p0082	N75-17823 #
NSF/RA/G-74/016	06	p0082	N75-17824 #	NSF/RANN/SE/GI-41003/PR-74-2	06	p0083	N75-17830 #
NSF/RA/N-73-022	06	p0105	N75-20884 #	NSF/RANN/SE/GI-41019/PR-74-2	06	p0071	N75-16114 #
NSF/RA/N-74-002B	05	p0042	N75-15190 #	NSF/RANN/SE/GI-41305/PR-74-2	05	p0037	N75-14280 #
NSF/RA/N-74-004	05	p0041	N75-15185 #	NSF/RANN/SE/GI-41894/PR-74-1	06	p0105	N75-20886 #
NSF/RA/N-74-004	05	p0041	N75-15186 #	NSF/RANN/SE/GI-41894/PR-74-2	06	p0072	N75-16120 #
NSF/RA/N-74-013-1	06	p0069	N75-16097*#	NSF/RANN/SE/GI-41895 PR-74-12	06	p0071	N75-16116 #
NSF/RA/N-74-013-2	06	p0069	N75-16098*#	NSF/RANN/SE/GI-43098	06	p0105	N75-20885 #
NSF/RA/N-74-013A-VOL-1	06	p0072	N75-16121 #	NSF/SOS-GI-11543	06	p0106	N75-20128 #
NSF/RA/N-74-013B-VOL-2	06	p0072	N75-16122 #				
				NVO-148	06	p0094	N75-19833 #
				OA-TRANS-938-PT-1	06	p0074	N75-16970 #
				OA-TRANS-939	06	p0078	N75-17184 #
				OCR-30-INT-2	06	p0088	N75-18743 #
				OCR-53-INT-10-VOL-4-PT-2	06	p0095	N75-19839 #
				OCR-53-INT-11-VOL-4-PT-3	06	p0095	N75-19840 #
				OCR-53-INT-13-VOL-4-PT-5	06	p0095	N75-19842 #
				OCR-73-INT-2	06	p0040	N75-15173 #
				OCR-74-INT-1	05	p0034	N75-13396 #
				OCR-74-INT-2	05	p0036	N75-14273 #
				OCR-79-INT-1	06	p0072	N75-16125 #
				OCR-81-INT-1	06	p0089	N75-18747 #

REPORT/ACCESSION NUMBER INDEX

OCR-83-INT-1	06	p0088	N75-18740	✱	PB-236039/4	05	p0037	N75-14277	✱
OCR-84	05	p0035	N75-13401	✱	PB-236068/3	06	p0072	N75-16124	✱
OCR-85-INT-1	06	p0065	N75-15772	✱	PB-236142/6	06	p0069	N75-16096	✱
OCR-86-F	05	p0037	N75-14279	✱	PB-236144/2	06	p0070	N75-16110	✱
OCR-92-INT-1	06	p0092	N75-19599	✱	PB-236156/6	05	p0037	N75-14279	✱
OCR-94-INT-1	06	p0083	N75-17828	✱	PB-236159/0	05	p0037	N75-14280	✱
OCR-97-INT-1	06	p0087	N75-18734	✱	PB-236162/4	06	p0070	N75-16109	✱
OCR-100-INT-1	06	p0065	N75-15768	✱	PB-236163/2	06	p0072	N75-16121	✱
OCR-102-VOL-1	06	p0071	N75-16113	✱	PB-236164/0	06	p0072	N75-16122	✱
OCR-102-VOL-2	06	p0078	N75-17007	✱	PB-236180/6	06	p0072	N75-16120	✱
OCR-102-VOL-3	06	p0078	N75-17008	✱	PB-236181/4	05	p0037	N75-14278	✱
OCR-103-INT-1	06	p0105	N75-20889	✱	PB-236189/7	06	p0072	N75-16119	✱
					PB-236190/5	06	p0077	N75-17005	✱
ORNL-EIS-74-52-VOL-2-NO-1	05	p0024	N75-10592	✱	PB-236193/9	06	p0071	N75-16115	✱
ORNL-EIS-74-52-VOL-2-4	05	p0029	N75-11469	✱	PB-236196/2	06	p0071	N75-16116	✱
ORNL-EIS-74-52-VOL-2-5	06	p0068	N75-16092	✱	PB-236208/5	06	p0071	N75-16117	✱
					PB-236247/3	06	p0071	N75-16114	✱
ORNL-NSF-EP-30	06	p0090	N75-18769	✱	PB-236266/3	05	p0037	N75-14281	✱
ORNL-NSF-EP-45	06	p0087	N75-18728	✱	PB-236305/9	05	p0040	N75-15169	✱
ORNL-NSF-EP-68	05	p0023	N75-10039	✱	PB-236322/4	06	p0071	N75-16111	✱
					PB-236346/3	06	p0092	N75-19599	✱
ORNL-TR-2827	06	p0086	N75-18724	✱	PB-236351/3	06	p0072	N75-16123	✱
					PB-236368/7	06	p0071	N75-16118	✱
OWRR-A-024-COLO(1)	05	p0037	N75-14277	✱	PB-236412/3	06	p0083	N75-17830	✱
					PB-236422/2	06	p0077	N75-17003	✱
P-1063	06	p0083	N75-17826	✱	PB-236498/2	06	p0065	N75-15769	✱
					PB-236522/9	06	p0065	N75-15768	✱
PAPER-C74-500-5	06	p0086	N75-18723	✱	PB-236581/5	06	p0077	N75-17004	✱
					PB-236582/3	06	p0088	N75-18737	✱
PB-227476/9	05	p0042	N75-15203	✱	PB-236583/1	06	p0088	N75-18736	✱
PB-233263/3	05	p0025	N75-10603	✱	PB-236585/6	06	p0090	N75-18783	✱
PB-233956/2	05	p0026	N75-10605	✱	PB-236587/2	06	p0090	N75-18784	✱
PB-234018/0	05	p0040	N75-15173	✱	PB-236588/0	06	p0088	N75-18743	✱
PB-234036/2	05	p0034	N75-13396	✱	PB-236608/6	06	p0084	N75-17848	✱
PB-234042/0	05	p0036	N75-14273	✱	PB-236631/8	06	p0071	N75-16113	✱
PB-234050/3	05	p0034	N75-13399	✱	PB-236632/6	06	p0078	N75-17007	✱
PB-234159/2	05	p0034	N75-13397	✱	PB-236633/4	06	p0078	N75-17008	✱
PB-234160/0	05	p0034	N75-13398	✱	PB-236669/8	06	p0090	N75-18786	✱
PB-234185/7	05	p0025	N75-10601	✱	PB-236683/9	06	p0078	N75-17006	✱
PB-234188/1	05	p0035	N75-13401	✱	PB-236712/6	06	p0086	N75-18718	✱
PB-234202/0	05	p0025	N75-10600	✱	PB-236714/2	06	p0079	N75-17456	✱
PB-234203/8	05	p0025	N75-10604	✱	PB-236726/6	06	p0066	N75-16072	✱
PB-234294/7	05	p0034	N75-13400	✱	PB-236755/5	06	p0080	N75-17749	✱
PB-234460/4	05	p0040	N75-15176	✱	PB-236900/7	06	p0085	N75-18443	✱
PB-234490/1	05	p0040	N75-15174	✱	PB-236971/8	06	p0089	N75-18747	✱
PB-234536/1	05	p0040	N75-15178	✱	PB-236972/6	06	p0088	N75-18740	✱
PB-234565/0	05	p0041	N75-15186	✱	PB-236974/2	06	p0083	N75-17825	✱
PB-234682/3	05	p0040	N75-15172	✱	PB-236997/3	06	p0082	N75-17821	✱
PB-234733/4	05	p0040	N75-15171	✱	PB-237005/4	06	p0088	N75-18742	✱
PB-234860/5	06	p0069	N75-16097	✱	PB-237006/2	06	p0082	N75-17824	✱
PB-234861/3	06	p0069	N75-16098	✱	PB-237028/6	06	p0083	N75-17828	✱
PB-235115/3	05	p0040	N75-15177	✱	PB-237042/7	06	p0082	N75-17823	✱
PB-235254/0	06	p0070	N75-16105	✱	PB-237045/0	06	p0082	N75-17822	✱
PB-235348/0	05	p0040	N75-15179	✱	PB-237113/6	06	p0095	N75-19879	✱
PB-235349/8	05	p0041	N75-15184	✱	PB-237116/9	06	p0088	N75-18739	✱
PB-235422/3	06	p0070	N75-16107	✱	PB-237142/5	06	p0087	N75-18730	✱
PB-235423/1	05	p0042	N75-15190	✱	PB-237151/6	06	p0088	N75-18744	✱
PB-235424/9	06	p0070	N75-16103	✱	PB-237209/2	06	p0083	N75-17826	✱
PB-235426/4	05	p0042	N75-15195	✱	PB-237215/9	06	p0084	N75-17853	✱
PB-235427/2	05	p0042	N75-15192	✱	PB-237316/5	06	p0083	N75-17827	✱
PB-235428/0	05	p0042	N75-15193	✱	PB-237353/8	06	p0085	N75-18442	✱
PB-235429/8	05	p0042	N75-15194	✱	PB-237605/1	06	p0093	N75-19814	✱
PB-235431/4	06	p0069	N75-16101	✱	PB-237625/9	06	p0087	N75-18734	✱
PB-235432/2	06	p0069	N75-16102	✱	PB-237661/4	06	p0087	N75-18735	✱
PB-235433/0	05	p0042	N75-15191	✱	PB-237670/5	06	p0095	N75-19838	✱
PB-235434/8	06	p0070	N75-16108	✱	PB-237694/5	06	p0096	N75-19880	✱
PB-235468/6	05	p0041	N75-15183	✱	PB-237695/2	06	p0091	N75-18788	✱
PB-235469/4	05	p0038	N75-14284	✱	PB-237696/0	06	p0091	N75-18797	✱
PB-235474/4	05	p0038	N75-14282	✱	PB-237720/8	06	p0090	N75-18782	✱
PB-235475/1	05	p0038	N75-14283	✱	PB-237763/8	06	p0095	N75-19839	✱
PB-235481/9	05	p0041	N75-15185	✱	PB-237764/6	06	p0095	N75-19840	✱
PB-235483/5	06	p0069	N75-16095	✱	PB-237765/3	06	p0095	N75-19841	✱
PB-235487/6	06	p0070	N75-16104	✱	PB-237766/1	06	p0095	N75-19842	✱
PB-235503/0	06	p0070	N75-16106	✱	PB-237815/6	06	p0085	N75-18713	✱
PB-235581/6	05	p0041	N75-15187	✱	PB-237831/3	06	p0090	N75-18762	✱
PB-235582/4	05	p0041	N75-15188	✱	PB-237843/8	06	p0088	N75-18738	✱
PB-235583/2	05	p0041	N75-15189	✱	PB-237845/3	06	p0087	N75-18732	✱
PB-235591/5	06	p0065	N75-15772	✱	PB-237848/7	06	p0089	N75-18760	✱
PB-235736/6	06	p0073	N75-16152	✱	PB-237849/5	06	p0090	N75-18761	✱
PB-235767/1	06	p0066	N75-16071	✱	PB-237851/1	06	p0093	N75-19813	✱
PB-235780/4	06	p0072	N75-16125	✱	PB-237894/1	06	p0089	N75-18759	✱
PB-235817/4	06	p0068	N75-16093	✱	PB-237936/0	06	p0091	N75-18801	✱
PB-235840/6	06	p0072	N75-16151	✱	PB-237937/8	06	p0084	N75-17858	✱
PB-235898/4	06	p0065	N75-15669	✱	PB-238002/0	06	p0087	N75-18733	✱
PB-235899/2	06	p0065	N75-15668	✱	PB-238003/8	06	p0089	N75-18756	✱
PB-235983/4	06	p0068	N75-16094	✱	PB-238005/3	06	p0083	N75-17829	✱
PB-236008/9	05	p0035	N75-14094	✱	PB-238041/8	06	p0107	N75-21160	✱
PB-236016/2	06	p0069	N75-16099	✱	PB-238064/0	06	p0097	N75-20478	✱
PB-236017/0	06	p0069	N75-16100	✱	PB-238066/5	06	p0089	N75-18757	✱

REPORT/ACCESSION NUMBER INDEX

PB-238068/1	06	p0095	N75-19843	#	SMRT PAPER A2/1	06	p0046	A75-21713	
PB-238069/9	06	p0089	N75-18755	#	SS-405	06	p0083	N75-17825	#
PB-238073/1	06	p0105	N75-20888	#	SS-411	06	p0082	N75-17824	#
PB-238075/6	06	p0106	N75-20936	#	SWRI-01-3487-001	06	p0091	N75-18788	#
PB-238082/2	06	p0105	N75-20887	#	TDCK-65202	05	p0035	N75-14002	#
PB-238103/6	06	p0104	N75-20883	#	TID-3349	05	p0023	N75-10578	+
PB-238124/2	06	p0097	N75-20746	#	TID-3351	06	p0103	N75-20871	#
PB-238285/1	06	p0105	N75-20884	#	TID-26534	05	p0031	N75-12442	#
PB-238360/2	06	p0105	N75-20889	#	TID-26637	06	p0097	N75-20805	#
PB-238505/2	06	p0105	N75-20890	#	TR-74-105	06	p0083	N75-17828	#
PB-238507/8	06	p0105	N75-20885	#	TR-152	05	p0033	N75-13385	#
PB-238582/1	06	p0105	N75-20886	#	TRW-21568-003	06	p0070	N75-16103	#
PB-238659/7	06	p0107	N75-21155	#	TRW-25168.001	06	p0070	N75-16107	#
PB-238783/5	06	p0106	N75-21028	#	TRW-25168.002	05	p0042	N75-15190	#
PR-3	06	p0105	N75-20888	#	TW-555	05	p0024	N75-10587	#
PWA-4984	06	p0067	N75-16084	#	UAG-R-225	06	p0105	N75-20885	#
QCR-54-INT-12-VOL-4-PT-4	06	p0095	N75-19841	#	UCID-16520	06	p0068	N75-16090	#
QPR-1	05	p0038	N75-14283	#	UCID-16528	06	p0077	N75-16996	#
QPR-2	06	p0071	N75-16118	#	UCID-16591	06	p0104	N75-20875	#
QPR-2	06	p0097	N75-20580	#	UCID-16593	06	p0094	N75-19830	#
QPR-3	05	p0038	N75-14284	#	UCID-16630-74-1	06	p0093	N75-19827	#
QPR-3	06	p0105	N75-20890	#	UCID-16631	06	p0097	N75-20693	#
QR-1	06	p0105	N75-20886	#	UCRL-51487	05	p0024	N75-10593	#
QR-3	06	p0104	N75-20882	#	UCRL-51511	05	p0024	N75-10594	#
R-1448-ARPA	05	p0031	N75-12449	#	UCRL-51533-REV-1	05	p0028	N75-11467	#
R-1592-PEA	05	p0034	N75-13388	#	UCRL-51557	05	p0043	N75-15462	#
RADC-TR-74-154	05	p0026	N75-10609	#	UCRL-51578	05	p0039	N75-15166	#
RAE-TR-73134	06	p0073	N75-16572	#	UCRL-75353	06	p0082	N75-17815	#
REPT-1	06	p0093	N75-19827	#	UCRL-75418	05	p0029	N75-11745	#
REPT-194-M	05	p0035	N75-14002	#	UCRL-75443	06	p0073	N75-16362	#
REPT-2852-41429	06	p0066	N75-16079	#	UCRL-75600	05	p0028	N75-11466	#
REPT-4074-VOL-1	06	p0091	N75-19339	#	UCRL-76076	06	p0095	N75-19867	#
REPT-4074-VOL-2	06	p0091	N75-19340	#	UHME/SOL/2	06	p0083	N75-17830	#
REPT-4074-VOL-3	06	p0091	N75-19341	#	UILO-ENG-74-2019	05	p0041	N75-15183	#
RFF-WORKING-PAPER-EN-4	06	p0080	N75-17783	#	UIUC-CAC-DN-73-105	06	p0070	N75-16104	#
RT/PROT-(74) 10	06	p0068	N75-16091	#	UKY-TR86-74-CHE2	05	p0040	N75-15176	#
R74AEG418	06	p0073	N75-16637	#	UMTA-IT-06-0092-74-2	06	p0068	N75-16094	#
S-442-VOL-1	06	p0098	N75-20830	#	UMTA-PA-06-0005-74-1	06	p0090	N75-18783	#
SA/ATR-1182	06	p0088	N75-18745	#	UMTA-VA-06-0023-74-3	06	p0107	N75-21160	#
SAE PAPER 740884	05	p0019	A75-16925		US-PATENT-APPL-SN-393527	05	p0032	N75-13007	#
SAE PAPER 740885	06	p0048	A75-22948		US-PATENT-APPL-SN-518544	05	p0024	N75-10586	#
SAND-74-26	05	p0034	N75-13390	#	US-PATENT-APPL-SN-518684	05	p0024	N75-10585	#
SAND-74-0007	06	p0076	N75-16991	#	US-PATENT-APPL-SN-536786	06	p0074	N75-16972	#
SAND-74-0035	06	p0092	N75-19390	#	US-PATENT-CLASS-325-4	05	p0032	N75-13007	#
SAND-74-0093	06	p0076	N75-16992	#	US-PATENT-3,851,250	05	p0032	N75-13007	#
SAND-74-0124	06	p0076	N75-16986	#	USGS-GD-74-035	06	p0072	N75-16124	#
SAND-74-0125	06	p0103	N75-20869	#	UTIAS-39	05	p0035	N75-13641	#
SAND-74-0146	06	p0087	N75-18727	#	VP-X-129	05	p0030	N75-12436	#
SAND-74-0146	06	p0081	N75-17810	#	W-DESC-SS-10275-1	05	p0042	N75-15192	#
SAND-74-0208	06	p0087	N75-18726	#	W-DESC-SS-10275-2	05	p0042	N75-15193	#
SAND-74-8219	06	p0087	N75-18726	#	W-DESC-SS-10275-3	05	p0042	N75-15194	#
SAND-74-8604	05	p0034	N75-13389	#	W-DESC-SS-10275-4	05	p0042	N75-15195	#
SAPR-1	05	p0037	N75-14280	#	WASH-1139-74	05	p0031	N75-12723	#
SAPR-1	06	p0072	N75-16119	#	WASH-1281-4	05	p0024	N75-10595	#
SAPR-1	06	p0072	N75-16120	#	WASH-1290	05	p0031	N75-12797	#
SAPR-1	06	p0077	N75-17003	#	WASH-1295	05	p0035	N75-13644	#
SAPR-1	06	p0088	N75-18742	#	WASH-1310	05	p0031	N75-12445	#
SD-75-SA-0012	06	p0085	N75-18319	#	WASH-1337-5-DRAFT	06	p0077	N75-16993	#
SLA-73-5888	06	p0077	N75-16994	#	WASH-1344	06	p0077	N75-16997	#
SLA-74-281	05	p0034	N75-13392	#	W74-12356	05	p0037	N75-14277	#
SLA-74-0162	06	p0093	N75-19825	#	W75-00012	06	p0084	N75-17848	#
SLA-74-5078	05	p0036	N75-14268	#					
SLA-74-5288	06	p0094	N75-19832	#					
SLA-74-5363	06	p0076	N75-16988	#					
SLA-74-5381	06	p0076	N75-16989	#					
SLL-73-0263	06	p0074	N75-16773	#					
SM/BIB/409/1	05	p0034	N75-13400	#					
SM/BIB/859	06	p0072	N75-16123	#					

REPORT/ACCESSION NUMBER INDEX

X-704-74-277		05	p0028	N75-11459**
X-923-74-322		05	p0027	N75-11413**