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NASA SP-473 (03)

# ENERGY

A CONTINUING BIBLIOGRAPHY  
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# ENERGY

## A Continuing Bibliography With Indexes

ISSUE 03

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 July 1 through September 30, 1974 in:

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



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## INTRODUCTION

This issue of *Energy: A Continuing Bibliography with Indexes* (NASA SP-7043(03)) lists 322 reports, journal articles, and other documents announced between July 1, 1974 and September 30, 1974 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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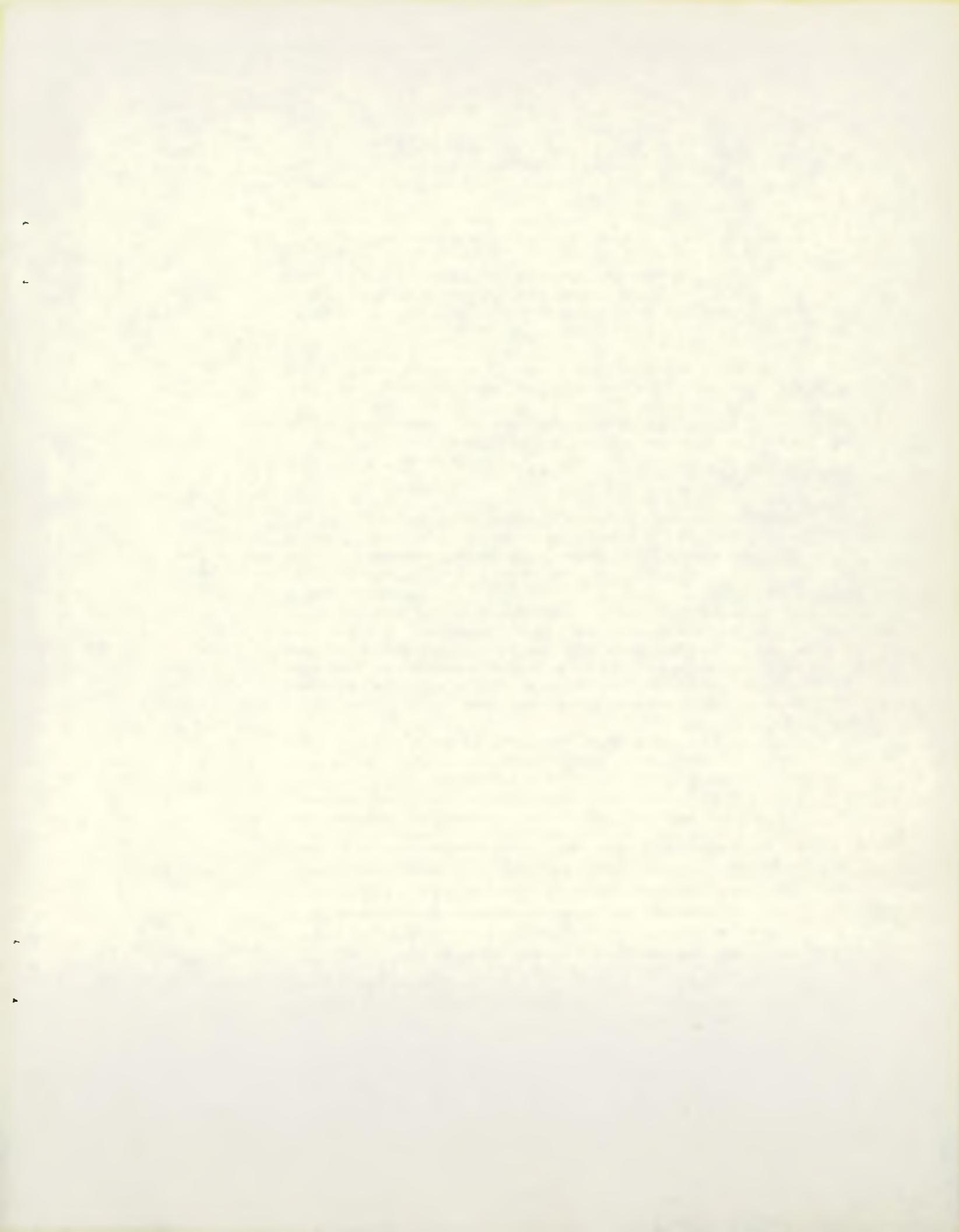
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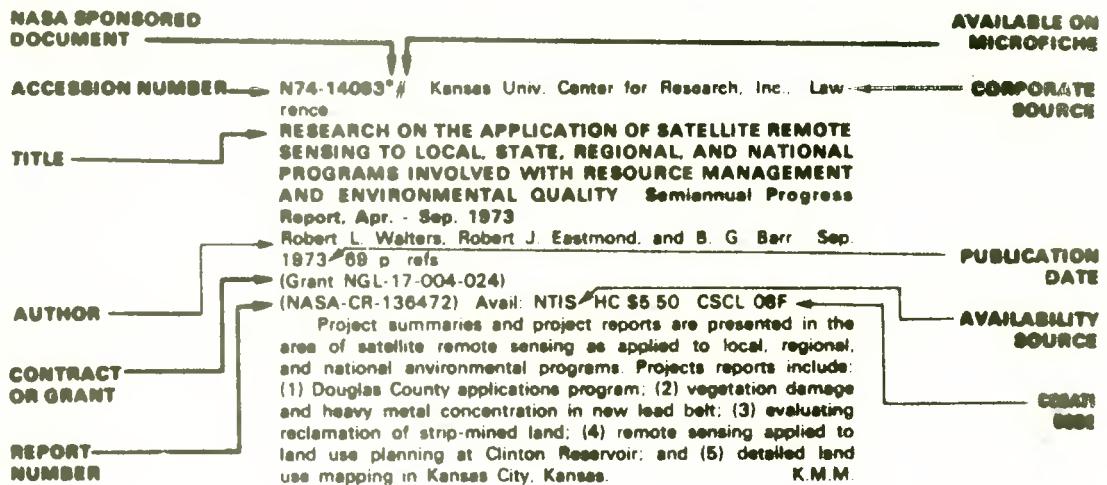
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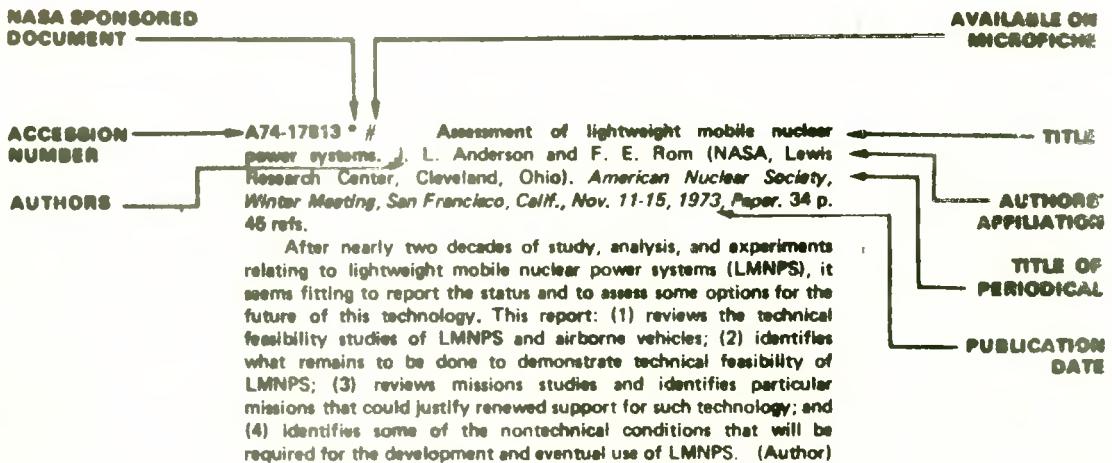
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## TYPICAL CITATION AND ABSTRACT FROM STAR



## TYPICAL CITATION AND ABSTRACT FROM IAA



A Listing of Energy Bibliographies Contained In This Publication:

1. **NSF-RANN Energy Abstracts: A Monthly Abstract Journal of Energy Research, Volume 1, No. 11, November 1973**  
N74-27537 p0114



## IAA ENTRIES

**A74-28746** Fuel system requirements for small gas turbine engines. R. G. Moore (Bendix Corp., Energy Controls Div., South Bend, Ind.). *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan., Apr. 2-5, 1974, Paper 740381.* 9 p. Members, \$1.25; nonmembers, \$2.00.

Fundamental engine configurations and general fuel control functional requirements for 250-1000 hp engines are discussed. A basic fuel control system and functional options developed to meet specific requirements of several engine models are described. Design details of several example options are presented to illustrate the degree of complexity required to obtain desired functions. (Author)

**A74-28747** Fuel system requirements for light aircraft turbocharged reciprocating engines. J. M. Kirwin and E. A. Hasse (Bendix Corp., Energy Controls Div., South Bend, Ind.). *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan., Apr. 2-5, 1974, Paper 740382.* 12 p. Members, \$1.25; nonmembers, \$2.00.

**A74-28943** Stabilization of ionization instability in an MHD generator. S. Hatori and S. Shiota (Tokyo Institute of Technology, Tokyo, Japan). *Physical Society of Japan, Journal, vol. 36, Mar. 1974, p. 920.*

The reduction of ionization instability through full ionization of seed material is considered. In particular, the steady relation between the magnetic field and the spatially averaged electron temperature under actual MHD-generator operating conditions is discussed.

M.V.E.

**A74-28967** Electron nonequilibrium in open-cycle MHD generators. G. S. Argyropoulos, S. T. Demetriades, E. D. Dose (STD Research Corp., Arcadia, Calif.), and D. A. Oliver (MIT, Cambridge, Mass.). *AIAA Journal, vol. 12, May 1974, p. 669-671.* 9 refs. NSF Grant No. C-727; Contract No. F44620-73-C-0001.

Localized regions close to the electrode walls of open-cycle MHD generators have high enough current density so that the free electrons are not in thermal equilibrium with the rest of the gas, even when the working fluid is such an effective absorber of electron energy as CO<sub>2</sub> or coal combustion products. The overall electrical performance of open-cycle MHD generators depends critically on the presence and behavior of such thin nonequilibrium regions adjacent to the electrodes. These effects are demonstrated and analyzed by means of previously developed numerical modeling techniques. (Author)

**A74-29416** # Rapid group analysis of directly distilled petroleum fractions by the method of recorded fluid-adsorption chromatography /FAC/ (Ekspresnyi gruppovoi analiz priamogonnykh neftdannykh fraktsii metodom registratsionnoi zhidkostno-adsorbsionnoi khromatografii /ZhAZh/). Iu. I. Chumakov, S. K. Lopatenko, and G. I. Shchipechov (Kievskii Institut Inzhenero-Grahdanskoi Aviatsii, Kiev, Ukrainian SSR). *Khimika i Tekhnologiya Tepliv i Massov.* no. 4, 1974, p. 61-63. 9 refs. In Russian.

**A74-29445** Heat pipes. L. L. Vasil'ev and S. V. Konev. (Translation of *Teploperedaiushchie Trubki*, Minsk, Izdatel'stvo Nauka i Tekhnika, 1972.) *Heat Transfer - Soviet Research, vol. 8, Jan.-Feb. 1974, p. I-V, 1-97.* 115 refs.

Discussion of the development of heat pipes and vapor chambers utilizing liquids of small heat conductivity and low boiling temperature as the heat carriers. The process of energy and mass transfer in heat pipes, as treated by a number of heat pipe specialists, is reviewed, distinguishing between high-temperature or 'isothermal' heat pipes and medium- and low-temperature range heat pipes. The influence of the boundary conditions inside the condensation zone on the heat flux, temperature field, and thermal resistance of low-temperature heat pipes and vapor chambers is considered for both one- and two-dimensional models. The determination of the capillary head, permeability, and porosity of capillary-porous bodies by a method based on recording both the concentration field of the liquid and the rate of its absorption into the porous body against the force of gravity is described. The problem of cooling and maintaining constant temperatures of semiconductor devices by means of heat pipes and vapor chambers is discussed. Finally, studies of cryogenic and coaxial heat pipes and of regulated heat pipes and vapor chambers are reviewed.

A.B.K.

**A74-29452** # The case for hydrogen-fueled transport aircraft. G. D. Brewer (Lockheed-California Co., Burbank, Calif.). *Astronautics and Aeronautics, vol. 12, May 1974, p. 40-51.* 15 refs.

Hydrogen is shown to offer significant advantages as an energy medium in a society which can no longer depend on the availability of petroleum and natural gas. For the near term requirements, liquid hydrogen can be manufactured from coal and lignite. In the longer term, power from nuclear power plants or solar collectors can generate large quantities of hydrogen by electrolysis or by thermochemical splitting of water. Introduction of hydrogen into the economy via the air-transportation industry offers many advantages: (1) significant improvements in performance for both subsonic and supersonic aircraft; (2) competitiveness, when needed, with the cost of fuel currently used; and (3) deployment by an aerospace industry experienced in handling liquid hydrogen and capable of quickly developing the necessary technologies. From the aviation example, hydrogen technology will more readily make the transition to w. industrial and domestic uses.

M.V.E.

**A74-29463** # Future availability of liquid hydrogen. W. J. D. Escher (Escher Technology Associates, St. Johns, Mich.). *Astronautics and Aeronautics, vol. 12, May 1974, p. 55-59.* 7 refs.

U.S. hydrogen production has been based mainly on natural gas and, to a far less extent on hydrocarbon fluids and coal. For fueling future commercial aircraft, LH<sub>2</sub> (liquid hydrogen) will likely be

produced from relatively abundant coal (and water). A cost estimate for liquid hydrogen 'at the airport' in 1985 would be \$2.50 per million Btu (\$0.13/lb). As coal becomes scarcer, and hence more expensive, producing LH<sub>2</sub> from water-splitting processes, using nuclear and solar energy (and possible geothermal) will eventually become cost-competitive. Just when depends on success in extracting, transporting, and processing coal into hydrogen, as well as advancements in energy-conversion systems operating on non-fossil sources (nuclear, solar).

F.R.L.

**A74-29572 Future of the light turbine helicopter.** T. R. Stuelpnagel (Hughes Helicopters, Culver City, Calif.). *Vertiflite*, vol. 20, Mar. Apr. 1974, p. 6-9.

It is predicted that in the 1980s the light-turbine helicopter (LTH) will be capable to compete economically with a half-ton truck. The use of the LTH accounts currently for 65% of all helicopter flight hours. This figure is expected to increase to 80% by the middle of the next decade. Trends towards a lowering of operating costs are discussed, giving attention to fuel consumption, maintenance, insurance, and depreciation.

G.R.

**A74-29603 Lasers blast a shortcut to the ultimate energy solution.** L. Lessing. *Fortune*, vol. 89, May 1974, p. 221-223 (4 ff.).

The problems inherent in developing a thermonuclear fusion process suitable for solving mankind's energy crisis by means of the containment method can possibly be avoided by a new approach in which lasers are used to heat tiny pellets of deuterium and tritium to temperatures at which fusion takes place. Techniques are being considered to hit the pellet simultaneously on all sides by laser beams. The vaporization of the pellet's surface would set off an implosion in the interior of the pellet. The resulting compression of the pellet core would make it possible to achieve fusion with 100,000 times less laser energy than that required according to previous estimates. Progress in the further development of this very promising process appears to be impeded by the secrecy in which much of the work on controlled laser fusion is being conducted and by inadequate financing.

G.R.

**A74-29823 Reliability of low-cost CdS/Cu<sub>2</sub>S solar cells.** M. M. Sayed (Hewlett Packard Co., Palo Alto, Calif.) and L. D. Partain (Delaware, University, Newark, Del.). *Electronics Letters*, vol. 10, May 2, 1974, p. 163, 164. 10 refs. NSF-supported research.

Accelerated life tests show that CdS/Cu<sub>2</sub>S solar cell lifetimes increase with lower temperature, cyclic light, and a nitrogen-gas ambience. A normal Arrhenius type of temperature dependence was found. Extrapolated lifetime of cells kept below 50°C in nitrogen gas with earth deployment exceeded twenty years. The probable decay mechanisms are thermal diffusion, formation of recombination centers, and voltage-induced decomposition.

(Author)

**A74-29949 Power sources (Les sources de puissance).** W. Palz (Centre National d'Etudes Spatiales, Paris, France). *La Recherche Spatiale*, vol. 13, Mar.-Apr. 1974, p. 13-16. In French.

General descriptions are given for the various solar cell generators developed at CNES for applications satellites. The merits and drawbacks of rigid and foldable arrays are discussed. Both silicon cells and cadmium sulfide cells have been developed. The latter are more supple and economic, but their power output is considerably less. The Soviet satellite SRET-1, launched in 1972, carried 80 CdS thin film cells realized by CNES, each about 4 sq cm, interconnected in integrated fashion. In 240 days of orbit, 20% degradation was noted, but the degradation was restricted to the outside coating and did not affect the semiconductor layers themselves.

P.T.H.

**A74-30101 \* # Clean fuels from biomass.** Y. Y. Hsu (NASA, Lewis Research Center, Cleveland, Ohio). *Southeastern Seminar on Thermal Science, 10th, New Orleans, La.*, Apr. 11, 12, 1974, Paper. 22 p. 19 refs.

The potential of growing crops as a source of fuels is examined, and it is shown that enough arable land is available in the U.S. so

that, even with a modest rate of crop yield, the nation could be supplied by fuel crops. The technologies for fuel conversion are available; however, some R&D efforts are needed for scaling up design. Fuel crop economics are discussed and shown to be nonprohibitive.

M.V.E.

**A74-30105 \* # Solar energy to meet the nation's energy needs.** F. E. Rom and R. L. Thomas (NASA, Lewis Research Center, Cleveland, Ohio). *National Forum on Energy Facts for Concerned Citizens, Boise, Idaho*, Apr. 26, 27, 1973, Paper. 25 p. 14 refs.

Discussion of the possibilities afforded by solar energy as one of the alternative energy sources capable to take the place of the dwindling oil and gas reserves. Solar energy, being a nondepleting clean source of energy, is shown to be capable of providing energy in all the forms in which it is used today. Steps taken toward providing innovative solutions that are economically competitive with other systems are briefly reviewed.

M.V.E.

**A74-30335 \* Electrohydrodynamic heat pipe experiments.** T. B. Jones and M. P. Perry (Colorado State University, Fort Collins, Colo.). *Journal of Applied Physics*, vol. 45, May 1974, p. 2129-2132. Grant No. NGR-06-002-127.

Experiments with two electrohydrodynamic heat pipes are reported. Both devices employ an electromechanical flow structure for axial liquid flow and a capillary wicking structure for (1) collection of condensed liquid at the cooled end and (2) distribution of this liquid at the heated end. One device has circumferential grooving for the capillary structure and the other has feltmetal wicking. The experiments successfully demonstrate the electrohydrodynamic heat pipe concept. Compatibility of the two circumferential wick structures with an axial electromechanical flow structure is also demonstrated. A significant mismatch of the capillary groove and electrohydrodynamic pumping capabilities results in severe hydrodynamic burn-cut limiting in the first heat pipe. Both devices have very poor over-all thermal conductances of the order of 1.2 W/deg C, reflecting the generally poor heat-transfer properties of the dielectric working fluids required in electrohydrodynamic heat pipes.

(Author)

**A74-30529 Fuel cells with the fuel dissolved in the electrolyte.** I. Onaca, M. Mavrodin-Taracic, and I. Solacolu (Academia Romana, Centrul de Cercetari de Chimie Fizica, Bucharest, Rumania). *Studii si Cercetari de Chimie*, vol. 21, no. 7, 1973, p. 761-771. *International Chemical Engineering*, vol. 14, Apr. 1974, p. 347-353. 48 refs. Translation.

A fuel cell using a fuel dissolved in the electrolyte is a system which achieves the conversion of chemical into electrical energy as a result of the fuel oxidation reaction. These types of fuel cells use, for their cathodes, gas electrodes with a three-phase interface, for their anodes two-phase interface porous electrodes and, as the electrolyte, concentrated solutions of an acid or a base in water. The use of alkaline electrolytes with good electrochemical performance is limited in the case of carbon-containing fuels by the phenomenon of carbonation; this makes it necessary to provide the installation with an electrolyte-decarbonation device. The performance of chemical current sources having their fuel dissolved in the electrolyte depends on the judicious selection of the system: fuel-oxidant-electrolyte-electrodes (structure and catalyst), and operating conditions (pressure and temperature).

F.R.L.

**A74-31213 Fusion reactor design problems.** A. H. Spino and A. Belozerov (International Atomic Energy Agency, Vienna, Austria). *Nuclear Fusion*, vol. 14, Apr. 1974, p. 281-283.

The reference design studies presented by a number of participants in the International Atomic Energy Agency (IAEA) workshop provided a framework for identifying what was felt to be several of the most crucial reaction problem areas and for setting up panels to look into these questions in greater depth. The studies investigated impurities, first-wall protection, bulk radiation damage, start-up, repair and accessibility, tritium, fusion and the environment, and fission-fusion hybrid systems.

F.R.L.

**A74-31286 #** Theoretical performance of ammonia, hydrogen, and biowaste rocketjets. R. E. W. Jansson and I. Edwards (Southampton, University, Southampton, England). (British Interplanetary Society, Symposium on Rocket Propulsion and Space Transportation, University College, London, England, Apr. 16, 18, 1972.) *British Interplanetary Society, Journal*, vol. 27, June 1974, p. 433-442. 8 refs.

The theoretical performance of H<sub>2</sub>, NH<sub>3</sub>, CO<sub>2</sub> and CH<sub>4</sub> rocketjets, deduced from realistic models of the nozzle flow, are discussed, and the importance of dissociation of the propellant in the heater and vibrational relaxation in the nozzle are shown. Using the theoretical data to generate engineering design parameters, it is demonstrated that the geometry of the nozzle, as well as the stagnation conditions, can be used as a variable to trade off power losses, hence power system mass, against propellant mass for a given mission total impulse. (Author)

**A74-31446** Energy self-sufficiency - An economic evaluation. M. A. Adelman, H. D. Jacoby, P. L. Joskow, P. W. MacAvoy, D. C. White, M. B. Zimmerman (MIT, Cambridge, Mass.), and H. P. Meissner. *Technology Review*, vol. 76, May 1974, p. 22-58. Research sponsored by the Massachusetts Institute of Technology.

On the assumption that the U.S. meets all its energy demands from internal sources by 1980, forecasts are made of the prices at which supply and demand will be in equilibrium. The results indicate that prices in the range from \$10.00 to \$12.00 per barrel (oil-equivalent) will be necessary to bring forth enough additional supplies of fossil fuels to satisfy demands in domestic energy markets by that time. The development of special price policies is recommended for the synthetics industry. Security can be provided against import disruption by the introduction of radically new import policies. One important element would be an import storage program. G.R.

**A74-31480 \*** Thermochemical water decomposition processes. R. E. Chao (University of Puerto Rico, Mayaguez, P.R.). *I & EC - Industrial and Engineering Chemistry, Product Research and Development*, vol. 13, June 1974, p. 94-101. 124 refs. NASA-supported research.

Thermochemical processes which lead to the production of hydrogen and oxygen from water without the consumption of any other material have a number of advantages when compared to other processes such as water electrolysis. It is possible to operate a sequence of chemical steps with net work requirements equal to zero at temperatures well below the temperature required for water dissociation in a single step. Various types of procedures are discussed, giving attention to halide processes, reverse Deacon processes, iron oxide and carbon oxide processes, and metal and alkali metal processes. Economical questions are also considered. G.R.

**A74-31574** Fusion power by laser implosion. J. L. Emmett, J. Nuckolls, and L. Wood (California, University, Livermore, Calif.). *Scientific American*, vol. 230, June 1974, p. 24-37.

Computer calculations conducted in the early 1960s showed that efficient generation of fusion energy could be achieved if lasers were used to implode thermonuclear fuel to 10,000 times its normal liquid density. A multibeam laser facility, scheduled for completion in 1977, is designed to prove the feasibility of initiating thermonuclear microexplosions by implosion of pellets of hydrogen isotopes to ultrahigh densities. A neodymium-glass laser system, although adequate for feasibility studies, will not serve for a practical fusion reactor. A search for a new laser medium is, therefore, being conducted. Additional technological problems which have to be solved for the operation of a laser-fusion power plant are also considered. G.R.

**A74-32600** Study of the effect of dilution on the lubricity of hydrotreated jet engine fuels. R. K. Agnihotri, J. R. Narang, K. C. Metha, and A. N. Nandy (Defence Research Laboratory, Kanpur,

India). *Wear*, vol. 28, June 1974, p. 392-394. 5 refs.

Using the ball and cylinder technique developed by Agnihotri et al. (1971), it is shown that mere blending of hydrotreated jet engine fuel with conventionally refined fuels does not by itself restore the lubricity lost caused by the hydrotreatment process. The degree of hydrotreatment and the type of crude oil the fuel originates from are important and require due consideration. M.V.E.

**A74-32887** Innovation and space flight (Innovation und Raumfahrt). H. Göllnitz (Messerschmitt-Bölkow-Blohm GmbH, Munich, West Germany). *Flug Revue/Flugwelt International*, June 1974, p. 31-34, 43, 44. In German.

The technological challenges of space flight have led to a multitude of new solutions which are now being utilized in other areas. The fields which benefit from new technological developments of space programs include electronics, data processing, process control, medicine, biology, materials science, machine design, and chemical propulsion systems. Specific new developments considered include the use of new metallic and nonmetallic materials, the design of large solar panels, ultrasonic test procedures, and advances in cryogenic technology including its application in surgery. G.R.

**A74-32908** Effects of radiation on the violet solar cell. R. A. Arndt (COMSAT Physics Laboratory, Clarksburg, Md.). *COMSAT Technical Review*, vol. 4, Spring 1974, p. 41-52. 6 refs.

The violet solar cell, which generates nearly 5 mW per sq cm more power than solar cells employed in present commercial communications satellites, hereafter referred to as satellite cells, has been irradiated with 1-MeV electrons to a fluence of 10 to the 16th power per sq cm and with 2- and 4-MeV protons to a fluence of 10 to the 13th power per sq cm. An electron fluence of about 10 to the 15th power per sq cm or a proton fluence of 2 times 10 to the 10th power per sq cm is required to reduce the power output of the violet cell to that of the satellite cell at beginning of life. The violet cell produces more power after low neutron fluences than a fully recovered Li-doped cell and only a few percent less power after high neutron fluences. (Author)

**A74-33071** Detecting and monitoring oil slicks with aerial photos. K. N. Vizy (Eastman Kodak Co., Rochester, N.Y.). *Photogrammetric Engineering*, vol. 40, June 1974, p. 697-708. 44 refs.

Quantitative results of tests conducted to determine the feasibility of using aerial photographic techniques for the detection and monitoring of oil slicks are presented. Three petroleum products were selected as being typical of oil pollution: gasoline, Diesel fuel, and spent automotive lubricating oil. Slicks of these products on water from the Genesee River were then photographed in several spectral regions. Significant detection capability was found in the ultraviolet and blue regions of the spectrum, less in the near-infrared, and almost none in the green and red. P.T.H.

**A74-33092 #** Investigation of the economic efficiency of surplus tanking of aircraft fuel (Untersuchung über die ökonomische Effektivität der Vorrettbetankung von Flugtreibstoffen). B. Göhler (Gesellschaft für internationales Flugverkehr mbH, Berlin, East Germany). *Technisch-ökonomische Informationen der zivilen Luftfahrt*, vol. 10, no. 2, 1974, p. 75-80. In German.

The effectiveness of the practice of tanking beyond the required amount in countries where the fuel prices are low is analyzed, using the IL-82 airliner as an example. The takeoff, horizontal flight (at constant altitude), and landing stages are examined separately, assuming normal atmospheric conditions and absence of wind in each stage. It is shown that economic efficiency depends primarily on the fuel price difference at home and abroad, on the distance flown, on the amount of surplus fuel, and on the flight altitude and velocity. The need for studying many other factors (including the problem of maximum landing weight) is demonstrated. V.P.

**A74-33096 #** Dolphin airship with undulatory-flow propulsion - Dynamic lift (Dolphinluftschiff mit Wellenstrahl - Dynamischer

Auftrieb). W. Schmidt (Gesellschaft für internationale Flugwerke mbH, Berlin, East Germany). *Technisch-ökonomische Informationen der zivilen Luftfahrt*, vol. 10, no. 2, 1974, p. 104-108. In German.

Queck and Schmidt (1970) have described a novel revolutionary concept of a droplet-shaped helium-filled airship developed on the basis of the dolphin principle. As the dolphin, the airship moves in a self-generated undulatory flow. Safe and comfortable in flight, it combines the maneuverability of a helicopter with the speed of a turboprop aircraft. An aerodynamic study is described, showing that the aerodynamic lift of the airship is roughly equal to that of a wing of the same (droplet) planform, and is 20 times that of a Zeppelin airship of equal volume. The capability of the airship to transport large loads over large distances at low cost is established. The possibility that the dolphin principle may lead to a revival of airship navigation is suggested.

V.P.

A74-33108 # Nonlinear stability of magnetohydrodynamic generators. D. A. Oliver (MIT, Cambridge, Mass.) and S. Jardin (Princeton University, Princeton, N.J.). *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 7th, Palo Alto, Calif., June 17-19, 1974, Paper 74-507*. 11 p. 10 refs. Members, \$1.50; nonmembers, \$2.00. NSF Grant No. GK-38130.

A nonlinear time domain theory for the stability of magnetohydrodynamic (MHD) generators is proposed. The method is capable of treating MHD generator response with flows in the subsonic, transonic, and supersonic flow regimes and with moving shock waves present in the duct. This theory is compared with linear theory predictions of the growth of convectively unstable finite amplitude fluctuations in MHD generators. It is shown that nonlinear, finite amplitude fluctuations grow much faster than infinitesimal fluctuations, and that generators which are globally stable to small amplitude fluctuations may be unstable if those fluctuations are of finite amplitude.

(Author)

A74-33299 An analysis of the national transportation policy. S. D. Browne (MIT, Cambridge, Mass.). *(Annual Air Law Symposium, 8th, Dallas, Tex., Mar. 14, 1974.) Journal of Air Law and Commerce*, vol. 40, Winter 1974, p. 75-79.

The present work advocates greater central control of national transportation policy making, and states that Congress must address the problem of an all-mode transportation department with power to allocate resources between the modes. It is also pointed out that recent data concerning the fuel efficiency of various modes of transportation are out of line. It is argued that these data, obtained by dividing total passenger miles by total fuel, reflected badly on air transportation without taking into consideration actual trip distances, infrastructure costs, and time considerations.

P.T.H.

A74-33584 Thermal cycle and effectiveness of a maneuverable power assembly with an MHD generator and turbogenerator. V. A. Kirillin, A. E. Sheindlin, E. M. Shelkov, E. V. Shishkov, S. A. Pashkov, and V. M. Latyshev (Akademii Nauk SSSR, Nauchno-Issledovatel'skii Institut Vysokikh Temperatur, Moscow, USSR). *(Teplotizika Vysokikh Temperatur*, vol. 11, Sept.-Oct. 1973, p. 1088-1091.) *High Temperature*, vol. 11, no. 5, May 1974, p. 968-980. 8 refs. Translation.

A74-33585 Investigation of heat exchange in an MHD generator channel. V. V. Kirillov and V. D. Semenov (Akademii Nauk SSSR, Nauchno-Issledovatel'skii Institut Vysokikh Temperatur, Moscow, USSR). *(Teplotizika Vysokikh Temperatur*, vol. 11, Sept.-Oct. 1973, p. 1092-1100.) *High Temperature*, vol. 11, no. 5, May 1974, p. 970-977. 13 refs. Translation.

A theoretical treatment of heat transfer and frictional drag, applicable to the conditions in the channel of an open-cycle MHDG, is presented. A calculation is made of the drag resistance and heat transfer for the turbulent flow along a flat wall of partially dissociated natural gas combustion products. The calculation is conducted for external Reynolds numbers from 100,000 to 10,000,000, a ratio of wall temperature to external temperature ranging from 0.133 to 1, and an external temperature range of 2,400 to 3,000 K. The degree of dissociation of the combustion products is

fairly high in the temperature range indicated; at external temperature of 3,000 K, the dissociation energy comprises 46% of the enthalpy of the gas. The effect of various factors on the heat exchange under given conditions is shown. The data obtained is compared with the results of calculations by other methods. The results of an experimental study of heat exchange in large open-cycle MHD installations are cited. A comparison of the theoretical data with the experimental results is given.

(Author)

A74-33811 # Minimum time and minimum fuel flight path sensitivity. M. A. Nichols (USAF; Arizona State University, Tempe, Ariz.) and J. K. Hedrick (Arizona State University, Tempe, Ariz.). *Journal of Aircraft*, vol. 11, June 1974, p. 320-325. 13 refs.

The sensitivity of minimum-time and minimum-fuel flight paths to variations in aircraft parameters in different atmospheric conditions was investigated using the energy state approximation. Numerical results are presented for a typical supersonic aircraft in Standard-Day, Hot-Day, and Cold-Day atmospheres. This paper shows how flight time and fuel consumption are affected by changes in thrust, weight, drag coefficients, and specific fuel consumption in each of three different atmospheric conditions. For each variation, the effect on performance (flight time or fuel consumption) is determined for the nominal paths. Then for each variation, the flight path is adjusted to be either time optimal or fuel optimal.

(Author)

A74-33871 Vertical multijunction solar-cell one-dimensional analysis. A. Gover and P. Stella (Heliotek, Sylmar, Calif.). *IEEE Transactions on Electron Devices*, vol. ED-21, June 1974, p. 361-366. 7 refs. Contract No. F33615-72-C-1310.

The vertical multijunction solar cell is a photovoltaic device which may allow conversion efficiencies higher than conventional planar devices. A one-dimensional model of the device is presented here which allows a simple and straightforward analysis of device performance to be conducted. The analysis covers the derivation of device short-circuit current, saturation current, open-circuit voltage, and maximum power as a function of illumination spectra, device geometry, and device material properties.

(Author)

A74-33982 Hydrogen production by reforming processes - The alternatives and economics. W. Hartley (Davy Powergas, Ltd., London, England). In: *Cryotech '73: The production and use of industrial gases*; *Proceedings of the Conference*, Brighton, England, November 13-15, 1973. Guildford, Surrey, England, IPC Science and Technology Press, Ltd., 1974, p. 54-80.

The paper discusses the alternative process routes available to produce H<sub>2</sub> or H<sub>2</sub>/CO mixtures from hydrocarbons using catalytic steam reforming or partial oxidation processes. The advantages, limitations and applications of each scheme are discussed. Typical investment and raw material/utility requirements are included for each process route. The investment data is based on costs for June 1973.

(Author)

A74-33983 Process design considerations in cryogenic hydrogen recovery plants. M. Ruhemann and K. Ticher (Petrocarbon Developments, Ltd., Manchester, England). In: *Cryotech '73: The production and use of industrial gases*; *Proceedings of the Conference*, Brighton, England, November 13-15, 1973. Guildford, Surrey, England, IPC Science and Technology Press, Ltd., 1974, p. 61-86; Discussion, p. 68.

The paper discusses the characteristic process features of plants which recover hydrogen of moderate purity from gas mixtures available at elevated pressures and in which no mechanical work is performed. The concept of 'efficiency' in this type of plant is explained and it is shown that the efficiency determines the maximum pressure at which tail-gases (i.e., the evaporated condensates) can be extracted. In most cases this pressure is limited, not by considerations of heat balance, but by the mixing entropy of the feed components. The significance is discussed of the injection of hydrogen into the evaporating condensates to lower the temperatures

to which the feed can be cooled and hence to raise the purity of the hydrogen product, and it is shown that the use of refluxing exchangers can improve the efficiency of the recovery process.

(Author)

*✓* A74-34084 PBA hydrogen plants - How well have they performed. C. H. Ketten and H. A. Stettler (Union Carbide Europe, S.A., Geneva, Switzerland). In: *Cryotech '73: The production and use of industrial gases: Proceedings of the Conference*, Brighton, England, November 13-18, 1973. Surrey, England, IPC Science and Technology Press, Ltd., 1974, p. 78-84; Discussion, p. 84.

Description of the design, operation, and applications of multiple-vessel adsorption systems used for recovery and purification of hydrogen gas by the pressure-swing principle. Performance histories of particular equipment are provided in applications involving purification of hydrogen in gas flows where the initial hydrogen content varies from 35% to 99.5%. Final purity can vary from 99 to 99.9999%, depending on need, and yield is satisfactory with tail gases being recycled, sent to fuel, or flared. Improvements in electrical components used for process control functions are highlighted.

T.M.

A74-34080 Symposium on Engineering Problems of Fusion Research, 5th, Princeton University, Princeton, N.J., November 5-8, 1973, Proceedings. Symposium sponsored by Princeton University, AEC, IEEE, and ANS. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, 703 p. \$25.

Topics discussed include the effect of helium on fusion reactor materials, fusion reactor heat transfer systems, reactor fuel handling, the power balance in fusion reactors, laser-controlled thermonuclear research, Tokamak reactor design, theta-pinch power plant development, blanket-coupled MHD, lithium-cooled reactor blankets, reactor blankets containing thorium, the injection of neutral beams into thermonuclear reactors, capacitive energy storage for theta-pinch compression, co-finial-field coil loading and stresses for a large-torus reactor, toroidal field coils and high-power injection heaters for the Ormec system, and topics concerning energy storage, mechanical design and data handling, magnet design, electron beams and lasers for high-temperature plasma diagnostics and high-voltage technology.

A.B.K.

A74-34083 A preliminary engineering design of a 'Venetian blind' direct energy converter for fusion reactors. W. L. Barr, R. J. Burleigh, W. L. Dexter, R. W. Moir, and R. R. Smith (California, University, Livermore, Calif.). *IEEE Transactions on Plasma Science*, vol. PS-2, June 1974, p. 71-82. 23 refs. AEC-sponsored research.

The considered scheme for the direct energy converter was first described by Moir and Barr (1973). According to this approach the beam from the reactor is expanded two-dimensionally in a conical magnetic expander. Energy selection is accomplished through the angular dependence of ion transmission through a system of ribbon grids resembling a Venetian blind. Some of the practical aspects of this concept are examined, giving attention to some of the problems involved and some possible solutions. A cost estimate for the energy converter is also presented.

G.R.

A74-34085 # Testing of photoelectric generators in the conditions of Apseron Peninsula, Azerbaijan SSR (Izpytanie fotoelektricheskikh generatorov v usloviyah Apseronskogo poluostrova AzSSR). M. Ia. Bakirov, E. K. Gasenov, and N. P. Aliev (Akademika Nauk Azerbaidzhanskoi SSR, Institut Fiziki, Baku, Azerbaijan SSR). *Gelotekhnika*, no. 2, 1974, p. 3-6. 8 refs. In Russian.

The diurnal output of a solar array was monitored during the months of August through December, 1972, on the Apseron Peninsula. The array consisted of silicon solar cells, and was rated to

produce 5 to 6 watts of power under conditions of 800 watts per sq. m of solar radiation. The diurnal variation in output was studied on the basis of a classification of days into clear, partly clear, or overcast days.

P.T.H.

A74-34087 # Study of the effect of increased humidity on the mirror coatings of solar energy concentrators (izuchenie vliyaniya vysokoi vlhchnosti na zerkal'nye pokrytiya koncentratorov solnechnoy energii). U. Kh. Gaziev, M. M. Kotun, and V. S. Trukhov (Akademika Nauk Uzbekskoi SSR, Fiziko-Tekhnicheskiy Institut, Tashkent, Uzbek SSR; Vsesoyuznyi Nauchno-Issledovatel'skiy Institut Issledovaniy Toka, Kishinev, Moldavian SSR). *Gelotekhnika*, no. 2, 1974, p. 36-37. In Russian.

A74-34098 # Effect of series resistance on the illuminating efficiency and optimal thickness of the alloyed layer of silicon photovoltaic cells (Vliyanie perekrovayushchego soderzhitvennykh perekrovok na effektivnost' i optimálnuyu tolshchino legirovannogo sloya izrannivayushchikh fotoperekrovok). V. P. Matveev, E. S. Maturov, M. M. Kotun, and I. P. Gavrilova (Vsesoyuznyi Nauchno-Issledovatel'skiy Institut Issledovaniy Toka, Kishinev, Moldavian SSR). *Gelotekhnika*, no. 2, 1974, p. 43-50. 7 refs. In Russian.

A74-34191 Developments in laser technology-II; Annual Technical Meeting, 17th, Seminar-in-Depth, San Diego, Calif., August 27-28, 1973, Proceedings. Seminar sponsored by the Society of Photo-optical Instrumentation Engineers. Edited by R. F. Wuerker (TRW Systems Group, Redondo Beach, Calif.). Redondo Beach, Calif., Society of Photo-optical Instrumentation Engineers (SPIE Proceedings, Volume 41), 1974, 205 p. Members, \$18.; nonmembers, \$21.

Recently developed laser systems and theoretical analysis of laser operation are described for a wide variety of laser types and applications. Some of the topics covered include: theory and experiment in laser driven fusion, scaling relations pertaining to a double discharge CO<sub>2</sub> TEA laser, laser internal aerodynamics and beam quality, experiments with nuclear-pumped gas lasers, biomedical applications of a holographic system for automatic surface mapping, computer holograms, holographic techniques in the study of marine plankton, integrated optics, and the use of He-Ne lasers in construction and building industry.

P.T.H.

A74-34192 Theory and experiments in laser driven fusion. K. A. Brueckner (KMS Fusion, Inc.). In: *Developments in laser technology-II; Annual Technical Meeting, 17th, Seminar-in-Depth, San Diego, Calif., August 27-28, 1973, Proceedings*. Redondo Beach, Calif., Society of Photo-optical Instrumentation Engineers, 1974, p. 5-12.

Configuration and physics requirements are discussed for fusion energy to be equal to laser energy in controlled fusion systems using a laser beam to initiate the fusion of a highly compressed deuterium-tritium (DT) pellet. Results of two-dimensional computer simulation of the stability of the pellet implosion are presented. A neodymium-glass laser system is described which has been used in tests measuring target reflectivity and electron temperature when pulses up to 300 joules with 3 nanosecond duration are delivered on plane CD<sub>2</sub> and CH<sub>2</sub> targets. Results of these preliminary experiments are discussed.

P.T.H.

A74-34367 Photovoltaic Specialists Conference, 10, Stanford University, Palo Alto, Calif., November 13-16, 1973, Conference Report. Conference sponsored by the Institute of Electrical and Electronics Engineers. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, 424 p. Members, \$18.75; nonmembers, \$25.

Various types of photovoltaic solar cells are discussed, and the functioning of their individual elements, including the advantages of different junction and semiconductor features, is examined. Methods of measuring the efficiency and testing the reliability of solar cell

arrays are presented along with suggestions for improving the performance of such cells by incorporating new principles of design and fabrication. The terrestrial applications of solar cells are considered in connection with ongoing developments in space technology, and the effects of radiation and environment are investigated.

J.K.K.

**A74-34368** Principles of photovoltaic solar energy conversion. J. J. Loferski (Brown University, Providence, R.I.). In: Photovoltaic Specialists Conference, 10th, Palo Alto, Calif., November 13-15, 1973, Conference Record.

New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 1-4.

The present work sets forth the main principles of operation of semiconductor photovoltaic cells. Four basic photovoltaic effect parameters discussed are the short circuit current; the open circuit voltage; the current for matched load, i.e. current under maximum power transfer conditions and the corresponding voltage. Maximum efficiency attainable in a photovoltaic cell is discussed. The efficiency is a strong function of temperature; it decreases as temperature increases. This must always be taken into account, especially if the cells are to be used with concentrators. P.T.H.

**A74-34369** Potential improvements in efficiency and cost of solar cells. M. Wolf (Pennsylvania University, Philadelphia, Pa.). In: Photovoltaic Specialists Conference, 10th, Palo Alto, Calif., November 13-15, 1973, Conference Record.

New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 5-14. 18 refs.

Several areas for potential improvement in silicon solar cells are identified. An improvement of 17% in collection efficiency is available through elimination of the high surface recombination velocity in combination with a reduction of the thickness of the diffused layer. While at present, silicon of a base resistivity of 2 to 10 ohm cm is commonly used, yielding open circuit voltages in the range 0.65 to 0.80 V, use of a base resistivity of 0.01 ohm-cm could potentially yield an open circuit voltage of 0.78 V. Present costs of silicon solar arrays are compared with cost goals for large-scale terrestrial applications. Proof of commercial feasibility may be achievable within 5 years with a copper sulfide/cadmium sulfide system, but should require, with expenditures of significant efforts, approximately 10 years for the silicon system. P.T.H.

**A74-34370** Solar and laser energy conversion with Schottky barrier solar cells. R. J. Stirn and Y.-C. M. Yeh (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: Photovoltaic Specialists Conference, 10th, Palo Alto, Calif., November 13-15, 1973, Conference Record.

New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 15-24. 24 refs. Contract No. NAS3-15420.

Photovoltaic devices have been fabricated for solar and short-wavelength laser energy conversion using the thin metal film-semiconductor (Schottky barrier) approach. Studies of the metal film optical characteristics and the voltage outputs were emphasized. Air mass zero efficiencies of 8 to 9% in GaAs and laser conversion efficiencies of 25% at 4880 Å in GaAs(0.8)P(0.4) are presently measured, with projected efficiencies of 15 and 45%, respectively. The techniques, if applied successfully to semiconductor thin films, could have an impact in solar energy terrestrial application. (Author)

**A74-34373** The effect of depletion region recombination currents on the efficiencies of Si and GaAs solar cells. H. J. Hovel (IBM Research Laboratory, San Jose, Calif.). In: Photovoltaic Specialists Conference, 10th, Palo Alto, Calif., November 13-15, 1973, Conference Record.

New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 34-39. 8 refs.

The Sali-Noyce-Shockley theory of depletion region recombination-generation currents is described along with the modification

by Cho for asymmetrical junctions. Computer calculations show that these currents do not seriously affect the efficiency of Si solar cells for reasonably high lifetimes, but lower the efficiency of GaAs devices by 1 to 1.5% even in the best of cases. Reasons for discrepancies between theory and experiment are discussed. (Author)

**A74-34378** Comparison of vertical multi-junction and conventional solar cell performance. T. B. S. Chadda and M. Wolf (Pennsylvania University, Philadelphia, Pa.). In: Photovoltaic Specialists Conference, 10th, Palo Alto, Calif., November 13-15, 1973, Conference Record.

New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 82-87.

A theoretical study has been carried out to compare the potentially achievable performance of vertical multijunction solar cells with that of the conventional solar cell for the case of the silicon n/p junction structure of 10-ohm-cm base resistivity under air mass zero conditions. The results confirm the prior supposition, that the performance of the vertical junction cell in monochromatized sunlight at beginning of life is only marginally superior to that of the conventional solar cell, but that it can withstand, if properly designed, a two to three times greater fluency of nuclear particle radiation (1-MeV electrons) before reaching equal end-of-life power output. (Author)

**A74-34383** GaAs solar cells with AlAs windows. D. Huber and K. Bogus (Telefunken AG, Heilbronn, West Germany). In: Photovoltaic Specialists Conference, 10th, Palo Alto, Calif., November 13-15, 1973, Conference Record.

New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 100-102. 5 refs. Research supported by the Gesellschaft für Weltraumforschung.

The conversion efficiency of GaAs solar cells is increased by using appropriate window materials. In an attempt to make the window material as transparent as possible, pure AlAs layers have been grown on GaAs by liquid phase epitaxy. AlAs has its indirect gap at 2.15 eV and its direct gap at 2.9 eV, which gives a reduction of absorption losses in the window by more than 20% compared to Ga(1-x)Al(x)As windows. An evaluation of quantum efficiency and solar cell I-V characteristic measurements leads to a conversion efficiency of 13.5% under air mass zero conditions. (Author)

**A74-34387** High voltage solar cell power generating system. E. Levy, Jr., R. W. Oplinden (Hughes Aircraft Co., El Segundo, Calif.), and A. C. Hoffman (NASA, Lewis Research Center, Cleveland, Ohio). In: Photovoltaic Specialists Conference, 10th, Palo Alto, Calif., November 13-15, 1973, Conference Record.

New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 123-131. Contract No. NAS3-15428.

A laboratory solar power system regulated by on/off switches has been delivered for operating high power (3 kW), high voltage (15,000 volt) loads (communication tubes, ion thrusters). The modular system consists of 26 solar arrays, each with an integral light source and cooling system. A typical array contains 2,600 series-connected cells. Each light source consists of twenty 500-watt tungsten iodide lamps providing plus or minus 5 percent uniformity at one solar constant. An array temperature of less than 40 C is achieved using an infrared filter, a water-cooled plate, a vacuum hold-down system, and air flushing. (Author)

**A74-34380** Qualification testing of laboratory produced violet solar cells. D. J. Curtin and R. W. Cool (COMSAT Laboratories, Clarksburg, Md.). In: Photovoltaic Specialists Conference, 10th, Palo Alto, Calif., November 13-15, 1973, Conference Record.

New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 139-152. 7 refs. Research supported by the Communications Satellite Corp.

Tests run on bare violet solar cells fabricated early in the program showed a 4.1% degradation in maximum power after 1000 hours of humidity as well as tape peel, thermal shock, and thermal soak tests. Normal solderless solar cells showed degradations from

13.6 to 22.1%, while cells with titanium-palladium-silver contacts showed degradations of 1.0% or less under humidity testing only. Covered violet solar cells showed no degradation. After a fluence of 3 times 10 to the 14th power 1-MeV electrons/sq cm, covered violet solar cells fabricated early in the program produced over 20% more power than conventional, Intelsat IV type cells. Temperature coefficients were also measured. Covered violet solar cells can be welded by parallel gap resistance welding without electrical degradation. A violet solar cell module fabricated in this way has survived 200 thermal shock cycles to -196°C without electrical degradation.

(Author)

**A74-34384 \*** Optimum design of antireflection coating for silicon solar cells. E. Y. Wang, F. T. S. Yu, V. L. Simms (Wayne State University, Detroit, Mich.), H. W. Brandhorst, Jr., and J. D. Broder (NASA, Lewis Research Center, Cleveland, Ohio). In: Photovoltaic Specialists Conference, 10th, Palo Alto, Calif., November 13-15, 1973, Conference Record. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 168-173. 15 refs.

Based on classical electromagnetic theory, reflectivity calculations for various single and double optical coating systems for silicon solar cells are presented. From calculations and considerations of solar spectral response of the solar cells, the number and thickness of coating materials needed to obtain efficient solar cells can be predicted. Some experimental results on single layer coated cells are also presented for comparison with calculations, and agreement is good. By means of microwave transmission line analogy, the design of the multilayer coating can be simplified by using Tchebycheff polynomials.

(Author)

**A74-34386** Vitreous oxide antireflection films in high-efficiency solar cells. A. G. Revesz (COMSAT Laboratories, Clarksburg, Md.). In: Photovoltaic Specialists Conference, 10th, Palo Alto, Calif., November 13-15, 1973, Conference Record.

New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 180, 181. 7 refs. Research sponsored by the Communications Research Corp.

New antireflection Ta<sub>2</sub>O<sub>5</sub> and Nb<sub>2</sub>O<sub>5</sub> films have been developed for the violet solar cells. These films are prepared in such a manner that the oxide is in the vitreous state, i.e., it is noncrystalline but has a high degree of short range order. As a result, these films do not absorb in the blue and violet range of the spectrum and the junction properties do not deteriorate (i.e., the fill factor is high).

(Author)

**A74-34398 \*** The multiple junction edge illuminated solar cell. B. L. Seter, H. W. Brandhorst, Jr., T. J. Riley, and R. E. Hart, Jr. (NASA, Lewis Research Center, Cleveland, Ohio). In: Photovoltaic Specialists Conference, 10th, Palo Alto, Calif., November 13-15, 1973, Conference Record. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 188-193. 9 refs.

The multiple junction edge illuminated solar cell (M-J Cell) was devised for high voltage, low current applications. Devices to be flight-tested in early 1974 with 98 series-connected PNN+ junctions in a 2 cm x 2.3 cm size deliver 36 volts at 1 milliamper. Test data of M-J Cells fabricated with resistivities of 10, 50, 100, 200, 450, and 1000 ohm-cm silicon are presented and problem areas are discussed. An additional potential application of the M-J Cell lies in utilization of its high-intensity performance that has been demonstrated at levels in excess of 100 AMO suns.

(Author)

**A74-34401** Improved performance from thin silicon solar cells. P. A. Iles and D. K. Zemrich (Globe-Union, Inc., El Monte, Calif.). In: Photovoltaic Specialists Conference, 10th, Palo Alto, Calif., November 13-15, 1973, Conference Record.

New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 200-206. 17 refs.

Several methods used to increase solar cell output have been applied successfully to thin cells. The experimental results show that

for AMO illumination, maximum power values exceeding 70 mW can be obtained for 4-sq cm cells down to thicknesses approaching 2 mils. The specific power obtained has exceeded 0.6 kW/lb. The methods described should be applicable to thin cells made from different forms of silicon available in the future.

(Author)

**A74-34404** The NSF/RANN Photovoltaic Energy Conversion Program. H. R. Blieden (National Science Foundation, Div. of Advanced Energy Research and Technology, Washington, D.C.) and F. H. Morse. In: Photovoltaic Specialists Conference, 10th, Palo Alto, Calif., November 13-15, 1973, Conference Record.

New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 219-226.

The general and specific objectives of the NSF/RANN Photovoltaic Energy Conversion Program are presented within the framework of the NSF/RANN Solar Energy Program. The program plan to achieve these objectives is described and the major milestones are identified. A brief summary of those photovoltaic projects currently under NSF/RANN support is included.

(Author)

**A74-34405 \*** Terrestrial applications of solar cell powered systems. W. C. Moore, J. W. Ravin (Textron Electronics, Inc., Heliotek Div., Sylmar, Calif.), R. M. Masters, and A. F. Forestieri (NASA, Lewis Research Center, Cleveland, Ohio). In: Photovoltaic Specialists Conference, 10th, Palo Alto, Calif., November 13-15, 1973, Conference Record.

New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 227-233.

A study was initiated to search out, list, and evaluate terrestrial applications of solar cells and design systems for those applications that show the most promise for becoming practical and accepted by users within the next five years. From a list of over 65 potential applications, ten were selected for further study. The study culminated in detailed engineering designs of systems for the two most attractive applications.

(Author)

**A74-34406 \*** The NASA-Lewis terrestrial photovoltaics program. D. T. Bernatowicz (NASA, Lewis Research Center, Cleveland, Ohio). In: Photovoltaic Specialists Conference, 10th, Palo Alto, Calif., November 13-15, 1973, Conference Record.

New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 234-238. 5 refs.

Those parts of the present NASA-Lewis research and technology effort on solar cells and arrays having relevance to terrestrial uses are outlined. These include raising cell efficiency, developing the FEP-covered module concept, and exploring low-cost cell concepts. Solar cell-battery power systems for remote weather stations have been built to demonstrate the capabilities of solar cells for terrestrial applications.

(Author)

**A74-34412** Layout and technology of the CTS solar array blanket. R. Buh (Telefunken AG, Hamburg, West Germany). In: Photovoltaic Specialists Conference, 10th, Palo Alto, Calif., November 13-15, 1973, Conference Record.

New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 296-308.

Description of a flexible solar cell blanket for the Canadian Communication Technology Satellite. The main components of the blanket are 200-micron-thick solar cells, 100-micron-thick cover slides, silver mesh interconnectors, substrate of 65-micron-thick reinforced Kapton, and flexible wires for power transfer. The most significant processes are automatic welding, bonding in vacuum, and a special technique for interconnecting subunits of the solar cell blanket.

(Author)

**A74-34416** Evaluation of ohmic losses in solar cells and array. J. Roger (Société Anonyme des Télécommunications, Paris, France). In: Photovoltaic Specialists Conference, 10th, Palo Alto Calif., November 13-15, 1973, Conference Record.

New York, Institute of Electrical and Electronics

Engineers, Inc., 1974, p. 345-352.

Methods for measuring the resistance of intercell and inter-module couplings, for optimizing solar cell gridlines and for evaluating wiring losses in a solar cell array are discussed. Curves are plotted to show the efficiency of an ideal solar cell as a function of open circuit voltage and short circuit current density. Plots are also included for various performance characteristics and specifications of solar cells and arrays.

V.Z.

**A74-34421\*** The drift field model applied to the lithium-containing silicon solar cell. M. P. Godlewski, C. R. Baraona, and H. W. Brandhorst, Jr. (NASA, Lewis Research Center, Cleveland, Ohio). In: Photovoltaic Specialists Conference, 10th, Palo Alto, Calif., November 13-15, 1973, Conference Record. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 378-383. 14 refs.

The drift field model used by Wolf (1963) to calculate the short-circuit current was extended to permit calculations of the open-circuit voltage and the maximum power under conditions of illumination of either tungsten (2800 °C) source or air mass zero sunlight. Voltages were calculated using an expression for the drift field diode saturation current. The model, applied to the oxygen-rich (C-13 group) lithium solar cells, was used to calculate the pre- and post-electron bombardment trends of the open-circuit voltage, maximum power, and short-circuit current for lithium gradients in the range from 10 to the 18th power to 10 to the 19th power Li/cm to the 4th power. Diffusion length degradation and carrier removal effects were sufficient to predict the cell performance up to  $3 \times 10$  to the 14th electrons per sq cm. Beyond this fluence it was necessary to include drift field removal effects. (Author)

**A74-34620** Nuclear fission as a general source of energy. L. R. Shepherd (Organization for Economic Cooperation and Development, Winfrith, Dorset, England). *Nature*, vol. 249, June 21, 1974, p. 717-720.

Attention is given to ways through which the heat generated by nuclear fission in reactors could be more fully utilized to meet overall energy requirements rather than merely producing electricity for distribution through utility grids. Procedures and technical requirements are discussed for (1) the direct use of waste heat in the thermodynamic cycles involved in generating electricity (low-temperature processes), (2) the direct utilization of the heat output of reactors in chemical industrial processes supplemented by electricity production (high-temperature processes), and (3) direct or indirect application of nuclear heat supply to produce synthetic liquid or gaseous fuels (high-temperature processes or methods involving intermediate electrical power generation). T.M.

**A74-34621** Prospects for hydrogen as an energy resource. J. K. Dawson (Atomic Energy Research Establishment, Harwell, Berks., England). *Nature*, vol. 249, June 21, 1974, p. 724-728.

Large-scale production of hydrogen from water is evaluated as a future source of fuel for transport and the reduction of iron ore. Potential markets for hydrogen fuel are estimated on the basis of expected fuel production costs and demands at the end of the century. Cost and feasibility analyses are included for two processes whereby nuclear energy is used in decomposition of water either through direct thermochemical decomposition or by electrolysis involving intermediate conversion to electric power. T.M.

**A74-34771** Solid state batteries. C. C. Liang (P. R. Mallory and Co., Inc., Burlington, Mass.). In: Applied solid state science: Advances in materials and device research. Volume 4. New York, Academic Press, Inc., 1974, p. 95-135. 111 refs.

A number of limitations present in batteries with aqueous solution electrolytes are not found in solid state battery systems in which both electrodes and electrolytes are in the solid state. In

recent years considerable progress has been made in the development of practical solid state batteries as energy sources. The general aspects of the conduction mechanisms of solid crystalline compounds are discussed, taking into account the ionic transport mechanisms of various highly conductive solid electrolytes. G.R.

**A74-34844** Energy management display. D. C. Soderstrom, R. C. McLane (Honeywell, Inc., Minneapolis, Minn.), and W. M. Branch (U.S. Navy, Naval Air Test Center, Patuxent River, Md.). In: Flight testing today - 1973; Proceedings of the Fourth National Symposium, Las Vegas, Nev., August 21-23, 1973. California, Md., Society of Flight Test Engineers, 1973. 5 p. Contract No. N00014-72-C-0194.

A research program in the field of energy management (efficient use of an aircraft's energy resources), aimed at developing a display suitable for exploring the areas of performance calibration, energy maneuverability, throttle-setting aids, efficient establishment of steady-state flight conditions, and similar flight research areas is described. The program led to the development of an energy/energy rate meter, whose theory of operations and applications is described. The results of flight tests conducted to evaluate the accuracy and utility of this relatively simple display concept are examined. V.P.

**A74-34978** Flight/propulsion control integration aspects of energy management. M. J. Wendl, G. G. Gross, J. L. Porter, and V. R. Pruitt (McDonnell Aircraft Co., St. Louis, Mo.). Society of Automotive Engineers, Air Transportation Meeting, Dallas, Tex., Apr. 30-May 2, 1974, Paper 740480. 17 p. Members, \$1.40; nonmembers, \$2.25. Contracts No. F33615-71-C-1144; No. F33615-73-C-3130; No. F33615-72-C-1163.

Analytical studies indicate substantial aircraft performance benefits can result from proper application of energy management principles, and that conceptual approaches involving close coupling of aerodynamic, propulsion, and control technical elements are required to achieve these benefits. Analytic tools used in these studies include a modified Rutowski technique for simultaneously optimizing throttle position and flight path. Pilot-in-the-loop simulation results are presented and the use of advanced pilot displays utilizing energy management techniques are described. (Author)

**A74-34985** Application of hydrogen to commercial transports. D. L. Kelly (Lockheed-California Co., Burbank, Calif.). Society of Automotive Engineers, Air Transportation Meeting, Dallas, Tex., Apr. 30-May 2, 1974, Paper 740481. 9 p. Members, \$1.40; nonmembers, \$2.25.

A design analysis of the conversion of an in-production wide-bodied transport to hydrogen fuel is presented. Comparisons are drawn between storage of hydrogen in the fuselage and storage in wing-external tanks. Required structural modifications are defined and costed, and a preferred configuration is selected on the basis of direct operating cost. It is shown that a conversion of a jet fueled wide-bodied transport to hydrogen fuel is technically and economically feasible, provided that it is preceded by a long-life tankage and insulation development. The preferred configuration has the hydrogen stored in pylon-mounted tanks above the wings. Flyaway cost of the hydrogen fueled conversion is 8 percent greater than that of the baseline jet fueled transport. M.V.E.

**A74-34986** Performance versus cost tradeoffs - Initial look at alternatives. G. P. Sallee (American Airlines, Inc., New York, N.Y.). Society of Automotive Engineers, Air Transportation Meeting, Dallas, Tex., Apr. 30-May 2, 1974, Paper 740494. 6 p. Members, \$1.40; nonmembers, \$2.25.

Review of some of the engine alternatives suggested to reduce the impact of rising fuel prices. It is concluded, based on an analysis which considered the depreciation of investment, the cost of capital, insurance and maintenance expenses, as well as fuel savings, that in order of priority, it is necessary to investigate the optimum way to improve current inservice engine performance at minimum increase in maintenance cost and to investigate the possibility of improving

current engines by means of modification within current dimensions to improve components. Only after these are investigated and fuel prices have substantially increased, will retrofit of new engines on old aircraft be worthy of consideration. (Author)

**A74-34980** An approach to aeroengine tradeoff factors. T. D. Sills (Rolls-Royce /1971, Ltd., Derby, England). *Society of Automotive Engineers, Air Transportation Meeting, Dallas, Tex., Apr. 30-May 2, 1974, Paper 740493.* 7 p. Members, \$1.40; nonmembers, \$2.25.

Engine tradeoff factors are discussed in a general manner. Some of the problems of their interpretation and their limitations in use, particularly when presented by the aircraft constructor or operator to the aeroengine manufacturer, are shown. The discussion is restricted to the performance and economic aspects of civil transport aircraft. Illustrative examples are given. (Author)

**A74-34983** Amphibian STOL and its facilities. R. G. Smathers, Jr. (Lockheed-Georgia Co., Marietta, Ga.). *Society of Automotive Engineers, Air Transportation Meeting, Dallas, Tex., Apr. 30-May 2, 1974, Paper 740488.* 15 p. 15 refs. Members, \$1.40; nonmembers, \$2.25.

The short-haul transportation problem, worldwide, is characterized by congestion both on the ground and in the air. Solutions in the form of ground transportation are expensive in terms of land utilization, high development costs, their adverse effect on the environment and ecology, and are 20-30 years in the future. STOL offers a solution, but the high cost of land for downtown STOLports has precluded implementation. The STOL amphibian provides a solution which uses existing waterways situated downtown in every major city. It will relieve ground congestion and alleviate saturated airports. Studies show that such a system meets the ten basic requirements established by the National Environmental Policy Act of 1969 and that it contributes significantly to a reduction in the energy consumed in travel to and from the airports. (Author)

**A74-35000** U.S. government airport capacity planning. C. L. Blake (FAA, Washington, D.C.). *Society of Automotive Engineers, Air Transportation Meeting, Dallas, Tex., Apr. 30-May 2, 1974, Paper 740474.* 8 p. Members, \$1.40; nonmembers, \$2.25.

In order to formulate policy for the orderly development and use of the nation's navigable air space, federal agencies such as the FAA and the Department of Transportation have launched several programs to determine aviation requirements for the next 10 years. This paper outlines their conclusions concerning airborne activities such as flow control, approach and departure control, wake vortex problems, and operating procedures as well as airport capacity and ground operations. The impact of the FAA's Research and Development Program and the implications of the current fuel shortage and economic situation are also discussed. (Author)

**A74-35001** Disposal of waste oils at military air bases. M. Lieberman, A. Beerbower (Esso Research and Engineering Co., Linden, N.J.), and R. H. Kroop (USAF, Washington, D.C.). *Society of Automotive Engineers, Air Transportation Meeting, Dallas, Tex., Apr. 30-May 2, 1974, Paper 740472.* 7 p. Members, \$1.40; nonmembers, \$2.25.

The disposal of waste lubricants and fuels at U.S. Air Force and Navy facilities is discussed. The waste products covered include: synthetic turbine oil, aviation piston engine oil, hydraulic fluids, and contaminated JP-4 and JP-5. Technical feasibility and the economics of various disposal alternatives, including use as a fuel, rerefining, and recycling, as well as entrepreneurial outlets are presented. Waste lubricants and fuels handling, classification, and storage are also discussed in connection with the disposal problem. (Author)

**A74-35008** Advanced controls for commercial transport aircraft. H. A. Shomber (Boeing Commercial Airplane Co., Renton, Wash.) and R. B. Holloway (Boeing Co., Wichita, Kan.). *Society of*

*Automotive Engineers, Air Transportation Meeting, Dallas, Tex., Apr. 30-May 2, 1974, Paper 740453.* 14 p. 27 refs. Members, \$1.40; nonmembers, \$2.25.

Advanced control concepts, e.g., CCV and ACT, hold considerable promise of more efficient operation for commercial transports. These potential improvements, greatest for new designs that include the control concepts from their outset, yield reductions in airplane weight and/or drag with associated impact on fuel requirements, operating costs, etc. Limited improvement is also available for existing airplanes that meet certain control system requirements. This paper discusses the potential impact of advanced controls on commercial transports as performance improvements or fuel savings, and the improvement sensitivity to the design mission and configuration. The commercial application of these advanced concepts must follow tight demonstration of the flight-critical aspects, and careful determination of the reliability (safety and dispatch), certification, and economic aspects. Finally, research and demonstration activities necessary for the commercial application of these advanced control concepts are recommended. (Author)

**A74-35278** Effect of plasma injection on cold wall type MHD generator. T. Kajikawa, T. Kashihara, and O. Nomura (Ministry of International Trade and Industries, Electrotechnical Laboratory, Tokyo, Japan). *Japanese Journal of Applied Physics, vol. 13, May 1974, p. 870-874.* 16 refs.

Difficulties concerning large electrode losses have to be overcome in connection with the development of a cold wall type MHD generator for practical applications. An investigation regarding the use of a plasma injection method was conducted to explore possibilities concerning the improvement of the MHD generating characteristics. The experimental results obtained show that an employment of the plasma injection method is feasible in the case of the small-scale cold wall type MHD generator considered. G.R.

**A74-35287** International Cryogenic Engineering Conference, 5th, Kyoto, Japan, May 7-10, 1974, Preprints. Volumes 1 & 2. Conference sponsored by the Cryogenic Association of Japan. Tokyo, H. Nagano, University of Tokyo, 1974. Vol. 1, 216 p.; vol. 2, 368 p.

Recent theoretical and experimental studies of superconductivity, its technology and applications, are presented in a number of papers. Some of the topics covered include superconducting levitated transport systems, superconducting power transmission, macroscopic derivation of maximum Josephson tunneling current density, ac losses of a superconducting wire in a longitudinal magnetic field, a high speed superconducting generator, superconducting magnet and fusion reactor, development of high voltage cryoresistive cable, a millikelvin dilution refrigerator with plastic exchangers, and indications for the future of superconducting technology.

P.T.H.

**A74-35288** # The use of superconductivity in the USA transportation program. R. H. Borcherts (Ford Motor Co., Dearborn, Mich.). In: *International Cryogenic Engineering Conference, 5th, Kyoto, Japan, May 7-10, 1974, Preprints. Volume 1.*

Tokyo, H. Nagano, University of Tokyo, 1974, p. B1-1 to B1-7. 18 refs. Research supported by the U.S. Department of Transportation.

The present paper summarizes the results of programs investigating the feasibility of high-speed ground transportation based on the concept of utilizing superconducting magnets to support a moving vehicle above a roadbed of discrete passive loops or coils. These studies have provided detailed mathematical formulation and experimental verification of the forces on a rectangular coil operated at an arbitrary height and velocity above a continuous conducting sheet as well as over an L-shaped guide-way. Important conclusions and recommendations reached are described. No serious problem has yet arisen which would eliminate either one of the magnetic suspension schemes (attraction or repulsion) from consideration.

P.T.H.

A74-35289 # Superconducting magnetic energy storage. H. L. Laquer (California, University, Los Alamos, N. Mex.). In: International Cryogenic Engineering Conference, 5th, Kyoto, Japan, May 7-10, 1974, Preprints, Volume 1. Tokyo, H. Nagano, University of Tokyo, 1974, p. C6-1 to C6-5. 7 refs. AEC-sponsored research.

The present work reviews the two forms (potential or kinetic) of secondary energy storage, and then discusses in general terms the elements of an inductive magnetic energy storage system. Four regions of application of superconductive magnetic storage are indicated: (1) microsecond power delivery into resistive loads such as flash lamps and lasers; (2) millisecond power delivery into inductive loads such as plasma compression coils for theta-pinch controlled thermonuclear reactors; (3) second delivery to limit short term energy drain from a utility system; and (4) kilosecond delivery into an electric utility system with the objective of load levelling or peakshaving. The problem of losses in superconducting coils is briefly discussed. P.T.H.

A74-36498 Fuel state - Expensive. P. Masefield. *Flight International*, vol. 105, June 27, 1974, p. 836-838.

There are real possibilities in the use of liquid hydrogen, although many problems remain, not least those of ground handling. Moreover, production of liquid hydrogen at present requires fossil fuels as the energy source. The whole purpose of using liquid hydrogen can be served only by the development of manufacturing cycles based on the use of nuclear, geothermal, tidal, solar, or hydroelectric power. To convert a petroleum-operated air-transport economy to a liquid-hydrogen operated air-transport economy would be vastly expensive. One other attractive nonfossil fuel would appear to be ethanol, which can be produced by solar energy from fermented cereal grain. It is not anticipated that oil supplies will run short in this century, and coal is even more plentiful. F.R.L.

A74-36683 # Theoretical and experimental investigation of two-component heat pipes. H. J. Brommer (Stuttgart, Universität, Stuttgart, West Germany). American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Thermophysics and Heat Transfer Conference, Boston, Mass., July 15-17, 1974, AIAA Paper 74-720. 9 p. 12 refs. Members, \$1.80; nonmembers, \$2.00.

The temperature and concentration distributions within two-component heat pipes and the extent of separation of components were theoretically investigated. Experiments carried out with water/methanol heat pipes of the six-artery type confirmed the theoretical results that only a partial separation of the components will occur.

Performance measurements also demonstrated that water/methanol heat pipes can be operated at high power levels (over 300 watts could be obtained with heat pipes 500 mm long and 13.5 mm in diameter). Two-component heat pipes have a superior cold start up behavior as compared to respective one-component heat pipes, but their axial temperature drop during nominal operation conditions is considerably higher. (Author)

A74-36684 # Performance tests of gravity-assist heat pipes with screen-wick structures. J. E. Kemme, J. E. Dovers, E. S. Keddy, J. R. Phillips, and W. A. Ranken (California, University, Los Alamos, N. Mex.). American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Thermophysics and Heat Transfer Conference, Boston, Mass., July 15-17, 1974, AIAA Paper 74-723. 8 p. Members, \$1.80; nonmembers, \$2.00. AEC-sponsored research.

A series of performance-limit tests were made at several operating temperatures with sodium heat pipes containing simple wicks comprised of layers of woven-wire screen. After each pipe was tested horizontally, vertical tests were conducted in a gravity-assist

mode with the evaporator down. Higher heat-transfer limits were achieved in the vertical tests, but good agreement between measured and calculated limits was not always obtained. Wick imperfections, in the form of spaces between screen layers and other large openings, were beneficial during horizontal operation because they provided low-impedance flow paths for liquid return. During vertical operation, however, the openings filled with vapor and sometimes produced superheat limitations which seriously reduced heat transfer. (Author)

A74-36640 Superconductivity - Large-scale applications. R. A. Hein (U.S. Navy, Naval Research Laboratory, Washington, D.C.). *Science*, vol. 185, July 19, 1974, p. 211-222. 49 refs.

As a result of a number of advances including the commercial development of high-current, high-field superconducting materials, superconductivity offers a solution to some of the pressing technological needs of our society. The development of superconducting solenoids is discussed along with applications of superconducting magnets in high-energy physics, the use of superconductivity in electric power transmission, and advances in the field of rotating electrical machinery due to the employment of superconducting components. Other applications of superconductivity considered are related to energy storage and transfer or involve the use of superconducting magnets in very fast trains. G.R.

A74-36137 # Operational and accidental petroleum product losses and their control and prevention /2nd revised and enlarged edition/ (Эксплуатационные и аварийные потери нефтепродуктов и борьба с ними /2nd revised and enlarged edition/), N. D. Ivanov. Leningrad, Izdatel'stvo Nedra, 1973. 160 p. 41 refs. In Russian.

This book discusses petroleum product losses during storage, transportation, delivery and handling as such losses take place according to experience in concerned Soviet industries. Vaporization, leakage, spillage, oxidation, and accidental losses are covered, pointing out their significant level in the Soviet Union. Indicated as measures for control and prevention of losses are the reduction of the gas-filled space in storage tanks, the use of tanks with floating covers, the reduction of storage temperature fluctuation, the use of high pressure containers, and improved pumping system designs. V.Z.

A74-36226 # Utilization of space technology for terrestrial solar power applications. R. K. Yasui (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.) and R. E. Patterson (TRW Systems Group, Redondo Beach, Calif.). In: Photovoltaic Specialists Conference, 10th, Palo Alto, Calif., November 13-18, 1973, Conference Record. Conference sponsored by the Institute of Electrical and Electronics Engineers, New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 239-253. 10 refs. Contract No. NAS7-100.

A description is given of the evolution of photovoltaic power systems designed and built for terrestrial applications, giving attention to problem areas which are currently impeding the further development of such systems. The rooftop testing of surplus solar panels is considered along with solar powered seismic observatories, solar powered portable radio sets, and design considerations identified from past experience. Present activities discussed are related to a solar powered on-shore beacon flasher system, a solar powered buoy, and a solar powered beacon flasher buoy. G.R.

A74-36232 Thermal control range associated with heat pipe cycling. H. B. McKee (McDonnell Douglas Astronautics Co., Huntington Beach, Calif.). In: Heat Transfer and Fluid Mechanics Institute, 24th, Corvallis, Ore., June 12-14, 1974, Proceedings. Stanford, Calif., Stanford University Press, 1974, p. 57-72. 5 refs.

The effect of dynamic cycling on variable conductance heat pipes temperature control is examined. Cycling of the heat pipe condenser environment or heat pipe evaporator heat input levels can

lead to concentration changes in the gas reservoir with a consequent change in the thermal control range. An analytical model is formulated and results of calculations presented which show the extent of these effects and their implication on gas reservoir charging. Calculations are also compared with experimental data obtained for gas controlled ammonia heat pipes under a simulated space environment. Test data was generated with the heat pipe operating with xenon and with helium control gases. (Author)

A74-36324 # A new solar selective surface. C. M. Horwitz (Sydney, University, Sydney, Australia). *Optics Communications*, vol. 11, June 1974, p. 210-212. 8 refs.

A new waveguide method of providing a selective surface for solar energy applications is described. Some measurements of a vacuum-deposited mesh are given, and elementary theory indicates that ratios of solar absorptance to thermal emittance of 30:1 should be possible at temperatures of about 200 C. (Author)

A74-36316 A review of precious resources and their effect on air transport; Proceedings of the Spring Convention, London, England, May 15, 16, 1974. Convention sponsored by the Royal Aeronautical Society. London, Royal Aeronautical Society, 1974. 282 p. \$14.35.

Papers on air transport resources are given, covering nuclear contribution to future energy supplies, alternative energy sources, metallic and other material resources, noise reduction goals, effects of fuel and materials shortages on aircraft development and operation, future propulsion technology for ground transport, and economic resources utilization in aviation. The pricing policies of oil producing nations, hydrogen energy systems, man as a precious resource, and the quality of life vs aeronautics are also dealt with.

V.Z.

A74-36319 # The development of aircraft as influenced by the shortage of materials and fuel. H. A. Goldsmith (British Aircraft Corp., Ltd., Filton, Bristol, England). In: A review of precious resources and their effect on air transport, Proceedings of the Spring Convention, London, England, May 15, 16, 1974. London, Royal Aeronautical Society, 1974. 17 p.

The broad implications of possible shortages and high prices of basic materials in the aviation industry are discussed, covering aluminum, titanium, iron, nickel, composites, and fuel. High prices of any of these materials are viewed as possible but the real near term shortage of any significance is believed to be only that of fuel. Some alternative fuels are considered, with hydrogen produced from water using energy derived from non-fossil power sources as an obvious candidate.

V.Z.

A74-36320 # Future propulsion techniques for ground transport. A. H. Wickens (British Railways, London, England). In: A review of precious resources and their effect on air transport; Proceedings of the Spring Convention, London, England, May 15, 16, 1974. London, Royal Aeronautical Society, 1974. 21 p.

Energy-related technical aspects of ground transport such as bus, car, electric train, Advanced Passenger Trains and aircraft are considered with attention to propulsion techniques of the future in the context of rising energy costs. Power requirement minimization, efficiency comparisons, aerodynamic, wheel and suspension drag, non-contacting suspensions, and operation in evacuated tubes are the subjects of the discussion. System design features relevant to energy consumption, heat engine characteristics, hybrid power systems, alternative fuels, electrification, energy storage technology, and flywheels are also covered. The need for firm but flexible long range policies in electrification, light-weight battery development and fuel

alternation is stressed, with combinations of innovation and conservation, and nuclear power as a long-range objective. V.Z.

A74-36321 # The economic utilisation of resources through aviation. I. Chichester-Miles (Hawker Siddeley Aviation, Ltd., Hatfield, Herts., England). In: A review of precious resources and their effect on air transport; Proceedings of the Spring Convention, London, England, May 15, 16, 1974. London, Royal Aeronautical Society, 1974. 74 p.

Civil aviation is assessed as a social utility producing a desirable and useful service with a minimum demand on resources such as manpower, time, land and fuel. It is indicated that a progressive improvement of aircraft technology, with the present level of airline administration and operations efficiency and present constraints on airport access and locations, can only partially benefit the productivity of the air transport system as a whole. Even so, technical improvements in conventional subsonic aircraft should consolidate the position of aviation as the most efficient user of manpower over distances down to 800 km or even less. It is also anticipated that the attraction of aviation in terms of efficient land utilization will steadily increase with the growing volume of air traffic. V.Z.

A74-36322 # Precious resources and air transport - An airline view. R. H. Whitty (British Airways Board, London, England). In: A review of precious resources and their effect on air transport; Proceedings of the Spring Convention, London, England, May 15, 16, 1974. London, Royal Aeronautical Society, 1974. 11 p.

Recent fuel price increases and possible further increases are discussed in the context of their effects on airline operation planning at present and in immediate and more remote future. The fuel position of air transport vs other transport competitors is analyzed with the conclusion that aviation is not a major user of existing oil fuels and that there will be hardly a short supply of kerosene type products at practical prices for aviation within the next 60 years.

V.Z.

A74-36327 # Air transport in Europe - Commercial trends and prospects. J. J. Scarlett (British Airways, European Div., Ruislip, Middx., England). In: Symposium on Air Transport in Europe, London, England, January 16, 1974, Proceedings. London, Royal Aeronautical Society, 1974, 12 p.

The present work indicates in general terms some of the main factors which would have to be taken into consideration in order to obtain a picture of the air travel industry in Europe over the next decade or so. It is pointed out that because of the increase in fuel prices, the fuel content of the operating costs of a charter airline might rise from 20/25% to one-third or more of the total cost of operation, which could dramatically change the trend over the past decade towards very low-fare travel within Europe. Other topics discussed include traffic growth and financial prospects. P.T.H.

A74-36331 # The energy crisis and energy from the sun; Proceedings of the Symposium on Solar Energy Utilization, Washington, D.C., April 30, 1974. Symposium sponsored by the Institute of Environmental Sciences and NASA. Edited by M. P. Thekkakara (NASA, Goddard Space Flight Center, Greenbelt, Md.), Mount Prospect, Ill., Institute of Environmental Sciences, 1974. 104 p.

Papers on the state of the art and future prospects of solar energy utilization in the United States are included. Research and technologies for heating and cooling of buildings, solar thermal energy conversion, photovoltaic conversion, biomass production and conversion, wind energy conversion and ocean thermal energy conversion are covered. The increasing funding of the National Solar Energy Program is noted.

V.Z.

A74-36332 # Solar energy research and utilization. W. R. Cherry (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: The energy crisis and energy from the sun; Proceedings of the Symposium on Solar Energy Utilization, Washington, D.C., April 30, 1974.

Mount Prospect, Ill., Institute of Environmental Sciences, 1974, p. 1-20. 23 refs.

The role of solar energy is visualized in the heating and cooling of buildings, in the production of renewable gaseous, liquid and solid fuels, and in the production of electric power over the next 45 years. Potential impacts of solar energy on various energy markets, and estimated costs of such solar energy systems are discussed. Some typical solar energy utilization processes are described in detail. It is expected that at least 20% of the U.S. total energy requirements by 2020 will be delivered from solar energy. V.Z.

A74-36333 # Data on incident solar energy. M. P. Thekkakara (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: The energy crisis and energy from the sun; Proceedings of the Symposium on Solar Energy Utilization, Washington, D.C., April 30, 1974. Mount Prospect, Ill., Institute of Environmental Sciences, 1974, p. 21-49. 44 refs.

Instrumentation for solar irradiance monitoring, and radiation scales are discussed in a survey of incident solar energy data. The absolute accuracy and intrinsic reliability of the values of the solar constant and zero air mass solar spectrum proposed by the Institute of Environmental Sciences as an ASTM standard are evaluated. Extraterrestrial observations are used for deriving solar irradiance data at ground level for widely varying atmospheric parameters, with special reference to air pollution. The effects of diffuse sky radiance and those of varying slopes of the solar energy collecting surface are examined. Average values of solar energy available at different locations in the United States are included. V.Z.

A74-36334 # The solar power options. P. E. Glaser (Arthur D. Little, Inc., Cambridge, Mass.). In: The energy crisis and energy from the sun; Proceedings of the Symposium on Solar Energy Utilization, Washington, D.C., April 30, 1974. Mount Prospect, Ill., Institute of Environmental Sciences, 1974, p. 75-87. 5 refs.

Solar power potential is discussed vs future needs, with particular attention to large-scale solar energy conversion to power by using wind, ocean thermal gradients, solar-powered heat engines, and photovoltaic energy conversion on earth and in space. The past development and the state of the art of this technology are reviewed with a projection into the future. Cost projections are given on the basis of available data. The prospects of solar energy applications are believed to be bright but slow, with significant advances over the next few decades. V.Z.

A74-36335 # Growing federal support for solar energy applications. L. O. Herwig (National Science Foundation, Washington, D.C.). In: The energy crisis and energy from the sun; Proceedings of the Symposium on Solar Energy Utilization, Washington, D.C., April 30, 1974. Mount Prospect, Ill., Institute of Environmental Sciences, 1974, p. 93-103.

The general objectives of the Federal Solar Energy Program are described as ones intended to provide the research and technology for economic terrestrial solar energy applications with the implementation of practical systems for commercial uses within the framework of national energy planning. The Program covers the following specific solar energy applications and technologies: heating and cooling of buildings, solar thermal energy conversion, photovoltaic conversion, biomass production and conversion, wind energy conversion, and ocean thermal energy conversion. It is believed that solar

energy applications such as heating and cooling of buildings, wind energy conversion and biomass production and conversion will have impact on U.S. energy requirements by the early 1980's. V.Z.

A74-36411 Thermochemical hydrogen generation. R. H. Wentorf, Jr. and R. E. Hanneman (GE Research and Development Center, Schenectady, N.Y.). *Science*, vol. 185, July 26, 1974, p. 311-319. 20 refs.

Cost estimates for hydrogen production indicate that electrolysis will probably not be generally competitive in this century with the better projected thermochemical approaches for large-scale uses. Continuing changes in fossil fuel prices will tend to make open-cycle processes less competitive than closed-cycle thermochemical processes in the long term. Particular attention is given to some tested, new closed-cycle thermochemical processes for hydrogen generation. Criteria for process selection are discussed and operational details for three processes are considered. G.R.

A74-36606 The impact of advanced turboshaft engine technology on T700-powered helicopter systems. L. B. Veno (General Electric Co., Aircraft Engine Group, Lynn, Mass.). *American Helicopter Society, Annual National V/STOL Forum, 30th, Washington, D.C., May 7-9, 1974, Preprint 871*. 8 p. 5 refs. Members, \$1.50; nonmembers, \$2.00.

The General Electric T700-GE-700 turboshaft engine currently under development by the U.S. Army for UTTAS (Utility Tactical Transport Aircraft System) and AAH (Advanced Attack Helicopter) represents a new generation of advanced technology engines in the 1500 horsepower class. How such an engine will provide notable improvements in performance, operation, and economy for this new generation of VTOL vehicles is described. A combination of the UTTAS and AAH helicopters illustrates these improvements. The T700 is a simple engine when compared to preceding turboshaft engines which manufacturers have produced in this horsepower class. Only five axial compressor stages and one centrifugal stage are necessary to achieve a pressure ratio higher than today's generation of engines. F.R.L.

A74-36941 The good and bad usages of air transport (Des bons et des mauvais usages du transport aérien). M. Wolkowitsch (Aix-Marseille, Université, Marseille, France). *Revue Générale de l'Air et de l'Espace*, vol. 37, no. 1, 1974, p. 7-17. In French.

The present work advocates that, especially in view of the fuel crisis and rising prices in air transport, plans for expanding air services to remote regions and for short-haul purposes be reconsidered. Rather, it would be best to continue improving the quality of air service for those routes where its advantages over other means of transport are undeniable, and to restrain the proliferation of air service where its existence is not absolutely necessary and where the development or improvement of rail transportation, for example, would be more sane and economical. P.T.H.

A74-37604 Engineering aspects of magnetohydrodynamics; Proceedings of the Fourteenth Symposium, University of Tennessee Space Institute, Tullahoma, Tenn., April 8-10, 1974. Symposium sponsored by the University of Tennessee Space Institute. Edited by Y. C. L. Wu (University of Tennessee Space Institute, Tullahoma, Tenn.). University, J. Fox, University of Mississippi, 1974. 363 p. \$15.

The sessions dealt with combustion gas generators, systems and optimization, plasma flows, properties, and diagnostics, liquid metal generators, and nonequilibrium generators and MHD lasers. Among the subjects discussed are performance and Hall field limitation studies in the Stanford M-8 MHD generator, a two-dimensional dynamic programming method for the optimization of DCW MHD

generators, electron vibrational energy transfer under MHD combustion generator conditions, the time-dependent magnetohydrodynamic generator, and laser Doppler velocimetry in MHD boundary layers. A study was made of a bi-phase DC MHD generator using a new motion system, and the effects of the development of boundary layers in a Faraday MHD generator were examined. Closed cycle MHD power generation experiments in the NASA Lewis facility are described.

F.R.L.

A74-37605 # Performance and Hall field limitation studies in the Stanford M-8 MHD generator. J. K. Koester and W. Untel (Stanford University, Stanford, Calif.). In: *Engineering aspects of magnetohydrodynamics; Proceedings of the Fourteenth Symposium, Tullahoma, Tenn., April 8-10, 1974.* University, J. Fox, University of Mississippi, 1974, p. I.6.1-I.6.6. 7 refs. Contract No. F33615-72-C-1088.

Experiments using a supersonic, hot-wall, variable-configuration generator are being performed to determine its flow and electrical characteristics. Effects at large Hall voltages (greater than 40 volts per pair) over various insulator gaps, are studied by impulsively loading the electrode circuits and recording, with fast instrumentation, the time response of the electrical parameters. A simple analysis of a filament breakdown indicates a strong dependence of breakdown voltage on the insulator gap. Experimental Hall voltages of 120 volts per pair, with a breakdown power of 1500 watts have been maintained over an insulator gap of 0.9 cm, with no signs of breakdown or abnormal behavior. (Author)

A74-37606 # Design and modeling of the gas flow system for a compact 10 MW MHD generator system. O. K. Sonju, J. Teno, R. Kessler, and D. Meader (Avco Everett Research Laboratory, Inc., Everett, Mass.). In: *Engineering aspects of magnetohydrodynamics; Proceedings of the Fourteenth Symposium, Tullahoma, Tenn., April 8-10, 1974.* University, J. Fox, University of Mississippi, 1974, p. I.7.1-I.7.6. USAF-ARPA-sponsored research.

The Viking II design program for a proposed 10 MW compact lightweight MHD generator is described. The program aims to demonstrate the feasibility of creating a burst-power transportable power supply suitable for military and industrial uses. Some of the unique features of the blower, channel, and diffuser are pointed out and the design of the gas flow train is described. The complete unit will have an overall weight of four to five thousand pounds, and the preliminary studies of prototype models indicate that this figure is well within reach. J.K.K.

A74-37607 # A two-dimensional dynamic programming method for the optimization of diagonal conducting wall magnetohydrodynamic generators. K. Y. Chang, W. C. Jackson, and Y. C. L. Wu (University of Tennessee Space Institute, Tullahoma, Tenn.). In: *Engineering aspects of magnetohydrodynamics; Proceedings of the Fourteenth Symposium, Tullahoma, Tenn., April 8-10, 1974.* University, J. Fox, University of Mississippi, 1974, p. III.1.1-III.1.7. 9 refs. Contract No. F44620-69-C-0031. Project THEMIS.

The method of dynamic programming is used to optimize both of the generator cross-sectional areas and magnetic field distribution that will yield maximum enthalpy extraction. There is no restriction on the form of penalty function to be optimized, nor the forms of the constraints. An example is given to optimize a 45 degree diagonal conducting wall generator. (Author)

A74-37608 # Two-dimensional electric fields in MHD-generator channels - Optimum loading circuits. V. A. Bitiurin, B. M. Burakhanov, S. A. Medin, and V. M. Ponomarev (Akademii Nauk USSR, Nauchno-Issledovatel'skii Institut Vysokikh Temperatur, Moscow, USSR). In: *Engineering aspects of magnetohydrodynamics;*

*Proceedings of the Fourteenth Symposium, Tullahoma, Tenn., April 8-10, 1974.* University, J. Fox, University of Mississippi, 1974, p. III.2.1-III.2.6. 5 refs.

The stationary two-dimensional distribution of the electric field and the current density in a MHD channel is calculated. It is assumed that the distributions of the hydrodynamic parameters, the conductivity, and the Hall parameter are determined by a quasi-one-dimensional flow calculation that includes boundary layers on the walls of the channel. The effect of load commutation on the generator parameters and the field and current distributions is studied for the simple case of a generator with two Faraday electrodes and two Hall electrodes. The analysis shows that maximum power is delivered when longitudinal currents are blocked by the application of a considerable Hall potential and sufficient asymmetrical Faraday potentials to the electrodes. J.K.K.

A74-37609 # The effect of magnetic field upon the output performance of segmented-open type MHD generator. Y. Ozawa and N. Kayukawa (Hokkaido University, Sapporo, Japan). In: *Engineering aspects of magnetohydrodynamics; Proceedings of the Fourteenth Symposium, Tullahoma, Tenn., April 8-10, 1974.* University, J. Fox, University of Mississippi, 1974, p. III.3.1-III.3.5. 8 refs.

Variational calculations are demonstrated for maximizing the conversion efficiency of a segmented-electrode open-type MHD generator. The optimal equation solutions presented show the ideal MHD generator performance under real operating conditions. M.V.E.

A74-37610 # Optimization of open cycle power plant MHD generator. A. E. Sheindlin, B. Ia. Shumiatskii, V. I. Kovbasuk, P. P. Ivanov, and G. M. Koriagina (Akademii Nauk SSSR, Nauchno-Issledovatel'skii Institut Vysokikh Temperatur, Moscow, USSR). In: *Engineering aspects of magnetohydrodynamics; Proceedings of the Fourteenth Symposium, Tullahoma, Tenn., April 8-10, 1974.* University, J. Fox, University of Mississippi, 1974, p. III.4.1-III.4.5.

Mathematical models of an MHD power plant and of an MHD generator are discussed using a quasi-one-dimensional approach. The use of this approach is shown to make possible the choice of flow control parameters leading to optimal MHD power plant and generator cost efficiency. M.V.E.

A74-37611 # NASA Lewis H2-O2 MHD program. J. M. Smith, L. D. Nichols, and G. R. Seikel (NASA, Lewis Research Center, Cleveland, Ohio). In: *Engineering aspects of magnetohydrodynamics; Proceedings of the Fourteenth Symposium, Tullahoma, Tenn., April 8-10, 1974.* University, J. Fox, University of Mississippi, 1974, p. III.7.1-III.7.5. 5 refs.

Performance and power costs of H2-O2 combustion powered steam-MHD central power systems are estimated. Hydrogen gas is assumed to be transmitted by pipe from a remote coal gasifier into the city and converted to electricity in a steam MHD plant having an integral gaseous oxygen plant. These steam MHD systems appear to offer an attractive alternative to both in-city clean fueled conventional steam power plants and to remote coal fired power plants with underground electric transmission into the city. Status and plans are outlined for an experimental evaluation of H2-O2 combustion-driven MHD power generators at NASA Lewis Research Center. (Author)

A74-37612 # Electron vibrational energy transfer under MHD combustion generator conditions. C. D. Hawley and M. Mitchner (Stanford University, Stanford, Calif.). In: *Engineering aspects of magnetohydrodynamics; Proceedings of the Fourteenth Symposium, Tullahoma, Tenn., April 8-10, 1974.* University, J. Fox, University of Mississippi, 1974, p. V.1.1-V.1.5. 13 refs. Contract No. F44620-73-C-0048.

Analysis of the energy transfer rate between an electron gas and the vibrational modes of diatomic gases. Detailed numerical predic-

tions obtained for molecular nitrogen and carbon dioxide are presented. These results indicate that the energy transfer rate is strongly dependent upon the electron velocity distribution function.

M.V.E.

A74-37613 # MHD effects on viscous and thermal wakes and their influence on the performance of MHD generators. S. J. Schneider and J. F. Louis (MIT, Cambridge, Mass.). In: *Engineering aspects of magnetohydrodynamics; Proceedings of the Fourteenth Symposium, Tullahoma, Tenn., April 8-10, 1974.*

University, J. Fox, University of Mississippi, 1974, p. V.2.1-V.2.10, 5 refs. U.S. Department of the Interior Contract No. 14-32-0001-1209.

Separate analytical studies of the development of velocity and thermal wakes induced by inlet vanes are described, and the influence of these wakes on the performance of MHD generators is evaluated. The results indicate that: (1) a velocity defect, when passing through an MHD generator, will be greater than its value for non-MHD flow due to the retarding Lorentz forces and will increase as the interaction parameter or the Lorentz forces increase; and (2) a thermal defect, when passing through an MHD generator, causes large changes in the conductivity of the fluid, but the defect decreases as the interaction parameter increases. No attempt has been made to combine the viscous and thermal wake solutions. M.V.E.

A74-37615 # The time dependent magnetohydrodynamic generator. D. A. Oliver (MIT, Cambridge, Mass.). In: *Engineering aspects of magnetohydrodynamics; Proceedings of the Fourteenth Symposium, Tullahoma, Tenn., April 8-10, 1974.*

University, J. Fox, University of Mississippi, 1974, p. V.5.1-V.5.9, 11 refs. Research supported by the U.S. Department of the Interior; NSF Grant No. GK-38130.

A general theory of unsteady magnetohydrodynamic channel flows is presented. A computational approach for solving the nonlinear fluid and Maxwell equations is developed. Illustrations of the theory and calculation techniques are given for generator load change transients and for the behavior of the generator with finite amplitude magnetoacoustic fluctuations. (Author)

A74-37616 # Wall roughness and area variation effects in high subsonic MHD generator channels. E. D. Doss and G. S. Argyropoulos (STD Research Corp., Arcadia, Calif.). In: *Engineering aspects of magnetohydrodynamics; Proceedings of the Fourteenth Symposium, Tullahoma, Tenn., April 8-10, 1974.*

University, J. Fox, University of Mississippi, 1974, p. V.6.1-V.6.4, 9 refs. U.S. Department of the Interior Contract No. 14-32-0001-1211; NSF Grant No. C-727; Contract No. F44620-73-C-0001.

Using computer simulation techniques, the influence of wall roughness perturbation effects and of area variation on the performance of high subsonic MHD generator channels is analyzed. Previous methods of accounting for these effects in the design of MHD channels are reviewed in the light of the results obtained.

M.V.E.

A74-37618 # Study of a bi-phase D.C. M.H.D. generator using a new motion system. A. Charon, R. Lagoutte, and J. Robert (Paris, Laboratoire de Génie Electrique, Forcenay-aux-Roses, Hauts-de-Seine, France). In: *Engineering aspects of magnetohydrodynamics; Proceedings of the Fourteenth Symposium, Tullahoma, Tenn., April 8-10, 1974.* University, J. Fox, University of Mississippi, 1974, p. VI.1.1-VI.1.5.

This paper reports the description and the calculation of a bi-phase D.C. M.H.D. generator. The author's purpose was to imagine a system in which thermic exchanges do not affect the efficiency. The study is limited to a small power unit (30 KW). The thermodynamic cycle, the flow process and the conversion in the nozzle have been taken into account to evaluate the output power and the efficiency. The calculation assumptions lead to a bit optimistic results. (Author)

A74-37619 # The effects of geometry and loss mechanisms on the performance of two-phase liquid-metal MHD generators. W. E. Amend, R. L. Cole, and J. C. Cutting (Argonne National Laboratory, Argonne, Ill.). In: *Engineering aspects of magnetohydrodynamics; Proceedings of the Fourteenth Symposium, Tullahoma, Tenn., April 8-10, 1974.* University, J. Fox, University of Mississippi, 1974, p. VI.2.1-VI.2.7, 8 refs. AEC-sponsored research.

Experiments were performed and supporting analytical effort was continued on a constant area, two-phase liquid-metal and inert gas MHD generator. Experiments were carried out under conditions similar to those utilized in the previous tests on a diverging channel generator so that detailed comparisons could be made. Generator efficiency data obtained in the constant area channel are similar to measurements made with diverging channel. Results indicate a maximum generator efficiency of 50% at high magnetic fields and low mixture quality and a decreasing efficiency with increasing quality. The open-circuit load factor varied from 0.95 at zero quality to 0.80 at a mixture quality of 0.01. Comparison of the straight channel data with data obtained in the diverging channel generator indicated significant differences in the current, and hence pressure distribution patterns in the generator. (Author)

A74-37620 # Boundary layer control in two-phase liquid-metal MHD generators. J. C. Cutting, R. L. Cole, W. E. Amend, and M. Patrick (Argonne National Laboratory, Argonne, Ill.). In: *Engineering aspects of magnetohydrodynamics; Proceedings of the Fourteenth Symposium, Tullahoma, Tenn., April 8-10, 1974.*

University, J. Fox, University of Mississippi, 1974, p. VI.3.1-VI.3.4, 8 refs. AEC-sponsored research.

Measured boundary-layer control results on a two-phase liquid-metal MHD generator with sidewall gas injection show that gas injection is effective in displacing the liquid boundary layer from the insulated wall. Removal or displacement of the conducting boundary layer results in as much as a 70% increase in generator performance. Excellent agreement between theory and experiment is observed. Measured open-circuit voltages increased by as much as 25% over previous results obtained without gas injection. M.V.E.

A74-37621 # Effects of the development of boundary layers on a Faraday MHD generator. S. Shioda, H. Yamamoto (Tokyo Institute of Technology, Tokyo, Japan), and I. Yamashita (Mechanical Engineering Laboratory, Tokyo, Japan). In: *Engineering aspects of magnetohydrodynamics; Proceedings of the Fourteenth Symposium, Tullahoma, Tenn., April 8-10, 1974.*

University, J. Fox, University of Mississippi, 1974, p. VII.2.1-VII.2.5.

Analysis of the results of an experimental investigation of flow-condition effects on the operation of a shock-tube driven MHD generator. The current flows from the upstream edge of the anode to the downstream edge of the cathode. The anode voltage drop is larger than the cathode voltage drop. This asymmetry is caused by the finite rate of ionization, and the entailed nonuniformities in conjunction with the ionization instability reduce the power output significantly. M.V.E.

A74-37622 # Ionisation, recombination and voltage drop measurements in a closed cycle MPD generator. I. R. McLab (International Research and Development Co., Ltd., Newcastle-upon-Tyne, England), J. S. Dolby, and M. G. Haines (Imperial College of Science and Technology, London, England). In: *Engineering aspects of magnetohydrodynamics; Proceedings of the Fourteenth Symposium, Tullahoma, Tenn., April 8-10, 1974.*

University, J. Fox, University of Mississippi, 1974, p. VII.3.1-VII.3.6, 10 refs.

Review of the results of ionization, recombination, and voltage drop measurements made in a section of a closed loop MPD generator facility. The measurements were performed in a segmented electrode alumina duct at gas temperatures up to 1700 K, 1 atm pressure, and with a 600 m/sec flow of cesium seeded helium. Measurements made with applied magnetic fields alone showed that the generator performance was less than ideal, probably because of

end loop shorting and electrode voltage drops. Yet, in spite of these and some other disappointing features in the performance of the closed loop facility, a useful amount of information was obtained on the behavior of nonequilibrium plasmas in small test sections. M.V.E.

**A74-37823 # Results of the Eindhoven MHD shocktunnel experiment.** J. W. M. A. Houben, A. Veefkind, L. H. T. Rietjens (Eindhoven, Technische Hogeschool, Eindhoven, Netherlands), and J. H. Blom. In: *Engineering aspects of magnetohydrodynamics; Proceedings of the Fourteenth Symposium, Tullahoma, Tenn., April 8-10, 1974.* University, J. Fox, University of Mississippi, 1974, p. VII.4.1-VII.4.7. 10 refs.

Results of the Eindhoven shocktunnel experiment are presented. The experiments are performed with an enthalpy input of 3.8 Mw and a magnetic induction up to 3 T. In comparison with earlier experiments the MHD channel was recently changed by extracting the potential probes. Loss mechanisms as inlet relaxation phenomena, voltage drops and short circuiting between adjacent electrodes are analyzed in detail. At a magnetic induction of 2.57 T a power of 100 kw has been extracted from a channel volume of 3 litres. Comparison of experimental results and results obtained from computational integration of the conservation equations shows a good agreement. (Author)

**A74-37824 # Electrode studies and recent results of non-equilibrium MHD generator experiments.** B. Zauderer, E. Tate, and C. H. Marston (General Electric Co., King of Prussia, Pa.). In: *Engineering aspects of magnetohydrodynamics; Proceedings of the Fourteenth Symposium, Tullahoma, Tenn., April 8-10, 1974.* University, J. Fox, University of Mississippi, 1974, p. VII.5.1-VII.5.4. 6 refs. Navy-supported research.

Experimental studies of comparative performance of 3 basic low temperature electrode designs were done in a Mach 5 MHD flow. Protruding wire electrodes parallel to the B field direction were distinctly superior to flush electrodes and to wires protruding in the E-field direction. The high Mach number channel is especially suited to the study of strong electromagnetic interaction in nonequilibrium generators. Preliminary results are reported. (Author)

**A74-37825 # Closed cycle MHD power generation experiments in the NASA Lewis facility.** R. J. Sovie and L. D. Nichols (NASA, Lewis Research Center, Cleveland, Ohio). In: *Engineering aspects of magnetohydrodynamics; Proceedings of the Fourteenth Symposium, Tullahoma, Tenn., April 8-10, 1974.* University, J. Fox, University of Mississippi, 1974, p. VII.6.1-VII.6.6. 10 refs.

Discussion of the performance improvements achieved through some modifications made in the closed cycle MHD facility. These modifications include a redesign of the MHD duct interior, addition of mixing bars, increased electrical isolation, and experimentation with various cesium seed vaporization and injection techniques. Uniform Faraday and Hall voltage profiles were obtained, and the Faraday open circuit voltage varied from 90 to 100% of the ideal  $u_{Bh}$ . M.V.E.

**A74-37791 # A two-temperature, gas-particle suspension in MHD power generation.** D. J. Helfritch and W. A. Gustafson (Purdue University, West Lafayette, Ind.). (*American Society of Mechanical Engineers, Paper 73-Pwr-C, 1973.*) *ASME, Transactions, Series A, Journal of Engineering for Power*, vol. 96, July 1974, p. 267-273. 24 refs. NSF-supported research.

A feasibility study has been made of the use of a two-temperature, gas-particle suspension as the conducting medium in MHD generators. Large gas-particle temperature differences following nozzle expansions have been calculated, and the power generated by the use of these suspensions in MHD generator ducts has been

investigated. Although relatively low gas temperatures have been considered, high electrical conductivities can be achieved by means of thermionic emission of electrons from high-temperature particles. It is shown that total output power increases as gas temperature is decreased by means of continued nozzle expansion. Output power is also increased through the use of relatively large particles. (Author)

**A74-37821 # Jet transport energy management for minimum fuel consumption and noise impact in the terminal area.** J. S. Bull and J. D. Foster (NASA, Ames Research Center, Moffett Field, Calif.). *American Institute of Aeronautics and Astronautics, Mechanics and Control of Flight Conference, Anaheim, Calif., Aug. 5-9, 1974, Paper 74-811.* 11 p. 6 refs. Members, \$1.50; nonmembers, \$2.00.

Significant reductions in both noise and fuel consumption can be gained through careful tailoring of approach flightpath and airspeed profile, and the point at which the landing gear and flaps are lowered. For example, the noise problem has been successfully attacked in recent years with development of the 'two-segment' approach, which brings the aircraft in at a steeper angle initially, thereby achieving noise reduction through lower thrust settings and higher altitudes. A further reduction in noise and a significant reduction in fuel consumption can be achieved with the 'decelerating approach' concept. In this case, the approach is initiated at high airspeed and in a drag configuration that allows for low thrust. The landing flaps are then lowered at the appropriate time so that the airspeed slowly decelerates to  $V_{sub r}$  at touchdown. The decelerating approach concept can be applied to constant glideslope flightpaths or segmented flightpaths such as the two-segment approach. F.R.L.

**A74-37822 # Sensitivity of suboptimal fixed-range flight paths.** J. K. Hedrick (Arizona State University, Tempe, Ariz.) and M. A. Nichols (Arizona State University, Tempe, Ariz.; USAF, Weapons Laboratory, Kirtland AFB, N. Mex.). *American Institute of Aeronautics and Astronautics, Mechanics and Control of Flight Conference, Anaheim, Calif., Aug. 5-9, 1974, Paper 74-813.* 8 p. 11 refs. Members, \$1.50; nonmembers, \$2.00.

The sensitivity of fuel consumption to variations in aircraft and atmospheric parameters is investigated using aerodynamic data for a F-4 type aircraft and atmospheric data as specified by MIL STD-210A. The flight paths considered contain a full throttle 'Rutowski' energy climb arc, a classical minimum fuel cruise arc, and a maximum range glide arc. Aircraft parameters considered were maximum available thrust, induced and zero-lift drag coefficients, aircraft weight, and specific fuel consumption; atmospheric parameters considered were temperature and density variations. The results show that fuel consumption is sensitive to variations in the drag coefficients, aircraft weight, and specific fuel consumption. However, compensating by flying trajectories adjusted to be fuel optimal for each variation does not appreciably improve the fuel penalty. (Author)



## STAR ENTRIES

**N74-21665#** Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.

**F-14 OPTIMUM FLIGHT MODES, VOLUME 1** Final Report. 1 Jul. 1972 - 30 Sep. 1973

D C Sederstrom and K L Curtner Oct. 1973 121 p refs (Contract N00014-72-C-0405: NR Proj 213-098) (AD-775248) Avail: NTIS CSCL 01/3

An F-14 optimum flight modes study is described. The overall objective of the project was to define an energy management demonstration system which could use the F-14A with its existing computer systems as a flight test vehicle. The work included development of a computer program to determine performance and generate trajectories for various energy management modes. An energy management demonstration system is presented, the computational algorithm is described, and potential performance benefits resulting from the use of an energy management system are discussed

Author (GRA)

**N74-21675** California Inst. of Tech., Pasadena. Environmental Quality Lab

**PROJECT SAGE PHASE 1 REPORT. SOLAR ASSISTED GAS ENERGY WATER HEATING FEASIBILITY FOR APPLICATION IN NEW APARTMENTS**

Edgar S. Davis Jun. 1973 47 p refs Sponsored in part by Southern Calif. Gas Co (Grant NSF GI-29728)

(EQL-Memo-11) Copyright. Avail: Issuing Activity

The feasibility of developing a commercial product for solar water heating in apartment buildings in Southern California is investigated. A definition of a baseline system is given, specifying plumbing configuration, materials, components, and collector design concept. An estimation of system cost and performance is also included along with the identification of component design, enabling solar water heating to become commercially viable

Author

**N74-21676#** Bureau of Mines, Morgantown, W Va

**OIL SHALE: A CLEAN ENERGY SOURCE**

Sidney Katell, Reid Stone, and Paul Wellman [1974] 27 p Presented at the 18th Ann. Meeting of the Am. Assoc of Cost Engrs., Los Angeles, 30 Jun - 3 Jul 1974

Avail: NTIS HC \$4.50

Shale oil needs to be developed to take its place among the usable reserves of energy supplies in the future. Environmental concerns are broad and encompass industrial and surrounding socio-economic area. Industrial activities and responsibilities of the potential developer are presented

Author

**N74-21677#** Scientific Translation Service, Santa Barbara, Calif.

**WIND POWER TURBOGENERATOR FOR HIGH ALTITUDE WIND UTILIZATION**

H Honnef Washington NASA Apr 1974 12 p Transl into ENGLISH from German patent no. 885284(3 Aug. 1953) 4 p (Contract NASw-2483)

(NASA-TT-F-15455) Avail: NTIS HC \$4.00 CSCL 10A

A windpowered electrical generator is reported that consists of two counter-rotating wheels, one being the armature and the other being the field. Means of compensating for varying wind speed are described

Author

**N74-21678#** Kanner (Leo) Associates, Redwood City, Calif. **THE PRESENT STATE OF PLANNING AND ERECTION OF LARGE EXPERIMENTAL WIND-POWER STATIONS**

V R Sektorov Washington NASA Apr. 1974 15 p Transl. into ENGLISH from Elektrichesvo (Moscow), no. 2, 1933 p 9-13

(Contract NASw-2481)

(NASA-TT-F-15512) Avail: NTIS HC \$4.00 CSCL 10A

An investigation into the use of wind-power stations, which are planned for the second 5-Year Plan is discussed. The size of stations planned is 5000 kW, and they are to be built in areas of the country where there is a sufficient annual wind speed to justify economic use. The Balaklava experimental station was investigated and results show that it was economical, but new research must be done to improve overall performance

Author

**N74-21679#** Kanner (Leo) Associates, Redwood City, Calif. **STUDIES OF THE UTILIZATION OF WIND ENERGY: THE USE OF dc GENERATOR/MERCURY-VAPOR INVERTER SETS CONNECTED TO ac NETWORKS**

Antonino Asta Washington NASA Apr 1974 14 p refs Transl. into ENGLISH from Ric. Sci. (Rome), no. 1-2, Jan. - Feb. 1950 p 53-59

(Contract NASw-2481)

(NASA-TT-F-15514) Avail: NTIS HC \$4.00 CSCL 10C

Different types of electrical generators are reviewed that can be used with wind energy. A set is described that is comprised of a generator supplied by a suitable type of excitation and a mercury-vapor inverter capable of incorporation in a three-phase network with constant voltage and frequency, provided with reservoirs, by a fixed-pitch air motor without a speed regulator. Experimental results obtained with such a set are reported

Author

**N74-21680#** Kanner (Leo) Associates, Redwood City, Calif. **REPORT ON RESULTS ACHIEVED WITH SEAS EXPERIMENTAL WINDMILL**

J Juul Washington NASA Apr. 1974 15 p Transl. into ENGLISH from Elektroteknikeren (Copenhagen) p 5-12 (Contract NASw-2481)

(NASA-TT-F-15515) Avail: NTIS HC \$4.00 CSCL 10A

The SEAS experimental windmill was built in order to attempt operation of a three-phase alternating current generator with a wind turbine as drive power in conjunction with existing ac installations. Testing in natural wind was carried out on the wing shapes that have proved in windtunnel tests to be the most feasible. Investigations were made on how much power can be achieved per unit area within the periphery of the wingtips (= wingspread area). Annual production that can be achieved per unit of wingspread area was determined. The following requirements were worked out experimentally: (1) the most favorable wingtip velocity, regulation arrangement of the wing; (2) the necessary automatic apparatus. Finally, the maximum effect of the wind turbine's axle in the wind direction was measured

Author

**N74-21681#** Kanner (Leo) Associates, Redwood City, Calif. **THIS IS HOW YOU CAN HEAT YOUR HOME WITH A LITTLE WINDMILL**

Washington NASA Apr. 1974 13 p refs Transl. into ENGLISH from Nv Teknik (Sweden), no. 3, Jan. 1974 p 8-9 (Contract NASw-2481)

(NASA-TT-F-15518) Avail: NTIS HC \$4.00 CSCL 10A

For many years, small windmills with generators and storage batteries have been available for supplying electricity to remote locations, but storage batteries are so expensive, that this type of electrical supply is normally unrealistic. A better way of utilizing wind power in a smaller installation is to let the electrical current take care of home heating via a heat accumulator, which has low maintenance cost and simple electrical equipment. One

such installation is described in this article, and figures on its economic feasibility are provided.

Author

**N74-21682#** Kanner (Leo) Associates, Redwood City, Calif.  
**WIND ELECTRIC POWER STATION**  
 Hermann Honnef Washington NASA Apr. 1974 14 p Transl.  
 into ENGLISH from German Patent no. 871580(23 Mar. 1963)  
 (Contract NASw-2481)

(NASA-TT-F-16522) Avail: NTIS HC \$4.00 CSCL 10A

A wind power station is described in which the structure on which the rotors are mounted may tilt as wind speed changes so that the rotors leave the vertical plane to anticipate increased wind speeds. The power station may have pulse generators located in front of the turbine rotors on extensions of the turbine shaft or on separated booms under the turbine; winches to tilt the turbine platform, normally locked by means of a brake, which is released when a predetermined wind thrust is reached; flexible tension members to transmit the thrust of the wind to the nontilting portion of the structure; provisions to change the direction of the winches as wind speed changes; an auxiliary van to control an electrically driven propeller to rotate the power plant into the wind; and auxiliary generators to be used when wind speeds are too low for normal synchronous operation.

Author

**N74-21683#** Committee on Science and Astronautics (U. S. House).  
**SOLAR HEATING AND COOLING DEMONSTRATION ACT**  
 Washington GPO 1974 510 p refs Hearings on H.R. 10952  
 et al. before Comm. on Sci. and Astronaut., 93rd Congr., 1st  
 Sess., No. 24. 13-15 Nov. 1973  
 (GPO-27-370) Avail: Subcomm. on Energy

The feasibility of using solar energy for the heating and cooling of buildings is discussed and the development of solar heating technology to meet performance criteria is projected.

G G.

**N74-21684#** Commission of the European Communities, Brussels (Belgium).  
**MEDIUM-TERM PROSPECTS AND GUIDELINES IN THE COMMUNITY GAS SECTOR**  
 1972 91 p  
 Avail: NTIS HC \$7.75

A summary of the main government measures affecting the operation of the gas industry in various European nations is presented. The gas supply, consumption, transport, distribution, and storage are discussed along with the capital investments, prices, and the structure of gas enterprises in the community.

F.O.S.

**N74-21685#** Heliotek, Sylmar, Calif.  
**STUDY TERRESTRIAL APPLICATIONS OF SOLAR CELL POWERED SYSTEMS** Final Report  
 Jerry W. Ravin Sep. 1973 134 p  
 (Contract NAS3-16828)

(NASA-CR-134512) Avail: NTIS HC \$9.75 CSCL 10A

Terrestrial applications of solar cells and design systems are considered for those applications that show the most promise for becoming practical and accepted by users within the next five years. The study includes the definition, categorization, evaluation and screening of the most attractive potential terrestrial applications for solar cells. Potential markets are initially grouped and categorized in a general sense and are weighted in priority by their business volume, present and future. From a categorized list including marine, transportation, security, communication, meteorological and others, 68 potential solar cell applications have been cataloged. A methodology was formulated to include the criteria for evaluation and screening. The evaluation process covers all parts and components of the complete system required for each application and gives consideration to all factors, such as engineering, economic, production, marketing and other factors that may have an influence on the acceptance of the system.

Author

**N74-21686#** Michigan Public Service Commission.  
**CONSERVATION AND EFFICIENT USE OF ENERGY: A STATE REGULATOR'S VIEW**  
 William R. Ralls 10 Jul. 1973 15 p refs

Avail: NTIS HC \$4.00

Alternatives available for the conservation and efficient use of energy are discussed. Energy shortages and problems are analyzed, and the steps for alleviating the shortages are outlined. Energy policies of the Wisconsin Public Service Commission are discussed along with state and national conservation measures. It is concluded that government decision makers must recognize their responsibility to the public to go beyond the umpire role, and take strong, affirmative action to reduce energy consumption and promote efficient use.

F.O.S.

**N74-21687#** Wisconsin Univ., Madison.  
**ELECTRICITY GROWTH: ECONOMIC INCENTIVES AND ENVIRONMENTAL QUALITY**  
 Charles J. Cicchetti Jan. 1973 47 p refs

Avail: NTIS HC \$5.50

The consumption of electricity continues to double in the United States at intervals equal to about 10 years. Some of the institutional reasons why these exponential rates continue are examined with special emphasis on economic incentives and the regulatory climate under which privately owned electric utilities operate. The public utility pricing question is considered from the economists' point of view. The findings of various econometric analysis of the demand for electricity are reviewed and the question of rate of return and utility growth is considered. Some environmental policy options and important new research directions are also discussed.

Author

**N74-21688#** Los Alamos Scientific Lab., N.Mex.  
**GEOTHERMAL ENERGY**  
 M. C. Smith 1973 9 p  
 (Contract W-7405-eng-36)  
 (LA-UR-73-1316) Avail: NTIS HC \$3.00

Dry hot rock in the earth's crust represents the largest and most broadly distributed reservoir of usable energy accessible to man. The engineering equipment and methods required to extract and use this energy appear to exist and are now being investigated actively as LASL. At least for deep systems in relatively impermeable rock, not close to active faults, the extraction of energy from dry geothermal reservoirs should involve no significant environmental hazards. The principal environmental effects of such energy systems will be those associated with the surface facilities that use the geothermal heat; these will be visual, in land use, and in the thermal-pollution potential of low-temperature power plants. The energy extraction system itself should be clean, safe, unobtrusive, and economical.

Author (NSA)

**N74-21689#** Los Alamos Scientific Lab., N.Mex.  
**POTENTIAL FOR THE PRODUCTION OF POWER FROM GEOTHERMAL RESOURCES**

M C Smith 1973 18 p  
 (Contract W-7405-eng-36)  
 (LA-UR 73-926) Avail: NTIS HC \$3.00

The nature and magnitude of the hot, dry rock geothermal energy resource are such that within the next 10 to 15 years it could begin to contribute significantly to the solution of some of our nation's most urgent energy, pollution, and balance-of-payments problems. A program to investigate and develop this resource was undertaken by the Atomic Energy Commission at Los Alamos Scientific Laboratory, and initial results from that program are described. It appears that the equipment and techniques required to make this vast energy reservoir useful already exist, and that a convincing demonstration of its usefulness is possible within less than five years.

Author (NSA)

**N74-21691#** Los Alamos Scientific Lab., N.Mex.  
**POTENTIAL FOR HOT-DRY-ROCK GEOTHERMAL ENERGY IN THE WESTERN UNITED STATES**  
 D W. Brown 25 Jul. 1973 22 p refs  
 (Contract W-7405-eng-36)  
 (LA-UR-73-1075) Avail: NTIS HC \$3.25

The U.S. Geological Survey has identified 1.8 million acres (2800 square miles) of western lands as having a significant potential for geothermal development. The LASL for the past 2 years has been actively investigating the potential for and problems associated with extracting geothermal energy from the much more numerous regions of the western United States containing hot, but essentially dry, rock at moderate depths. A recent survey reveals that about 7% of the 13 state area comprising the Western Heat Flow Province--about 95,000 square miles--is underlain, at a depth of 5 km (16,400 ft), by hot rock at temperature levels above 290 C. In the Los Alamos concept, a man-made geothermal reservoir would be formed by first drilling into suitably hot rock, and then creating a very large surface area for heat transfer using conventional hydraulic fracturing techniques developed by the oil industry. Author (NSA)

**N74-21698# Energy Research Corp., Bethel, Conn.**  
**HIGH VOLTAGE FUEL CELL ASSEMBLY Final Report, May 1972 - Jun. 1973**

Ralph N. Camp and Bernard S. Baker Jan. 1974 44 p  
(Contract DAAK02-72-C-0458; DA Proj. 1T6-62705-A-012)  
(AD-774820; ERC-1456F) Avail: NTIS CSCL 10/2

The concept of a high voltage, planar fuel cell element was investigated. Experimental units composed of 2, 4 and 20 single, series connected cells were built and tested for periods of greater than 100 hrs. at temperatures of 130C. Phosphoric acid contained in organic fibre matrices was the electrolyte. A design based on the performance of these units is contained in the report. Twenty-cell units were able to produce 70mA/sq cm at 12 volts. Author (GRA)

**N74-21697# Massachusetts Inst of Tech., Cambridge. Energy Lab.**  
**IMPACTS OF NEW ENERGY TECHNOLOGY, USING GENERALIZED INPUT-OUTPUT ANALYSIS Final Report**  
James E. Just Feb. 1973 302 p refs  
(Grant NSF GI-32874)  
(PB-228139/4GA; MIT-EL-73-1) Avail: NTIS HC \$7.00 CSCL 21D

Comparative economic and environmental impacts of high and low BTU coal gasification and the gas turbine topping cycle during the 1980-85 time period were forecast. The forecast used a projected 1980 input-output table that was augmented by detailed air pollution coefficients and water, steel, and energy usage coefficients. Direct and indirect impacts of both investment in and operation of the new technologies were examined. Data was obtained from basic engineering studies of these processes and converted to input-output technical and capital coefficients. Alternative high, medium, and low energy growth futures for 1985 were projected both with and without the new technologies. Results indicate the high sensitivity of total capital investment and certain capital goods industries to the rate of energy use growth. Aggravation of the situation may result from the introduction of high BTU coal gasification. Several economic mechanisms that will help to hold total capital investment within its historical boundaries as a percentage of GNP are also examined. Possible applications, refinements, and extensions are included. GRA

**N74-21698# Energy Research Corp., Bethel, Conn.**  
**ELECTROLYTE FOR HYDROCARBON AIR FUEL CELLS**  
Interim Technical Report, May - Nov. 1973  
Ralph N. Camp and Bernard S. Baker Feb. 1974 29 p refs  
(Contract DAAK02-73-C-0084; DA Proj. 1T0-61102-A-34A)  
(AD-774832; ERC-2597S, ITR-2) Avail: NTIS CSCL 10/2

The electrochemical properties tetrafluoroethanedisulfonic acid which had been shown to be superior to phosphoric acid as an electrolyte for direct propane oxidizing fuel cells were explored further. Platinum electrodes immersed in both tetrafluoroethanedisulfonic acid and phosphoric acid saturated with propane were subjected to linear cyclic voltage sweeps and the resultant currents plotted as a function of potential. Peaks corresponding to the absorption and oxidation of propane were found to lie at more reversible potentials in tetrafluoroethanedisulfonic acid. Author (GRA)

**N74-21771# California Inst of Tech., Pasadena. Environmental Quality Lab**

**CONTROL OF GASOLINE VAPOR LOSSES FROM STATION AND VEHICLE FILLING**

Kenneth Heitner May 1973 15 p refs  
(Grant NSF GI-29726)  
(EQL-Memo-5) Avail: NTIS HC \$4.00

Control technologies and hardware are being developed for gasoline vapor losses. Several alternative methods have been evolved to solve the problem. The cost of these control systems is considerably less than new vehicle controls already required by law and can be absorbed with a very slight increase in the price of gasoline. In air basins where additional reductions of hydrocarbon emissions are required to achieve state and Federal ambient air quality standards for oxidant, gasoline (and other organic) vapor losses can be controlled through regulations similar to the San Diego Rule 63.

**N74-21921 Centre d'Etudes et Recherches de la Compagnie Electro-Mecanique, Le Bourget (France). Lab de Cryotechnique.**

**DEVELOPMENT OF A MULTIPOLAR INDUCTOR UTILIZING THE POSSIBILITIES OF HOLLOW SUPERCONDUCTORS WITH SUPERCRITICAL HELIUM CIRCULATION Final Report [RECHERCHES EN VUE DE LA REALISATION D'UN INDUCTEUR MULTIPOLAIRE UTILISANT LES POSSIBILITES DES SUPRACONDUCTEURS CREUX A CIRCULATION D'HELIOUM SUPERCRITIQUE COMPTE RENDU DE FIN DE CONTRAT]**

J. P. Bordenave and A. Malandain May 1972 48 p refs In FRENCH  
(Contract DGRST-70-7-2503)

Avail: Issuing Activity

A study for hermetic seals of use in alternators with rotating superconductor excitation and fixed cryostat is presented. Rotating seals using ferromagnetic liquids were investigated and discarded due to unacceptable losses. Sliding seals in graphite/ceramic were used in single seal and double seal versions and some conclusions are drawn. Rotating seals using liquid He were investigated and a test rig prepared. The possibility of having liquid helium in the rotating shaft was considered and the means used to limit the temperature at rotor tip are discussed. Problems associated with helium supercriticality are detailed. The implementation of a thermal shunt between hub and rotor tip is considered. ESRO

**N74-22014# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.**

**AUTOMATED STRIP-MINE AND RECLAMATION MAPPING FROM ERTS Special Report**

Robert H. Rogers, Principal Investigator, Larry E. Head (Ohio State Univ.), and Wayne A. Pettyjohn Apr. 1974 15 p Original contains imagery. Original photography may be purchased from the EROS DATA Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS  
(Contract NAS5-21762)  
(E74-10490; NASA-CR-136891) Avail: NTIS HC \$4.00 CSCL 081

The author has identified the following significant results. Computer processing techniques were applied to ERTS-1 computer-compatible tape (CCT) data acquired in August 1972 on the Ohio Power Company's coal mining operation in Muskingum County, Ohio. Processing results succeeded in automatically classifying, with an accuracy greater than 90%: (1) stripped earth and major sources of erosion; (2) partially reclaimed areas and minor sources of erosion; (3) water with sedimentation; (4) water without sedimentation; and (5) vegetation. Computer-generated tables listing the area in acres and square kilometers were produced for each target category. Processing results also included geometrically corrected map overlays, one for each target category, drawn on a transparent material by a pen under computer control. Each target category is assigned a distinctive color on the overlay to facilitate interpretation. The overlays, drawn at a scale of 1:250,000 when placed over an AMS map of the same area.

immediately provided map locations for each target. These mapping products were generated at a tenth of the cost of conventional mapping techniques.

**N74-22074#** Tetra Tech, Inc., Arlington, Va.  
**ULTRA-DEEP DRILLING FOR GEOTHERMALS** Final Report  
 Samuel O. Patterson, Bruno E. Sables, and Anthony Kooharian Dec. 1973 144 p refs  
 (Contract NOD-9825; ARPA Order 2419)  
 (AD-774108; TETRAT-A-74-339-005) Avail NTIS CSCL 08/9

Geothermal energy offers significant promise as a source of clean, widely available power. The first stage of its availability involves near surface sources; the second, abnormal thermal gradients; and the third stage, deep wells. This report assesses the potential and limitations of rotary drilling for deep geothermal systems. The assessment found that hot, dry rock geothermal energy produced from wells in the 35-40,000-ft range offers good potential to provide clean energy, a self-contained or independent energy source, no resupply for special problem maintenance systems, and the promise of economic competitiveness up to 100 Mw.

Author (GRA)

**N74-22091#** Woods Hole Oceanographic Institution, Mass.  
**REVIEW OF THE RESULTS FROM THE EASTERN ATLANTIC CONTINENTAL MARGIN PROGRAM OF THE INTERNATIONAL DECADE OF OCEAN EXPLORATION**  
 K O. Emery Oct 1973 34 p refs  
 (Grant NSF GX-28193)  
 (PB-226580/9GA, WHOI-Ref-73-75 WHOI-Contrib-3218)  
 Avail. NTIS HC \$3.00 CSCL 08C

A large geophysical and geological study of the Eastern Atlantic Continental Margin is reported. Excellent results were obtained aboard ship with a computerized system of gravity, magnetics, and seismic reflection and refraction. Although not designed primarily for economic exploration, the cruises did map large sediment-filled basins and belts of salt diapiric structures, some of which were previously unreported and none of which were completely mapped. In addition, small paged structures discovered on the deep ocean floor may have some promise as sources for gas. Lastly, areas of coastal upwelling, large river discharge, and open ocean divergence were outlined as areas being exploited for fish, and they include at least one that appears to be little exploited at present. (Modified author abstract) GRA

**N74-22292#** Massachusetts Inst of Tech Cambridge Operations Research Center  
**OPTIMAL CONTROL OF SULFUR DIOXIDE EMISSIONS AT POWER STATIONS MODELS AND A CASE STUDY**  
 Nitin R Patel Sep 1973 128 p refs  
 (Contract DAHCO4-73-C 0032)  
 (AD-775392; AROD 9239-10-M, TR 82) Avail. NTIS CSCL 04/2

The principal concern of this thesis is to analyze emission control strategies which depend upon meteorological conditions. A meteorological model is developed to relate source emissions with average concentration of a pollutant in a region under different meteorological conditions. The problem of determining optimal dynamic controls for SO<sub>2</sub> emissions at fossil fueled power stations is treated by constructing a linear programming model. This model is extended to encompass seasonal control of sources which are not amenable to more frequent controls. Another extension is constructed to analyze the effects of errors in meteorological forecasts. The various models are applied to the Metropolitan Boston Air Pollution Control District. The impact of dynamic emission controls on new site selection for fossil-fueled power stations is examined. A stochastic linear programming formulation is developed and an algorithm is designed to solve the stochastic linear programming problem. (Modified author abstract) GRA

**N74-22312#** Kanner (Leo) Associates, Redwood City, Calif.  
**STUDIES OF HEAT RESISTANT MATERIALS FOR HIGH-TEMPERATURE GAS REACTOR**

Shozo Sekino Washington NASA May 1974 30 p Transl. into ENGLISH of "Koon Gasu Ro Yo Tainetsu Zairyu No Kento", Nippon Steel Corp., Tech. Res. Inst., Yawata, Japan, report, 18 Oct. 1973 21 p  
 (Contract NASW-2481)

(NASA-TT-F-15576) Avail. NTIS HC \$4.50 CSCL 18J

As one of the countermeasures against the energy crisis, hope is entertained for the development of nuclear energy. MHD power generation may be of assistance from the standpoint of improved energy efficiency; high-temperature gas reactors are noted for their high efficiency. The GGA Company has developed a large-scale commercial high-temperature gas reactor whose prospects for the future are good. A preliminary requirement for using high-temperature gas economically and safely is the development of heat-resistant materials. Data are summarized concerning the suitability for this purpose of the existing alloys, including the alloys which are currently being mentioned as candidates. Data on corrosion resistance, creep resistance, thermal fatigue resistance, structural stability, weldability and machinability are reported

Author

**N74-22372#** Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div  
**PASSAGE OF CURRENT THROUGH BOUNDARY LAYERS**  
 V Yu Baranov, D D Malyuta, and F R Ulinich 1 Feb. 1974 24 p refs Transl. into ENGLISH from Teplofiz. Vysokikh Temperatur. Akad. Nauk SSSR (Moscow), v. 11, no. 3, May/Jun 1973 p 457 467

(AD 775138 FTD HT 23-698-74) Avail. NTIS CSCL 20/9

The drop in potential near an electrode in the presence of a cold boundary layer is studied theoretically and experimentally. The effect of a microarc on the gas-dynamic parameters in the channel of a MHD generator is analyzed

GRA

**N74-22504#** National Aeronautics and Space Administration, Lewis Research Center Cleveland, Ohio  
**FEASIBILITY OF SPACE DISPOSAL OF RADIOACTIVE NUCLEAR WASTE. 2: TECHNICAL SUMMARY**  
 Washington May 1974 130 p refs  
 (NASA-TM-X-2912; E 7876) Avail. NTIS HC \$4.75 CSCL 22A

The feasibility of transporting radioactive waste produced in the process of generating electricity in nuclear powerplants into space for ultimate disposal was investigated at the request of the AEC as a NASA in house effort. The investigation is part of a broad AEC study of methods for long-term storage or disposal of radioactive waste. The results of the study indicate that transporting specific radioactive wastes, particularly the actinides with very long half-lives, into space using the space shuttle/tug as the launch system, appears feasible from the engineering and safety viewpoints. The space transportation costs for ejecting the actinides out of the solar system would represent less than a 5-percent increase in the average consumer's electric bill.

Author

**N74-22589#** Dynatherm Corp., Cockeysville, Md.  
**HEAT PIPE DESIGN HANDBOOK, PART 1**  
 E A Skrabek Aug. 1972 331 p refs  
 (Contract NAS9-11927)  
 (NASA-CR-134284; DTM-72-3-Pt-1; DRL-2-Pt-1) Avail. NTIS HC \$19.75 CSCL 20M

The development and characteristics of heat pipes are examined. The subjects discussed are: (1) principles of operation, (2) heat pipe theory, (3) pressure gradient effects, (4) variable conductance, (5) design procedure, and (6) performance limit evaluation.

Author

**N74-22581** California Inst of Tech., Pasadena, Environmental Quality Lab  
**ELASTICITY OF DEMAND FOR GASOLINE IN THE SOUTH**

**COAST AIR BASIN**

Alan M. Schneider 1973 18 p refs  
(Grant NSF GI-29726)

(EQL-Memo-10) Copyright Avail Issuing Activity

An analysis of California gasoline sales was made, using Box and Jenkins' linear time series methods, in an attempt to detect the change due to a 17% change in price. There was no detectable change within the 2% noise limit of the method. Thus, either the elasticity is less than 2 parts in 17, and/or the tools must be further refined to detect it.

Author

**N74-22590#** Georgia Inst of Tech., Atlanta. School of Nuclear Engineering.

**COMPARATIVE EVALUATION OF SOLAR, FISSION, FUSION, AND FOSSIL ENERGY RESOURCES, PART 3 Final Report**

J. D. Clement and W. A. Reupke 20 Mar 1974 61 p refs  
(Grant NGR-11-002-166)

(NASA-CR-138117) Avail: NTIS HC \$6.25 CSCL 108

The role of nuclear fission reactors in becoming an important power source in the world is discussed. The supply of fissile nuclear fuel will be severely depleted by the year 2000. With breeder reactors the world supply of uranium could last thousands of years. However, breeder reactors have problems of a large radioactive inventory and an accident potential which could present an unacceptable hazard. Although breeder reactors afford a possible solution to the energy shortage, their ultimate role will depend on demonstrated safety and acceptable risks and environmental effects. Fusion power would also be a long range, essentially permanent, solution to the world's energy problem. Fusion appears to compare favorably with breeders in safety and environmental effects. Research comparing a controlled fusion reactor with the breeder reactor in solving our long range energy needs is discussed.

Author

**N74-22592#** California Inst of Tech. Pasadena. Environmental Quality Lab

**TRENDS OF ENERGY USE IN CALIFORNIA AND THE SOUTH COAST AIR BASIN**

Paul K. Mazaika May 1973 58 p refs  
(Grant NSF GI 29726)

(EQL-Memo-6) Avail: NTIS HC \$6.00

A time history is presented of the major sources of energy described for 1969 in List's report, 'Energy Use in California'. As the data are compiled differently in these two reports, a comparison and interpretation is shown for 1969. The major difference is that his data are only for fuel used to provide energy within the state boundaries, while this report includes consumption for uses other than energy (LPG for chemical feedstock), and fuel used outside the state that was sold in the state (oil for ocean vessels). Natural gas delivered, gasoline, and LPG burned show good agreement. California's total electricity production agrees well. For the South Coast air basin, natural gas use agrees well between the two reports, while both gasoline use and electricity use are about 7% greater in the present work.

Author

**N74-22593#** RAND Corp., Santa Monica, Calif.

**ENERGY ALTERNATIVES FOR CALIFORNIA: THE CURRENT CRISIS. 2: CONSERVATION OF ENERGY**

Ronald D. Doctor Dec 1973 34 p refs  
(P-5156) Avail: NTIS HC \$4.75

Methods for enacting energy conservation in California are discussed. Estimates are made of potential energy savings in the industrial, commercial, residential, and transportation sectors. It is recommended that the state government assume a more active role in allocating resources with particular attention to geographic and socioeconomic factors.

SKW

**N74-22594#** RAND Corp., Santa Monica, Calif.

**ENERGY ALTERNATIVES FOR CALIFORNIA: THE CURRENT CRISIS. 3: ALLOCATION OF SCARCE SUPPLIES**

Richard H. Ball Dec 1973 21 p refs  
(P-5157) Avail: NTIS HC \$4.25

Projected allocations of scarce energy supplies for California are discussed. The state economy was divided into residential, commercial, industrial, and transportation sectors. Energy supplies discussed are petroleum, electricity, natural gas, coal, and wood. Energy demand profiles are projected based on figures for demand in 1973. The role of government in allocating energy resources is discussed.

S. K. W.

**N74-22595#** RAND Corp., Santa Monica, Calif.

**THE POLICY EFFECTS ANALYSIS METHOD: A SYSTEM DYNAMICS SIMULATION STUDY OF THE DEFENSE FUEL SUPPLY SYSTEM**

James D. Steele Nov 1973 18 p refs Presented at Conf. of the Operations Res. Soc. of Am., San Diego, Calif., 12-14 Nov. 1973

(P-5129) Avail: NTIS HC \$4.00

A computerized simulation of military procurement policy for jet fuels and aviation gasoline is presented. The analysis is used to evaluate the effects of procurement policy on military operations. The effect of international and domestic energy policies on procurement is also discussed.

S.K.W.

**N74-22600#** Committee on Science and Astronautics (U. S. House)

**RESEARCH ON GROUND PROPULSION SYSTEMS**

Washington GPO 1974 139 p refs Hearings on H.R. 10392 before Comm on Sci. and Astronaut., 93rd Congr., 2d Sess., No. 26, 4-6 Feb 1974

Avail: Subcomm. on Space Sci. and Appl.

Congressional hearings on a bill providing for more efficient ground propulsion systems are presented. Performance, efficiency, and environmental quality factors for propulsion systems are outlined. Plans for hydrogen engines are emphasized.

S.K.W.

**N74-22602#** Little (Arthur D.), Inc., Cambridge, Mass.

**SOLAR HEATED AND COOLED OFFICE BUILDING FOR THE MASSACHUSETTS AUDUBON SOCIETY: INITIAL PLANNING AND DESIGN Final Report**

Jun. 1973 58 p refs Prepared jointly with Cambridge Seven Assoc. Sponsored by Mass. Audubon Soc.

(C 75457) Avail: NTIS HC \$6.00

A solar space conditioned office building is planned. The initial planning study consists of establishment of design criteria, preliminary engineering and architectural studies, planning for the design and construction phase, and estimation of design and construction costs and schedules.

Author

**N74-22603#** Georgia Inst of Tech., Atlanta. Schools of Mechanical and Nuclear Engineering

**COMPARATIVE EVALUATION OF SOLAR, FISSION, FUSION, AND FOSSIL ENERGY RESOURCES. PART 1: ENERGY FROM FOSSIL FUELS Final Report**

J. R. Williams [1974] 51 p refs

(Grant NGR-11-002-166)

(NASA CR-138188) Avail: NTIS HC \$5.75

The conversion of fossil fired power plants now burning oil or gas to burn coal is discussed along with the relaxation of air quality standards and the development of coal gasification processes to insure a continued supply of gas from coal. The location of oil fields, refining areas, natural gas fields, and pipelines in the U.S. is shown. The technologies of modern fossil-fuel boilers and gas turbines are defined along with the new technologies of fluid-bed boilers and MHD generators.

K.M.M.

**N74-22604#** Georgia Inst of Tech., Atlanta. Schools of Mechanical and Nuclear Engineering

**COMPARATIVE EVALUATION OF SOLAR, FISSION, FUSION, AND FOSSIL ENERGY RESOURCES. PART 5: CONCLUSIONS AND RECOMMENDATIONS Final Report**

J. R. Williams [1974] 9 p refs

(Grant NGH-11-002-166)

(NASA-CR-138183) Avail. NTIS HC \$4.00 CSCL 10B

Air pollution resulting from the use of fossil fuels is discussed. Phenomena relating to the emission of CO<sub>2</sub> such as the greenhouse effect and multiplier effect are explored. Particulate release is also discussed. The following recommendations are made for the elimination of fossil fuel combustion products in the United States: development of nuclear breeder reactors, use of solar energy systems, exploration of energy alternatives such as geothermal and fusion, and the substitution of coal for gas and oil use.

S.K.W.

N74-22810# Interior Dept., Washington, D.C.

UNITED STATES ENERGY FACT SHEETS, 1971

Feb. 1973 144 p

Avail. NTIS HC \$10.25

Basic aspects of the nation's fuel-energy situation are outlined. Information for the individual states as well as regions is presented. Data from many different publications are consolidated with emphasis on basic facts and patterns about our fuel-energy picture from state and regional viewpoints. Energy Fact Sheet is a series of tables for the individual states. The tables summarizing the data for the various regions and the nation provide broad-scale comparisons. Several illustrations are included to portray some salient facts. The location of fuel reserves are shown on several maps.

Author

N74-22815# Los Alamos Scientific Lab., N Mex.

ENERGY AND ENVIRONMENT: SYSTEM AND PERSPECTIVES

D A Freiwald Nov 1973 13 p refs

(Contract W-7405-eng-38)

(LA-5447-MSI) Avail. NTIS HC \$4.00

The concept of energy and environment is discussed from various perspectives, including space and time, energy systems development and natural resources, limits to growth, influence systems, the total environment, alternate schemes, and a communications structure. Brief discussions are presented as to how these subjects interrelate, and what types of programs might meaningfully ameliorate energy problems on a long-time scale.

Author (NSA)

N74-22822# Air Force Academy, Colo.

PROJECT POL (PETROLEUM, OIL, AND LUBRICANTS): OPTIMIZING PROCUREMENT OF AVIATION FUELS OR DEFENSE SUPPLY AGENCY Final Report

Larry M Austin and William W. Hogan Jan 1974 93 p refs (AD-775063) USAFA-TR-74-2) Avail. NTIS CSCL 15/5

Defense Department requirements for aviation fuels are met with purchases made in the usual competitive bidding environment. This large scale contract bidding and selection problem is modeled as a mixed integer linear program with a special structure. The solution of this large optimization problem is approached via an algorithm employing decomposition and implicit enumeration techniques which exploit the special structure of the underlying formulation. Computational results are discussed, and a FORTRAN computer program which implements the basic algorithm (POLKA) is exhibited.

Author (GRA)

N74-22703# Techtran Corp., Glen Burnie, Md.

THE MEASUREMENT OF LARGE WIND ENERGY GENERATORS

C Martini Washington NASA May 1974 16 p Transl into ENGLISH from Elektrotech. Maschinenbau (Austria), v. 57, no. 7/8, 17 Feb. 1939 p 83-89

(Contract NASW-2485)

(NASA TT-F-15433) Avail. NTIS HC \$4.00 CSCL 10A

The weight comparison of energy generators according to the Honnepf System is represented in curves wherein the weight is plotted as a function of three variables: the number of poles, air induction, and diameter.

Author

N74-22704# 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

1973 117 p Proc held at Cherry Hill, N. J. 23-25 Oct.

1973 2 Vol

(Contract NAS7-100, Grant NSF AG-485)

(NASA CR 138209, NSF-RA-N-74-013-Vol-1)

JPL-SP43-3-Vol-1) Avail. NTIS HC \$9.00 CSCL 10A

Technological aspects of solar energy conversion by photovoltaic cells are considered. The advantage of the single crystal silicon solar cell approach is developed through comparisons with polycrystalline silicon, cadmium sulfide/copper sulfide thin film cells, and other materials and devices.

G.G.

N74-22705# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

WORKSHOP PROCEEDINGS. PHOTOVOLTAIC CONVERSION OF SOLAR ENERGY FOR TERRESTRIAL APPLICATIONS. VOLUME 2: INVITED PAPERS

1973 294 p refs Proc held at Cherry Hill, N. J., 23-25 Oct.

1973 Sponsored by NASA 2 Vol.

(Grant NSF AG-485)

(NASA-CR-138193, NSF-RA-N-74-013-Vol-2)

JPL-SP43-3-Vol-2) Avail. NTIS HC \$17.75 CSCL 10A

A photovoltaic device development plan is reported that considers technological as well as economical aspects of single crystal silicon, polycrystal silicon, cadmium sulfide/copper sulfide thin films as well as other materials and devices for solar cell energy conversion systems.

G.G.

N74-22706# Kanner (Leo) Associates, Redwood City, Calif. STATISTICAL SUMMARY AND EVALUATION OF VENTO-ELECTRIC POWER STATION OUTPUT (PART 2 OF 2)

D R Stein Washington NASA Jun 1974 16 p refs Transl into ENGLISH from Elektrizitaetswirtschaft (Frankfurt am Main), v. 50, no. 11 Nov 1951 p 325-329

(Contract NASW 2481)

(NASA-TT-F-15652) Avail. NTIS HC \$4.00 CSCL 10A

Data obtained from the operation of windmills in Denmark were used to study the performance of several sizes and designs. Tabulated information shows: (1) how performance is affected by wind velocity patterns, particularly mean velocities, by rotor diameter, and by how the output is used; (2) what fraction of available wind is utilized; (3) how regularly or irregularly output varies with time; (4) what peak values occur; (5) the duration of lulls; and (6) how utilization time depends upon the power level used as a reference.

Author

N74-22708# Techtran Corp., Glen Burnie, Md.

MEETING FUTURE PEAK ELECTRICAL ENERGY DEMANDS BY MEANS OF ELECTROCHEMICAL STORAGE SYSTEMS

Klaus D Beccu Washington NASA May 1974 12 p refs Transl into ENGLISH from Chem.-Ingr.-Tech., v. 48, no. 3, 1974 p 95-99 Presented at the Session of GDCh Specialist Group Appl. Electrochem., Ludwigshafen am Rhein, West Germany.

4-5 Oct 1973

(Contract NASW 2485)

(NASA-TT-F-15634) Avail. NTIS HC \$4.00 CSCL 10C

The electrical energy crisis is considered in terms of storage equipment. Various types are compared in terms of costs, efficiency, maintenance, and raw material reserves. It is concluded that more study and research is needed before adequate energy storage systems can cover peak load periods.

Author

N74-22954# Colorado School of Mines, Golden, Dept. of Geology

GEOLOGIC INFORMATION FROM SATELLITE IMAGES

Keenan Lee, Daniel H. Knepper, Principal Investigators, and Don L. Sawetzky 27 Mar. 1974 39 p refs Presented at the 3d

Ann. Remote Sensing of Earth Resources Conf., Tullahoma, Tenn., 26 Mar. 1974. Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS and EREP (Contracts NAS9-13394; NAS5-21778; Grant NGL-06-001-015)

(E74-10507; NASA-CR-138230; Rept-74-3) Avail: NTIS HC \$5.00 CSCL 08G

The author has identified the following significant results. Extracting geologic information from ERTS and Skylab/EREP images is best done by a geologist trained in photointerpretation. The information is at a regional scale, and three basic types are available: rock and soil, geologic structures, and landforms. Discrimination between alluvium and sedimentary or crystalline bedrock, and between units in thick sedimentary sequences is best, primarily because of topographic expression and vegetation differences. Discrimination between crystalline rock types is poor. Folds and fractures are the best displayed geologic features. They are recognizable by topographic expression, drainage patterns, and rock or vegetation tonal patterns. Landforms are easily discriminated by their familiar shapes and patterns. It is possible to optimize the scale, format, spectral bands, conditions of acquisition, and sensor systems for best geologic interpretation. Several examples demonstrate the applicability of satellite images to tectonic analysis and petroleum and mineral exploration.

N74-22066#/ Colorado School of Mines, Golden. Dept. of Geology.

**APPLICABILITY OF REMOTE SENSOR DATA TO GEOLOGIC ANALYSIS OF THE BONANZA TEST SITE COLORADO**  
Semimonthly Progress Report, 1 Oct. 1973 - 31 Mar. 1974  
Daniel H. Knepper, Keenan Lee, Principal Investigators. R. W. Butler, J. C. Fisher, and D. Huntley May 1974 30 p. refs ERTS

(Grant NGL-06-001-015)

(E74-10508; NASA-CR-138231; Rept-74-1) Avail: NTIS HC \$4.50 CSCL 08G

There are no author-identified significant results in this report.

N74-23072#/ United Nations Development Program.  
**CARBONIZATION AND HYDROGENATION OF COAL**

1973 146 p. refs  
(ID/80) Avail: NTIS MF \$1.45; United Nations, Sales Section, New York or Geneva HC \$3.00, Sales No.: E.72.II.B.26

Coal treatment processes are described in relation to their economic and utilitarian viability in developing countries. Carbonization, hydrogenation, and the Fischer-Tropsch gasification processes for making oils, chemicals, and gas from coal are described along with plant layouts. The processes are compared on the basis of product properties and uses, and the internal and external economic factors associated with production. Capital investment, manpower, coal reserves, and market considerations are discussed, and the developing countries for which coal treatment industries might be suited are listed.

A.A.D.

N74-23180#/ Bureau of Mines, Bartlesville, Okla.  
**OXYGENATES IN AUTOMOTIVE EXHAUSTS. EFFECT OF AN OXIDATION CATALYST**  
D. E. Seizinger and B. Dimitriades Dec. 1973 28 p. refs  
(PB-2270971/3; BM-RI-7837) Avail: NTIS HC \$3.25 CSCL 13B

Analytical methods for oxygenates in exhaust gases were studied, and emission of these compounds from automotive engines were measured. It was shown that an estimate of the oxygenate yield from gasoline used in a noncatalytic system can be synthesized from data obtained with simple fuels. Such

synthesized data were used for comparison of noncatalytic with catalytic systems. It is concluded that the compositional character and class distribution of oxygenates in exhaust from catalytic systems may differ significantly from the composition and distribution for oxygenates not subjected to catalytic conversion. (Modified author abstract) GRA

N74-23327#/ Institut Franco-Allemand de Recherches, St. Louis (France).

**APPLICATION OF PHASE TRANSITIONS TO THE ELECTRO-MECHANICAL ENERGY CONVERSION [APPLICATION DES TRANSITIONS DE PHASE A LA CONVERSION MECANO-ELECTRIQUE DE L'ENERGIE]**

F. Bauer and Y. Fetteau (Lab. de Ferroelectricite, Lyon) 28 Sep 1973 9 p. refs In FRENCH  
(ISL-CO-2/73) Avail: NTIS HC \$4.00

The adiabatic depolarization of ferroelectric ceramics is discussed for direct energy release. The basic principles of the method are reviewed and theoretical calculations show that charge release should be performed in an extremely short time. Metastable materials are best adapted in view of the transition F/AF high mobility. A low electric conductivity at high pressure (25 kbar) and high remanent polarization are shown to be essential. Applications as high impulse current generators for electric detonators are outlined. ESRO

N74-23337#/ Bureau of Mines, Amarillo, Tex. Branch of Helium Resources.

**ANALYSES OF NATURAL GASES, 1972**

L. E. Cardwell and L. F. Benton Nov. 1973 109 p. refs  
(PB-225977/8; BM-IC-8607) Avail: NTIS MF \$1.45; SOD HC \$1.25 CSCL 21D

This publication contains routine analyses and related source data for 299 natural gas samples from 22 states and three foreign countries. All samples were collected during Calendar Year 1972 as a part of a continuous survey of the free world for occurrences of helium. GRA

N74-23481#/ Georgia Inst. of Tech., Atlanta. School of Nuclear Engineering.

**COMPARATIVE EVALUATION OF SOLAR, FISSION, FUSION, AND FOSSIL ENERGY RESOURCES. PART 2: POWER FROM NUCLEAR FISSION** Final Report  
J. D. Clement [1973] 82 p. refs  
(Grant NGR-11-002-165)

(NASA-CR-138397; E-26-808-Pt-2) Avail: NTIS HC \$7.25 CSCL 21D

Different types of nuclear fission reactors and fissionable materials are compared. Special emphasis is placed upon the environmental impact of such reactors. Graphs and charts comparing reactor facilities in the U. S. are presented. S.K.W.

N74-23487#/ Committee on Government Operations (U. S. Senate).

**STAFF STUDY OF THE OVERSIGHT AND EFFICIENCY OF EXECUTIVE AGENCIES WITH RESPECT TO THE PETROLEUM INDUSTRY, ESPECIALLY AS IT RELATES TO RECENT FUEL SHORTAGES**

Washington GPO 8 Nov. 1973 115 p. refs Prepared for the Permanent Subcomm. on Investigations, 93d Congr., 1st Sess., 8 Nov. 1973  
(GPO-23-784) Avail: SOD \$1.00

Policies of the Federal government are discussed as they relate to managing the oil import program, providing adequate

supplies of crude oil for processing by refineries, overseeing operations and domestic refineries needed to meet demand, and maintaining a climate for the necessary expansion of domestic refinery capacity required to meet demand for gasoline and distillate fuel oil. A compilation of relevant facts accumulated from various sources is presented to serve as background for public hearings on oversight of the executive branch with respect to the petroleum industry, especially as it relates to recent fuel shortages.

Author

N74-23510# North Atlantic Treaty Organization, Brussels (Belgium). Scientific Affairs Div.

**TECHNOLOGY OF EFFICIENT ENERGY UTILIZATION**

Eugene G. Kovach, ed. Oct. 1973 77 p Conf. held at Les Arcs, France, 8-12 Oct. 1973

Avail: NTIS HC \$7.00

The proceedings of a conference on the efficient utilization of energy are presented. The contributions which science and technology could make to maintaining current processes at lower energy cost were investigated. Attention was centered on the end uses of energy, without consideration of its original source, its transmission, or even its form. The roles played by major social, political, or economic decisions were considered. The contributions to be expected from research and development activities toward efficient energy utilization were emphasized.

Author

N74-23511# Committee on Interior and Insular Affairs (U. S. Senate).

**PRESIDENTIAL ENERGY STATEMENTS**

Washington GPO 1973 112 p refs Presented to Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 1973 (GPO-24-933) Avail: SOD HC \$1.05

Presidential energy statements relating to national energy policy are presented. Topics include energy requirements and the resources available to meet them. Research and development relating to energy production is discussed.

S.K.W.

N74-25615# Georgia Inst of Tech, Atlanta. School of Mechanical Engineering

**COMPARISON AND EVALUATION OF POWER PLANT OPTIONS FOR GEOSYNCHRONOUS POWER STATIONS. PART 1. SYNCHRONOUS SOLAR POWER Final Report**

J. R. Williams [1973] 47 p refs

(Grant NGR-11-002-181)

(NASA-CR-138493) Avail: NTIS HC \$5.50 CSCL 10A

The present state-of-the-art is described for the development of solar power generators in far out synchronous orbit for power generation. Concepts of geosynchronous solar power satellites are discussed including photovoltaic arrays for power satellites, solar thermal power satellites, and power transmission to earth.

F.O.S

N74-25616# Arizona Univ, Tucson Optical Sciences Center **CHEMICAL VAPOR DEPOSITION RESEARCH FOR FABRICATION OF SOLAR ENERGY CONVERTORS Annual Progress Report, 1 Jan. - 31 Dec. 1973**

B. O. Seraphin 31 Jan 1974 83 p refs

(Grant NSF GI-36731X)

(NSF/RANN/SE/GI-36731X/PR/73/3)

Avail: NTIS

HC \$7.25

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

Author

**N74-25617# Scientific Translation Service, Santa Barbara, Calif. WIND GENERATING STATIONS UNDER JOINT OPERATIONAL CONDITIONS**

A. Kroms Washington NASA Jun 1974 32 p refs Transl. into ENGLISH from A. Bull Schweiz. Elektrotech. Ver. (Zurich), v. 45, 1954, p 135-144

(Contract NASW-2483)

(NASA-TT-F-15837) Avail: NTIS HC \$4.75 CSCL 10A

The following topics are discussed: wind power generators in combined operation; fundamentals of wind power as energy source and of its characteristics, structural features of generators, the feasibility of combined wind power and hydraulic power station, and the economic outlook for wind power. A bibliography is included.

Author

**N74-25618# Scientific Translation Service, Santa Barbara, Calif. STATISTICAL SUMMARY AND EVALUATION ON ELECTRIC POWER GENERATION FROM WIND POWER STATIONS**

Dimitri R. Stein Washington NASA 6 Jun. 1974 23 p refs Transl. into ENGLISH from Elektrizitaetswirtschaft (Frankfurt am Main), v. 50, no. 10, 11 Oct. 1951 p 279-285

(Contract NASW-2483)

(NASA-TT F 15651) Avail: NTIS HC \$4.25 CSCL 10A

The technical developments and utilization of wind powered generating systems are discussed. A table of data is presented to show the energy production of Danish wind powered generation stations from 1941 to 1944. A statistical evaluation of the energy production by wind powered generators is provided. The characteristics of the power generation stations and the method for transmitting the power are described.

Author

**N74-25619# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.**

**A COMPUTER PROGRAM TO DETERMINE GEOMETRIC PARAMETERS FOR THE AFM SOLAR ARRAYS**

Edward M. Gaddy Apr 1974 72 p ref

(NASA-TM-X-70656 X-711-74-121) Avail: NTIS HC \$6.75 CSCL 10A

A computer program has been written to aid in the design of the A E M-1 solar array and to determine the power that will finally be available from the array. The program will plot the array output as a function of the satellite's position in a given orbit and will calculate the average output over the orbit.

Author

**N74-25620# Committee on Aeronautical and Space Sciences (U S Senate)**

**SOLAR HEATING AND COOLING**

Washington GPO 1974 277 p refs Hearing on S 2658 and H.R. 11884 before Comm. on Aeron. and Space Sci., 93d Congr., 2d Sess., 25 Feb. 1974

(GPO-29-939) Avail: Comm. on Aeron. and Space Sci.

A Congressional hearing was conducted to investigate the use of solar energy to help alleviate the energy shortage. The bill under consideration would direct NASA in cooperation with other Federal agencies, to develop a commercial demonstration of the technology of solar heating and for the technology of combined solar heating and cooling. Testimony is provided by several scientists and technologists concerning the methods of using solar energy. Examples of solar energy conversion systems are provided. A cost analysis of the project was made.

P.N.F.

**N74-25621# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md.**

**SOLAR ENERGY RESEARCH AND UTILIZATION**

William R. Cherry May 1974 23 p refs

(NASA TM-X-70660, X-704-74-139) Avail: NTIS HC \$4.25 CSCL 10A

The role is described that solar energy will play in the heating and cooling of buildings, the production of renewable gaseous, liquid and solid fuels and the production of electric power over the next 45 years. Potential impacts on the various energy markets and estimated costs of such systems are discussed along with illustrations of some of the processes to accomplish the goals. The conclusions of the NSF/NASA Solar Energy Panel (1972) are given along with the estimated costs to accomplish

the 15 year recommended program and also the recent and near future budget appropriations and recommendations are included.

Author

N74-2623# Army Foreign Science and Technology Center, Charlottesville, Va

HETEROGENEOUS SOLAR CONVERTERS BASED ON POLYCRYSTALLINE CADMIUM SULFIDE AND SELENIDE

V. N. Komashchenko, A. I. Marchenko, and G. A. Fedorus 6 Nov. 1973 11 p. refs. Transl. into ENGLISH from Poluprov. Tekh. Mikroelektron. Akad. Nauk Ukr. SSR. Respub. Mezhdunar. Sb. (Moscow), no. 4, p. 112-121

(AD-776551. FSTC-HT-23-1083-72) Avail. NTIS CSCL 10/2

Data are presented on the development and investigation of photoconverters based on pressed sintered tablets of CdS and CdSe, as well as some more detailed data on photoconverters based on CdSe films.

Author

N74-2625# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div

PROSPECTS AND SCIENTIFIC PROBLEMS OF THE APPLICATION OF METHODS OF DIRECT ELECTRICAL POWER ACQUISITION FROM CHEMICAL FUELS

N. S. Lidorenko and G. F. Muchnik 21 Mar. 1974 29 p. refs. Transl. into ENGLISH from Izv. Akad. Nauk SSSR. Energ. i Transp. (Moscow), no. 2, 1973, p. 15-27

(AD-776734. FTD-MT-24-2-74) Avail. NTIS CSCL 10/2

The fundamental prospects for the use of electrochemical generators, which convert the chemical energy of fuel into electrical energy are examined. The optimal areas of their application in comparison with other energy sources are determined. Comparisons are conducted for a series of criteria, including technical-economic. A survey is given of the fundamental problems (theoretical, experimental, technical) which appear in the process of creating ECG

GRA

N74-26239# Bonner and Moore Associates, Inc., Houston, Tex

PROJECTED AVAILABILITY OF MOTOR GASOLINE AND DISTILLATE FUELS, 1975 - 1985 Final Report

15 Jan. 1974 108 p  
(Contract DAAD05-73-C-0558. DA Proj. 1T6-62611 A-106)  
(AD 775859. RGH-042) Avail. NTIS CSCL 21/4

The project involved the preparation of forecasts for raw materials availability and product demands for the U.S. refining industry through 1985 and the construction of a mathematical model of the industry. The major objective was to conduct an economic projection of the availability and compositional trends for automotive gasolines and distillate fuels during the next decade. Four major product demand forecasts (scenarios) were prepared and used to examine the industry. Additionally, the availabilities of jet and diesel fuels were examined in 1985 under two alternate premises

Author (GRA)

N74-26243# Naval Civil Engineering Lab., Port Hueneme, Calif.

SUBSTITUTION OF JP-5 AVIATION FUEL FOR DF-2 DIESEL UNDER FIELD CONDITIONS

John S. Williams Feb 1974 10 p. refs

(AD-777047. NCEL-TN 1333) Avail. NTIS CSCL 21/4

The report covers the work done to determine whether JP-5 aviation turbine fuel is a suitable substitute for DF-2 diesel fuel in the heavy equipment of the Naval Construction Force when such equipment is deployed on a large construction project. (Modified author abstract)

GRA

N74-26244 California Inst of Tech., Pasadena. Environmental

Quality Lab.

COST AND PERFORMANCE OF AUTOMOTIVE EMISSION

CONTROL TECHNOLOGIES

Glen R. Cass Dec. 1973 32 p. refs

(Grant NSF GI-29726)

(EQL-Memo-7) Copyright. Avail. Issuing Activity

The near-term commercial feasibility of a wide range of automotive emission control technologies was investigated. Manufacturability and costs associated with each emission control technology are considered. Principle control techniques are listed along with fuel economy, price, maintenance cost, and emissions data for subcompact vehicles identified by the model year, in which they were marketed. These engine-vehicle combinations are then compared on the basis of estimated annual cost to the consumer above a 1970 baseline figure. Data indicate that cost alone will not govern the adoption of one emission control technology over another, either by consumers or manufacturers. Additional incentives are discussed.

A.A.D.

N74-26253# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio

STATE OF TECHNOLOGY ON HYDROGEN FUELED GAS TURBINE ENGINES

Jack B. Eager May 1974 13 p. refs  
(NASA-TM-X-71661. E-7990) Avail. NTIS HC \$3.00 CSCL 21E

A series of investigations was conducted episodically from the 1950's to the early 1970's to investigate the feasibility and potential problem areas in the use of hydrogen fuel for gas turbine engines. A brief summary and bibliography are presented of the research that has been conducted by NASA, its predecessor NACA, and by industry under U.S. Air Force sponsorship. Although development efforts would be required to provide hydrogen fueled gas turbine engines for aircraft, past research has shown that hydrogen fueled engines are feasible, and except for flight weight liquid hydrogen pumps, there are no problem areas relating to engines requiring significant research

Author

N74-26255# Avco-Everett Research Lab., Everett, Mass.

DISK GEOMETRY MHD GENERATOR FOR HIGH VOLTAGE HIGH POWER AIRCRAFT REQUIREMENTS Final Technical Report, Jul. 1971 - Dec. 1973

James E. Klepeis and Jean F. Louis Feb 1974 111 p. refs  
(Contract F33615-71-C-1905. AF Proj. 3145)

(AD-775749. AFAPL-TR-74-6) Avail. NTIS CSCL 21/3

The disk represents a magnetohydrodynamic (MHD) channel geometry in which either a simple outward radial flow occurs, or there is a combination of radial flow with swirl. Distinguishing features and major advantages of the disk are electrodeless walls, and the simplicity of channel and magnet design. For airborne applications of the MHD generator, the goal is to achieve high power density and high power per unit weight. For certain electrical loads, a high voltage output is also desirable. The disk is uniquely suited to airborne applications because the radial symmetry peculiar to the geometry, and its capability to operate at very high electric fields, makes the disk a compact, high-voltage power supply. Described in the report is an experimental program concerned with the investigation and demonstration of the high-interaction performance of a large-scale disk generator driven by a large diameter (61.0 cm) shock tube. (Modified author abstract)

GRA

N74-26400# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

CERTAIN PECULIARITIES OF COMBUSTION OF BALLOONED GASES AND STABILIZATION OF A FLAME

V. A. Bolin, O. N. Ermolaev, and S. N. Shonn 8 Mar. 1974 10 p. refs. Transl. into ENGLISH from Teoriya i Praktika Szhiganiya Gaza (USSR), v. 5, 1972 p. 68-72

(AD-776731. FTD-HT-23-872-74) Avail. NTIS CSCL 21/2

The problems involved in burning low calorie exhaust gases (industrial by-products) are discussed. Particular attention is given to the problem of the stability of combustion of gases whose heat of combustion does not exceed 300 kcal/cu m. Flame stabilization in this process is also discussed

K.M.M.

N74-26405# Committee on Aeronautical and Space Sciences (U.S. Senate)

## NASA AUTHORIZATION FOR FISCAL YEAR 1975.

## PART 3

Washington GPO 1974 338 p Hearings on S. 2955 before Comm. on Aeron. and Space Sci., 93d Congr., 2d Sess., 2 and 4 Apr. 1974

(GPO-31-919) Avail: Comm. on Aeron and Space Sci.

A congressional hearing to authorize appropriations for NASA programs was conducted. Comprehensive testimony was provided on the space sciences program with additional statements on Skylab solar physics, the Large Space Telescope, and Spacelab payloads. Statements on tracking and data acquisition and energy research and development were also heard. A special report by representatives of the aircraft industry cited NASA's role in aeronautical research and technology and the importance of continuing studies, particularly in noise reduction. Finally, an analysis of FY 1975 NASA budget figures is presented with attention to future programs and costs

A.A.D.

## N74-28409# National Bureau of Standards, Washington, D.C. THE ENERGY COMPLEX: TARGET FOR TODAY'S TECHNOLOGY

Richard W. Roberts Sep 1973 12 p refs Presented at 3d Urban Technol Conf., Boston, 26 Sep 1973  
Avail: NTIS HC \$4.00

Per capita energy consumption, national energy expenditure, and future energy demands are cited as preface to a summary of national energy research and development efforts. National energy habits are discussed along with pertinent conservation measures. Energy source research is outlined and the building design technologies reported which make more efficient use of energy presently available

A.A.D.

## N74-28411# Committee on Public Works (U. S. Senate). THE ADMINISTRATION'S PROPOSAL FOR RELAXATION OF AIR POLLUTION STANDARDS

Washington GPO 1973 132 p refs Hearing before Comm. on Public Works, 93d Congr., 1st Sess., 18 Sep. 1973  
(GPO-22-629) Avail: Subcomm. on Air and Water Pollution.

A Congressional hearing was conducted to assess the possible impact of relaxing air pollution standards in order to assist in reducing the severity of the energy crisis. Principal emphasis was placed on the adverse effects of permitting sulfur oxide emission standards to be lowered. A forecast of the availability of energy resources was made to show the need for importing energy supplies against the availability of energy sources from foreign countries. Various processes for reducing the sulfur content of fuels are explained. The types of alternate fuel sources which may be available are analyzed

P.N.F.

## N74-28412# Committee on Public Works (U. S. Senate) THE IMPACT OF AUTO EMISSION STANDARDS Report of the Staff of the Subcommittee on Air and Water Pollution

Washington GPO Oct 1973 155 p refs Presented to the Comm. on Public Works, 93d Congr., 1st Sess., Oct. 1973  
(GPO-21-548) Avail: Subcomm. on Air and Water Pollution

Progress is reported in a Congressional hearing on compliance with the Clean Air Act of 1970. Automobile emission control levels and test procedures are reviewed and the following issues are discussed: (1) quality assurance, (2) emission control and energy conservation, (3) the emission control technologies of catalyst systems and alternative engine designs, (4) leadtime, (5) the nitrogen oxide measurement problem, and (6) fuel additives. The role of the automotive industry in implementation of standards is emphasized

A.A.D.

## N74-28435# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio PRELIMINARY PERFORMANCE APPRAISAL OF NAVY V STOL TRANSPORT AND SEARCH-TYPE AIRPLANES

## USING HYDROGEN FUEL

W. C. Streck May 1974 33 p refs  
(NASA-TM-X-71550, E 7962) Avail: NTIS HC \$3.25 CSCL 01C

First-cut estimates are given of the performance advantages of liquid-hydrogen-fueled, ejector wing, V/STOL aircraft designed for shipboard delivery and search-type missions. Results indicate that the use of LH<sub>2</sub> could reduce gross weights 30 percent, empty weights 15 percent, and energy consumption 10 percent for a fixed payload and mission. If gross weight is fixed, the delivery range could be increased about 60 percent or the hover time during a search mission doubled. No analysis or discussion of the economic and operational disadvantages is presented.

Author

## N74-28408# Lincoln Lab., Mass. Inst. of Tech., Lexington. CALCULATION AND COMPARISON OF THE ECONOMY OF ELECTROCHEMICAL FUEL CELLS

Franz A. Pohl, Harald Bohm et al May 1973 21 p refs Transl into ENGLISH from Wiss. Ber. AEG-Telefunken (West Germany), v. 45, 1972 p 141-146  
(NTC-74-11868; Rept-73-145) Avail: NTIS HC \$4.25: National Translation Center, John Crerar Library, Chicago, Ill. 60616

The characteristics and operating principles of electrochemical fuel cells are discussed. The economy of typical fuel cells is calculated and the economy of different low temperature fuel cells is compared. It was determined that the tungsten carbide/carbon fuel cell is more economical than the other low temperature fuel cells investigated. Mathematical models are developed to show the manner in which the comparisons were conducted.

Author

## N74-28503# Arizona Univ., Tucson. Optical Sciences Center. RESEARCH APPLIED TO SOLAR-THERMAL POWER SYSTEMS Semiannual Progress Report, 1 Jan. - 30 Jun. 1973

B. O. Seraphin 10 Apr 1973 57 p refs  
(Grant NSF GI-36731X)

Avail: NTIS HC \$6.00

Research on a new approach to a selective solar energy converter that can be used to transform solar radiation into high temperature heat was conducted. This heat can be transferred and applied in a steam turbine-generator unit to produce electricity. The selective solar energy converter 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 black body radiation from the heated unit. The bottom layer is a metal film having high reflectance.

Author

## N74-28504# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. THE DEVELOPMENT OF A SOLAR-POWERED RESIDENTIAL HEATING AND COOLING SYSTEM

10 May 1974 80 p  
(NASA-TM-X-70089, M-TU-74-3) Avail: NTIS HC \$7.00 CSCL 10A

Efforts to demonstrate the engineering feasibility of utilizing solar power for residential heating and cooling are described. These efforts were concentrated on the analysis, design, and test of a full-scale demonstration system which is currently under construction at the National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Alabama. The basic solar heating and cooling system under development utilizes a flat plate solar energy collector, a large water tank for thermal energy storage, heat exchangers for space heating and water heating, and an absorption cycle air conditioner for space cooling.

Author

## N74-28505# Committee on Interior and Insular Affairs (U. S. Senate)

GEOOTHERMAL RESOURCES, PART 1 The Potential for the Production of Power from Geothermal Resources

Washington GPO 1973 294 p refs Hearing before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 13 Jun. 1973  
 (GPO-21-438) Avail: Subcomm. on Water and Power Resources

The potential for the production of electricity and heat energy from geothermal sources is projected and requirements for Federal programs in exploration, research, and development of geothermal resources are considered. G.G.

N74-26506# Committee on Interior and Insular Affairs (U. S. Senate).

**GEOTHERMAL RESOURCES, PART 2 The Potential for the Production of Power from Geothermal Resources**

Washington GPO 1974 484 p refs Hearing before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 10 Aug. 1973 (Idaho Falls, Idaho) and 11 Aug. 1973 (Klamath Falls, Oregon)

(GPO-26-473) Avail: Subcomm. on Water and Power Resources

The progress of technology in the development of geothermal resources is considered for solving the particular energy problems of the Pacific Northwest. G.G.

N74-26508# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio

**STATUS OF FEP ENCAPSULATED SOLAR CELL MODULES USED IN TERRESTRIAL APPLICATIONS**

A. F. Ratajczak and A. F. Forestieri 1974 7 p refs Proposed for presentation at 9th Intersoc. Energy Conversion Eng. Conf., San Francisco, 26-30 Aug. 1974

(NASA-TM-X-71564, E-7998) Avail: NTIS HC \$3.00 CSCL 10A

The Lewis Research Center has been engaged in transferring the FEP encapsulated solar cell technology developed for the space program to terrestrial applications. FEP encapsulated solar cell modules and arrays were designed and built expressly for terrestrial applications. Solar cell power systems were installed at three different land sites, while individual modules are undergoing marine environment tests. Four additional power systems are being completed for installation during the summer of 1974. These tests have revealed some minor problems which have been corrected. The results confirm the inherent utility of FEP encapsulated terrestrial solar cell systems. Author

N74-26509# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.

**SOLAR THERMAL ELECTRIC POWER SYSTEMS Progress Report, 1 May - 30 Jun. 1973**

Jul. 1973 78 p refs Prepared in cooperation with Westinghouse Elec. Corp., Boulder, Colo.

(Grant NSF GI-37815)

Avail: NTIS HC \$7.00 CSCL 10A

A research project in the generation of electric power from solar energy was conducted. The objective of the research was an appraisal of methods for converting solar energy to electricity and a determination of promising methods for future development. The subjects discussed are: (1) the characteristics of solar collectors, (2) heat storage, (3) systems optimization methods, (4) cost estimation, and (5) ranking alternatives for solar energy supply to utilities. The materials used in solar collectors are identified and typical solar collector configurations are examined. Author

N74-26510# Committee on Science and Astronautics (U. S. House).

**ENERGY FROM GEOTHERMAL RESOURCES**

Washington GPO May 1974 96 p refs Presented to Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., 10 May 1974 Prepared by Library of Congr.

(GPO-32-309) Avail: Subcomm. on Energy

The technology for utilizing dry steam deposits for electric power is reasonably well advanced, but these deposits are uncommon in nature. Exploitation of these deposits will provide valuable additions to local power supplies. The unit power cost

of dry steam is well under that of fossil and nuclear fuels and dry steam has less adverse environmental impact. Using the steam will likewise conserve conventional fuels, which may then be used elsewhere or for other purposes. Wet steam and hot water electric power plants are more expensive than the dry steam plants, but such deposits are much more common. The technology is, again, reasonably, but not totally, developed: corrosion remains a major problem. As with the case of dry steam deposits, in areas containing wet steam and hot water resources, conventional fuels can be saved and the environment protected by the construction of geothermal power plants and by using the remaining hot water for such secondary purposes as space heating, the extraction of minerals, and as a source of potable water. Author

N74-26512# Linguistic Systems, Inc., Cambridge, Mass.  
**OPERATING CONDITIONS AND TYPES OF WIND-POWER ELECTRIC SUBSTATIONS FOR RURAL AREAS**

V. R. Sektorov Washington NASA May 1974 17 p refs Transl. into ENGLISH from Elektrichestvo (Moscow), no. 10, Oct. 1949 4 p

(Contract NASW-2482)

(NASA-TT-F-15517) Avail: NTIS HC \$4.00 CSCL 10A

The efficiency of regimes of work of wind motor electric generating sets, working in a system jointly with other power stations, with constant and variable speed of rotation of the windmill, is compared. A method is given for evaluating the possible percentage of participation of wind driven installations in the power supply of rural regions, based on the future power balances of the regions and the technical conditions for the operation of wind driven installations. Author

N74-26514# California Univ., Livermore. Lawrence Livermore Lab.

**ANALYSIS OF THE WINDS OF SITE 300 AS A SOURCE OF POWER**

P. B. Archibald 23 Oct. 1973 17 p refs

(Contract W-7405-eng-48)

(UCRL-51489) Avail: NTIS HC \$4.00

Site 300 is a strategically located area lying east of the Lawrence Livermore Laboratory at Livermore, California. The prevalent wind is from the west; its driving force is the pressure gradient between the hot interior valley and the cool marine air of the Pacific Ocean. Wind measurements indicate that this is a good site for electrical power generation. Author (NSA)

N74-26515# Sandia Labs., Albuquerque, N.Mex.

**TRANSCRIPT OF TALK ON SOLAR ENERGY**  
 R. P. Stromberg Dec. 1973 18 p Presented to Environ. Comm. of the Western Systems Coordinating Council at a Meeting hosted by the Public Service Co. of New Mexico, Albuquerque, 24-25 Sep. 1973

(Contract AT(29-1)-789)

(SLA-73-1028) Avail: NTIS HC \$3.00

A transcript of a solar energy talk is reported that emphasizes the potential for a solar community. Author (NSA)

N74-26518# Michigan Univ., Ann Arbor Dept. of Materials and Metallurgical Engineering.

**PRELIMINARY REPORTS, MEMORANDA AND TECHNICAL NOTES OF THE MATERIALS RESEARCH COUNCIL SUMMER CONFERENCE, VOLUME 2: PROCEEDINGS OF THE DISCUSSION GROUP ON SOLAR ENERGY CONVERSION**

Edward E. Huckle Jul 1973 296 p refs Conf held at La Jolla, Calif., Jul. 1973

(Contract DAHC15-71-C-0253; ARPA Order 2341)

(AD-777737) Avail: NTIS CSCL 10/2

Discusses applications of solar energy, concentration and collection of solar energy, photovoltaic conversion, ocean thermal gradients, energy storage, and fuel cells. GRA

N74-26519# Carnegie Mellon Univ., Pittsburgh, Pa  
**SOLAR SEA POWER Semiannual Progress Report, 1 Nov. 1973 - 31 Jan. 1974**  
 Clarence Zener, Abraham Lavi, Robert Rothfus, Francis McMichael, and Ching Chang Wu 25 Jan. 1974 113 p refs (Grant NSF GI-39114) (PB-228068/3; NSF-RANN/SE/GI-3911/PR-74-2. NSF-RA/N-74-003) Avail: NTIS HC \$4.50 CSCL 10B

A conceptual design is developed which in no way depends upon ocean currents, and in which all physical processes are well understood. Contamination of the input water to the boiler by the output water is avoided by taking advantage of the naturally occurring density stratification, at least for plants which do not exceed 700,000 kilowatts. High density power generation without moisture and the consequent power expenditure in its removal, is obtained by falling film evaporation on vertical tubes. Appreciable pressure drop in the large banks of vertical tubes in the evaporator and condenser is avoided by proper manifolding. The optimization scheme is shown to be capable of handling 30 variables and 20 constraints within a compilation and running computer time less than a minute GRA

N74-26520# Carnegie Mellon Univ., Pittsburgh, Pa  
**SOLAR SEA POWER Quarterly Progress Report, 1 Jun. 30 Sep. 1973**  
 Clarence Zener, Abraham Lavi, and Ching Chang Wu 11 Oct. 1973 140 p refs (Grant NSF GI-39114) (PB-228069/1; NSF-RA/N-73-063. NSF-Rann/SE/GI-39114/PR-73-1, QPR-1) Avail: NTIS HC \$4.75 CSCL 10B

The first quarterly report analyzes the physical principles involved in the most critical components of a Solar Sea Power Plant. These critical components are considered to be the boiler, condenser, turbine, cold water pipe (approximately 2,000 ft long, approximately 60 ft diameter). The following conclusions have been obtained. Boiler. Because of the slow rise of bubbles in fluids, and because of the low power available for separating moisture from vapor, film evaporation is preferred to pool boiling. Condenser. The heat transfer in condensers may be greatly improved by an optimally designed, contoured surface. Turbine. The available temperature drop of 10C for the heat engine is sufficient to drive a single stage turbine with 50% reaction in stator and in rotor, and with maximum gas velocities of 740 ft/sec. Cold Water Pipe. Elastic instability, the mode of failure most difficult to guard against, may be controlled by two concentric 1/8 in. pipes spaced 2 in. apart, with an appropriate filler. GRA

N74-26521# Carnegie Mellon Univ., Pittsburgh, Pa  
**PROCEEDINGS, SOLAR SEA POWER POWER PLANT CONFERENCE AND WORKSHOP Final Report**  
 Abraham Lavi Jun 1973 288 p refs Conf held Pittsburgh, 27-28 Jun 1973 (Grant NSF GI-39115) (PB 228066/7; NSF-RA/N 73-064) Avail: NTIS HC \$6.75 CSCL 10B

On June 27 and 28, 1973 a national conference was convened for discussions on ocean thermal energy conversion. Its objectives were to afford an opportunity for information exchange, identification of key problems, and for discussions of how to implement the sea solar power plant technology. Summaries of the working groups' outputs are presented for the following topics: power plant siting, economic and political problems, environmental considerations; low temperature gradient heat transfer, turbines and fluids, plant anchoring; and cold water pipe design GRA

N74-26522# Delaware Univ., Newark, Inst. of Energy Conversion  
**EFFECT OF SHADING ON CdS/Cu(x)S SOLAR CELLS AND OPTIMAL SOLAR ARRAY DESIGN**

Mohamed Sayed and Larry Partain 13 Jun 1973 55 p refs (Grant NSF GI-34872) (PB-227900/8; NSF-RANN/SE/GI-34872-73-4) Avail: NTIS HC \$3.75 CSCL 10B

The effects of shading on solar arrays in general has been analyzed using the specific I-V characteristics of a CdS/Cu(x)S solar cell. The major differences in the amount of power lost with various array configurations subjected to identical shading conditions has been determined. The conditions under which localized heating or hot spots occur has been treated and the criteria for their avoidance has been precisely defined. The effects of protective diodes in reducing power loss and in preventing hot spots has been included. General design rules to assist in obtaining optimal solar structures have been formulated and presented Author (GRA)

N74-26523# Massachusetts Univ., Amherst  
**RESEARCH APPLIED TO OCEAN SITED POWER PLANTS Annual Progress Report, 1 Jan. - 31 Dec. 1973**  
 J. Hilbert Anderson 25 Jan. 1974 69 p refs (Grant NSF GI-34979) (PB-228067/5; NSF-RA/N-74-002) Avail: NTIS HC \$3.75 CSCL 10B

One total system configuration for a 400 mWe ocean thermal power plant has been conceptualized. Enough work has been accomplished to show that concept could be replicated in a broad swatch in the Gulf Stream along the U.S. southeast coast. Subsystems have been reduced to diagrams and major components have been sized. A complete math model of the total heat engine cycle has been created and parametric studies are now possible with reasonable computer time expenditures. One 1100 mWe submerged nuclear power plant has been arranged and balanced GRA

N74-26641# National Materials Advisory Board, Washington, D.C.  
**A SEMI-DELPHI EXERCISE ON SUBSTITUTE CATALYSTS FOR PLATINUM IN AUTOMOBILE EMISSION CONTROL DEVICES AND PETROLEUM REFINING Final Report**  
 Mar 1974 53 p (Contract GS-OO-DS-(P)-94008) (NMAB-314) Avail: NTIS HC \$5.75

A determination of the potential of base metal catalysts as substitutes for platinum and other related noble metal catalysts for automobile emission devices and petroleum refining is presented. Possible scenarios, after the introduction of the first generation of emission control devices containing platinum, are discussed along with suggested areas for research in base metal and platinum catalysts. Factors that could affect the requirements for automobile exhaust catalysts also were developed Author

N74-26774# Joint Publications Research Service, Arlington, Va.  
**THE PROSPECTS FOR MHD POWER PLANTS IN POWER ENGINEERING**  
 V. A. Kirilin, L. A. Melentyev, and A. Ye. Sheyndlin 31 May 1974 19 p Transl. into ENGLISH of "O Perspektivakh MGD Elektrostroitsiya v Energetike" Moscow, 1974 p 1-21 (JPRS-62139) Avail: NTIS HC \$4.00

A brief review is presented of the basic results of the first phase of development of the U-25 installation. Author

N74-26775# Joint Publications Research Service, Arlington, Va.  
**EXPERIENCE FROM THE FIRST STAGE OF DEVELOPMENT OF THE U-25 INSTALLATION**  
 A. Ye. Sheyndlin, A. V. Nedospasov, S. A. Pashkov, D. S. Pinkhasik, S. I. Pishchikov, V. S. Sidorov, G. P. Telegin, Ye. M. Shelkov, and V. Ya. Shumatskii 31 May 1974 21 p Transl. into ENGLISH of "Opyt Pervogo Etapa Osvoyeniya Ustanovki U-25" Moscow, 1973 (JPRS-62129) Avail: NTIS HC \$4.25

A description is given of the U-25 installation which is an experimental combined power plant with an open-cycle MHD generator.

Author

**N74-28873#** American Gas Association, Arlington, Va.  
**ACTION IN THE ATLANTIC: A VITAL STEP FOR OUR NATION'S ENERGY AND ENVIRONMENTAL NEEDS** [1974] 18 p

(G-70172-100M8.73-408) Avail: NTIS HC \$4.00

The offshore exploration of the Atlantic Continental Shelf is discussed in terms of the increasing energy demands. Gas and oil reserves, petroleum geology, and undersea drilling are briefly described.

F.O.S.

**N74-27088#** Environmental Protection Agency, Research Triangle Park, N.C. Air Pollution Technical Information Center. **AIR POLLUTION FROM MOTOR VEHICLES** Final Report [1973] 201 p refs Transl. into ENGLISH of Swed. Min. of Commun. Report, 1971 (APTC-41654) Avail: NTIS HC \$13.25

A summary of five years of developmental work on motor vehicle exhaust gases is presented. Based on the acquired experience, suggestions are presented for strengthening the Swedish regulations concerning vehicle exhaust gases, etc., and for the direction of the continued work in the field of motor vehicle exhaust gases.

Author

**N74-27089#** Environmental Protection Agency, Research Triangle Park, N.C. Air Pollution Technical Information Center. **AIR POLLUTION FROM MOTOR VEHICLES, APPENDICES** Appendix to Final Report [1973] 93 p refs Transl. into ENGLISH of Swed. Min. of Commun. Report, 1971 (APTC-41655-App) Avail: NTIS HC \$7.75

**N74-27162#** Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.

**COMPILATION OF AIR POLLUTANT EMISSION FACTORS, SUPPLEMENT 1, SECOND EDITION**

Jul. 1973 29 p

(PB-228708/4) Avail: NTIS HC \$4.50 CSCL 13B

Data are revised on atmospheric emission concerning the storage, transportation, and marketing of petroleum products.

Author

**N74-27247#** Naval Intelligence Support Center, Washington, D.C. Translation Div.

**INDUCTION MAGNETOHYDRODYNAMIC MHD GENERATOR WITH A CAVITY-TYPE NUCLEAR REACTOR**

V. A. Dmitrievskii and L. A. Zaklyazminskii Dec 1973 14 p refs Transl. into ENGLISH from Teplofiz. Vys Temp. (USSR), v. 9, no. 2, Mar./Apr. 1971 p 405-412

(AD-777444; NISC-Trans-3489) Avail: NTIS CSCL 10/2

A design for an induction magnetohydrodynamic generator (MHD) with a cavity-type nuclear reactor is discussed.

GRA

**N74-27280#** AiResearch Mfg Co., Phoenix, Ariz. **ADAPTABILITY OF THE CLOSED BRAYTON GAS TURBINE TO UTILITY POWER PLANTS** Engineering Report 28 Dec 1973 42 p

(Rept-73-310448) Avail: NTIS HC \$5.25 CSCL 21E

The utilization of fossil fuels in the closed Brayton cycle engine as applied to large scale utility power plants is described in terms of ecological advantages, operating efficiency, capabilities, and practicality. A plant layout and diagrams of the gas turbine equipment are shown. Heat source concepts, nuclear systems,

and heat sink concepts are discussed. Computer analysis programs for the closed Brayton cycle and contractor information are included.

AAD

**N74-27383#** Hermann Oberth-Gesellschaft, Gesellschaft zu Foerderung der Erforschung und Erschliessung des Weltraums e.V., Hannover (West Germany).

**INDUSTRIAL EVOLUTION AND REVOLUTION IN THE CISLUNAR SPACE 1980 - 2010** [INDUSTRIELLE EVOLUTION UND REVOLUTION IM GEOLUNAREN RAUM 1980-2010]

Krafft A. Ehricke (North American Rockwell, Downey, Calif.) 1973 52 p refs In GERMAN Presented at the 21st Aeronautics Meeting of the Hermann-Oberth Ges., Garmisch-Partenkirchen, West Ger., Sep. 1972

(Astronaut-FB-32; SD-72-SA-0173) Avail: NTIS HC \$5.75

The industrial evolution and revolution in geolunar space after 1900 is discussed. Topics include industrial ecology of the open world, growth by extraterrestrial industrialization, and space industry. Energy supply from space, notably electricity generation in space, energy supply by solar rays (the Soletta concept), electricity generation on earth, and worldwide distribution through relay stations in space, is dealt with.

ESRO

**N74-27438#** Committee on Public Works (U. S. Senate).

**NONDEGRADATION POLICY OF THE CLEAR AIR ACT**

Washington GPO 1973 421 p refs Hearing before Comm. on Public Works, 93d Congr. 1st Sess., 24 Jul. 1973

(GPO-20-928) Avail: Subcomm. on Air and Water Pollution

A Congressional hearing was conducted to discuss the possible effects of proposed legislation to relax the standards imposed by the clean air act. The provisions of various items of legislation to maintain prescribed cleanliness of water and air are analyzed. Statements from specific witnesses concerning their reaction to proposed changes in the legislation constitute the principal parts of the report. Statements are included concerning energy conversion techniques, effects of fuel consumption, and industrial pollution problems.

Author

**N74-27442#** Committee on Government Operations (U. S. House).

**ENERGY REORGANIZATION ACT OF 1973**

Washington GPO 1973 427 p Hearings on H.R. 1510 before Comm. on Govt. Operations, 93d Congr. 1st Sess., 27-29 Nov 1973

(GPO-25-108) Avail: Subcomm. on Legislation and Military Operations

Congressional hearings were conducted to reorganize and consolidate certain functions of the Federal Government in a new energy research and development administration and in a nuclear energy commission in order to promote more efficient management of such functions. The organization and functions of the organization are explained. Testimony is provided by selected witnesses to show the current level of effort in energy management and the expected benefits to be derived from the new organization.

Author

**N74-27443#** Committee on Government Operations (U. S. House).

**FEDERAL ENERGY ADMINISTRATION**

Washington GPO 1973 307 p Hearings on H.R. 11793 before Comm. on Govt. Operations, 93d Congr. 1st Sess., 10-11 Dec 1973

(GPO-26-725) Avail: Subcomm. on Legislation and Military Operations

Congressional legislation to reorganize and consolidate certain functions of the Federal Government in a new Federal Energy Administration is proposed. The organization and functions of the various offices are explained. Testimony from recognized experts in the energy field is reported to show the extent of the problem and their reactions to the government proposal.

Author

N74-27444// Committee on Interstate and Foreign Commerce (U. S. House).

**ENERGY EMERGENCY ACT**

Washington GPO 1973 541 p. Hearings on H.R. 11031, H.R. 11450, H.R. 11202, H.R. 11505, and H.R. 11509 before Comm. on Interstate and Foreign Com., 93d Congr., 1st Sess., 14, 15, 27, and 28 Nov. 1973

(GPO-26-038) Avail: Comm. on Interstate and Foreign Com.

Congressional hearings on an emergency energy act to give the President extraordinary powers to cope with the energy crisis are presented. The bill provides the President and State and local governments the power to develop contingency plans for reducing petroleum consumption, and assuring the continuation of vital public services in the event of emergency fuel shortages or severe dislocations in the nation's fuel distribution system, and for other purposes. Mandatory Federal actions to be taken to alleviate fuel shortages are described. Testimony of selected witnesses is reported to show the expected advantages of such action.

Author

N74-27446// RAND Corp., Santa Monica, Calif.

**THE PRICE ELASTICITY OF RESIDENTIAL ENERGY USE**

Kent P. Anderson Feb. 1974 21 p. refs  
(P-5180) Avail: NTIS HC \$4.25

The long-run price elasticity estimates obtained in several recent studies of residential gas and electricity demands are discussed. The nature of responses to price and, in particular, to the role of inter-fuel substitution compared with the role of alterations in usage rates or the size, efficiency, and features of new and renovated equipment are examined. The own- and cross-price elasticities obtained in these studies imply that large equal percentage increases in the prices of all types of energy sources would eventually lead either to marked increases in energy conservation or to a shift from utility gas and electricity to other sources of energy. Latter interpretation is intuitively implausible for price increases that would apply to all types of energy. But the alternative interpretation -- that there is a quantitatively significant link between energy price and the degree of energy conservation -- is not well supported by casual observation.

Author

N74-27447// RAND Corp., Santa Monica, Calif.

**ENERGY ALTERNATIVES FOR CALIFORNIA: THE CURRENT CRISIS. 4: REGULATORY ASPECTS OF ENERGY POLICY**

William R. Harris Jan 1974 19 p. refs  
(P-5158) Avail: NTIS HC \$4.00

A study on energy alternatives for the State of California was conducted. The study contains the following considerations: (1) sources and uses of energy for California, (2) conservation of energy, (3) planning for fuel shortages and other energy emergencies, and (4) Federal-State interactions on energy policy. Emphasis is placed on short range solutions to immediate problems resulting from Arab oil export policies and the resultant impact on the availability of required sources of power in California.

Author

N74-27448// Committee on Interior and Insular Affairs (U. S. Senate).

**NUCLEAR STIMULATION OF NATURAL GAS**

Washington GPO 1973 894 p. refs. Hearing before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 11 May 1973

(GPO-96-678) Avail: Subcomm. on Public Lands

A Congressional hearing was conducted on Project Rio Blanco, Colorado, to determine the uses versus the hazards of stimulating the production of natural gas from tight-rock formations by the use of nuclear devices. Fission product activity whereby the detonation of a 30-kiloton nuclear bomb triggers the transformation of chimney gas deposits into usable energy is explained. The effects to the environment of the resulting radioactivity is discussed along with the following matters: (1) the purposes of the test; (2) the costs of the test, both economic and environmental; (3) reasonable alternatives to nuclear stimulation; (4) whether Project Rio Blanco should proceed; (5) consumer acceptance; and (6) the future of the technology.

A.A.D.

N74-27450// Committee on Interior and Insular Affairs (U. S. Senate).

**COAL POLICY ISSUES. PART 2: APPENDIX 3: ADDITIONAL STATEMENTS RECEIVED FOR THE RECORD**

Washington GPO 1973 589 p. refs. Hearings before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 1973 (GPO-20-768) Avail: Comm. on Interior and Insular Affairs

The reliability and adequacy of bulk power supplies in the U.S. was discussed in a Congressional hearing to determine present and future energy needs towards the formulation of a national energy policy. The coal industry is discussed in terms of: (1) extraction, including mine safety; (2) transportation, including reestablishment and reequipping of the railroads; (3) combustion, including new technologies and reequipping of the railroads; (4) combustion, including new technologies for the more efficient use of coal; (5) conversion of coal to low-sulphur gaseous, liquids, or solids; and (6) ecological considerations, including mine drainage and refuse treatment, power plant particulate emission from coal combustion, and strip mine reclamation. Present coal-fired generating capacity is reported according to figures presented by utility companies from different sections of the country, and general trends in energy consumption and coal utilization are observed for nine regions of the National Electric Reliability Council.

A.A.D.

N74-27454// Committee on Government Operations (U. S. House).

**DRAFT OF PROPOSED LEGISLATION TO PROMOTE MORE EFFECTIVE MANAGEMENT OF CERTAIN RELATED FUNCTIONS OF THE EXECUTIVE BRANCH** Communication from the President of the United States

Washington GPO 1973 83 p. refs. Presented to Comm. on Govt. Operations, 93d Congr., 1st Sess., 29 Jun. 1973  
(H-Doc-93-119; GPO-83-011) Avail: US Capitol, House Document Room

Congressional action to draft a proposed legislation to promote more effective management of certain related functions of the Executive Branch was conducted. The proposal involves reorganizing and consolidating those functions in a new department of energy and natural resources. Also considered in a new energy research and development administration. The interrelated operations of the energy administration with other governmental functions are examined.

Author

N74-27455// Committee on Public Works (U. S. House).

**ENERGY EMERGENCY ACT** From Committee of Conference

Harley O. Steagars Washington GPO 7 Feb. 1974 103 p. refs. Report to accompany S. 2589 presented by Comm. on Public Works at the 93d Congr., 2d Sess., 7 Feb. 1974  
(H-Rept-93-793) Avail: US Capitol, House Document Room

Congressional action with respect to an Energy Emergency Act is presented. The establishment and functions of the Federal Energy Emergency Administration are defined. Energy conservation plans which can be implemented in a short time are proposed. Some of the provisions of the bill include the following: (1) coal conversion and allocation, (2) Federal actions to increase available domestic petroleum supplies, (3) prohibition on inequitable prices, (4) protection of franchised dealers, (5) antitrust procedures, and (6) administrative procedure and judicial review.

Author

N74-27456// Select Committee on Small Business (U. S. House).

**PHASE 4 OIL REGULATIONS AND PETROLEUM MARKETING PROBLEMS**

Washington GPO 1973 584 p. refs. Hearings before Select Comm. on Small Business, 93d Congr., 1st Sess., 18 Sep. and 23-24 Oct. 1973

(GPO-24-674) Avail: Subcomm. on Activities of Regulatory Agencies

A Congressional hearing was conducted to examine the petroleum products marketing problems of small businesses. The government regulations and procedures for controlling petroleum supplies are examined. The cost control actions are analyzed to determine their impact on the petroleum distributors. Statistical

analyses of the petroleum industry are included in the form of tables and graphs to show the supply and demand aspects of the problem.

Author

N74-27524# Interior Dept., Washington, D.C. Office of Coal Technology.

**CLEAN ENERGY FROM COAL TECHNOLOGY**

1973 43 p

Avail: SOD HC \$0.75

The potential use of coal as the primary fossil fuel to meet future energy requirements is discussed. The abundance of coal, and conversion of coal to other fuels are described with emphasis on gasification.

F.O.S.

N74-27525# Committee on Government Operations (U. S. House).

**CONSERVATION AND EFFICIENT USE OF ENERGY, PART 2**

Washington GPO 1973 350 p refs Hearings before Comm. on Govt. Operations and Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., 10 Jul 1973 Prepared in cooperation with Comm. on Sci. and Astronautics 4 Vol.

(GPO-24-290) Avail: Subcomm. on Conservation and Natural Resources

The problem of growing demands for energy spurred on by an expanded economy and coupled to shrinking supplies is considered. Stringent environmental standards prevent wider use of the most plentiful fossil fuel resources. The formulation of a national policy for energy conservation and efficient use of energy is investigated.

G.G.

N74-27526# Committee on Government Operations (U. S. House).

**CONSERVATION AND EFFICIENT USE OF ENERGY, PART 3**

Washington GPO 1973 698 p refs Hearings before Comm. on Govt. Operations and Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., 11 Jul. 1973 Prepared in cooperation with Comm. on Sci. and Astronaut. 4 Vol.

(GPO-24-682) Avail: Subcomm. on Conservation and Natural Resources

The overall aspects of the energy production-transmission-consumption system are considered and related environmental issues are stressed. An energy conservation policy is advocated that combines the efforts of government, industry, and private citizens.

G.G.

N74-27527# Committee on Government Operations (U. S. House).

**CONSERVATION AND EFFICIENT USE OF ENERGY, PART 4**

Washington GPO 1973 454 p refs Hearings before Comm. on Govt. Operations and Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., 12 Jul. 1973 Prepared in cooperation with Comm. on Sci. and Astronaut. 4 Vol.

(GPO-25-654) Avail: Subcomm. on Conservation and Natural Resources

Various energy conversion and supply processes are outlined and the need for a national energy policy is emphasized in the face of increased energy demands.

G.G.

N74-27528# Kentucky Univ. Lexington. Inst. for Mining and Minerals Research.

**A KENTUCKY COAL UTILIZATION RESEARCH PROGRAM, PROJECT 3: LOW BTU GAS AND SOLID DESULFURIZED FUEL**

Annual Report, 1 Jul. 1972 - 30 Jun. 1973

Nov. 1973 132 p refs

Avail: NTIS HC \$9.75

Processes to produce a solid desulfurized fuel at the lowest cost per Btu and per KWhr were evaluated. It became apparent that the price of energy from the so-called environmentally clean

fuels will continue to rise and that most processes will become economical before the technology has been fully demonstrated in a so-called commercial or demonstration plant. Evaluation of producer gas processes showed that the fixed bed atmosphere gas producer has the lowest fuel cost of presently available processes. A computer program has been developed to assist us in the analysis of a fixed bed gasifier and prediction of its performance. The available data on the sulfur content in Kentucky coals and their associated reserves have been assembled. A short evaluation of the various coal cleaning procedures was completed and a more extensive program on coal washing, coal blending and evaluation of a sulfur leaching process was initiated.

Author

N74-27530# Kentucky Univ. Lexington. Inst. for Mining and Minerals Research.

**A KENTUCKY COAL UTILIZATION RESEARCH PROGRAM, PROJECT 4: MEASUREMENT OF INHIBITION ISOTHERMS FOR KENTUCKY COAL** Annual Report, 1 Jul. 1972 - 30 Jun. 1973

Oct. 1973 41 p refs

Avail: NTIS HC \$5.25

Brushed and sieved coal was fluidized in 10 gram batches in a 22 mm ID quartz reactor up to a temperature of 870 C. The release of H2S during heatup under nitrogen and at the run temperature under the same gas (pyrolysis), hydrogen, or hydrogen-hydrogen sulfide mixtures was followed by gas chromatography. The residue or char was analyzed for pyritic, organic, sulfide, sulfate, and total sulfur. Inhibition isotherms, equilibria between sulfur in the char and gaseous hydrogen sulfide, were measured at 600 and 870 C. At the lower temperature the isotherm was found to be independent of the hydrogen sulfide concentration in the gas stream and the char sulfur content remained constant at 2.6%. In addition to the inhibition isotherms, sulfur-form transformation diagrams were constructed for coal treated with nitrogen, hydrogen, and hydrogen-hydrogen sulfide mixtures. Pyritic sulfur, which comprised 40% of the sulfur in the original coal, was completely converted to ferrous sulfide at 600 C in hydrogen and 740 C in nitrogen. At 870 C the sulfur content of the char produced under hydrogen was 1.1%.

Author

N74-27531# Kentucky Univ. Lexington. Inst. for Mining and Minerals Research.

**A KENTUCKY COAL UTILIZATION RESEARCH PROGRAM: SUMMARY OF FIRST YEAR PROGRESS AND ACCOMPLISHMENTS**

Oct. 1973 9 p

Avail: NTIS HC \$4.00

The cost controlling processing stages in the liquefaction of coal are considered. These stages include the hydrogen supply, the separation of ash solids from coal oil, and catalysis for the solvation-hydrogenation approach to coal liquefaction, and reactor design and char utilization for the pyrolysis approach. Innovation research in these areas has the potential to provide a substantial improvement in the economics of large scale coal liquefaction.

Author

N74-27532# Commission of the European Communities, Brussels (Belgium).

**PROBLEMS, RESOURCES AND NECESSARY PROGRESS IN COMMUNITY ENERGY POLICY 1976 - 1985** [1974] 54 p refs

Avail: NTIS HC \$5.75

Demand prospects and future supply situations for principle sources of primary energy are considered in this descriptive synthesis of the essential problems of energy policy which will be encountered between now and 1985. Available policy options are identified and their individual consequences are evaluated.

Author

N74-27533# Commission of the European Communities, Brussels (Belgium).

**PROSPECTS OF PRIMARY ENERGY DEMAND IN THE COMMUNITY (1975 - 1980 - 1986)**  
 [1974] 121 p refs  
 Avail NTIS HC \$9.25

Trends in the energy demand during the years 1980 to 1970 are analyzed and used to project future energy requirements up to 1985. The effects of various economic parameters on this trend analysis are considered in deriving long term consumption aspects G.G

**N74-27536#** Sydney Univ. (Australia). Dept of Mechanical Engineering

**ENERGY RESOURCES AND USAGE**

D W George Feb 1973 23 p refs Presented at Maximum Utilization of Ind Energy Conf. Sydney, 21 Feb. 1973 (ER-2; Conf-730223-1) Avail AEC Depository Libraries HC \$3.25

The overall picture shows that Australia faces no foreseeable energy problems. Such an assumption ignores many technological and environmental problems associated with the inefficient or thoughtless use of invaluable energy resources. Issues such as Lake Pedder, the Clutha controversy, and the forthcoming public inquiry into environmental aspects of the proposed Moomba-Sydney natural gas pipeline give an indication of the pattern of the future, and an informed public interest in such matters should be welcomed by all concerned. National planning and coordination are correlated with technological advances for the optimum decisions to be made involving energy NSA

**N74-27637#** Oak Ridge National Lab. Tenn.  
**NSF-RANN ENERGY ABSTRACTS. A MONTHLY ABSTRACT JOURNAL OF ENERGY RESEARCH, VOLUME 1, NO. 11, NOVEMBER 1973**  
 M P Guthrie Nov 1973 25 p refs Sponsored in part by NSF  
 (Contract W 7405 eng 26)  
 (ORNL FIS 73-52(Vol 1)(No 11)) Avail NTIS HC \$3.25

The bibliography contains 91 abstracts on energy sources, electric power (generation, supply and demand, transmission, environmental effects, and use), and energy (production, consumption, supply and demand, and policy). The research publications cited are technical journal articles, popular or semi-technical magazine articles, topical reports, progress reports, symposium papers and proceedings, monographs, and books published within the past two years NSA

**N74-27543#** Stanford Research Inst., Menlo Park, Calif.  
**POLLUTION-FREE ELECTROCHEMICAL POWER GENERATION FROM LOW GRADE COAL**  
 D F McMillen, R D Weaver, and M Anbar Aug 1973 50 p refs  
 (Grant NSF GI-34027)  
 (PB 228006/3 NSF RA/N 73 0108) Avail NTIS HC \$3.25 CSCL 07D

Results are described of a study, exploring the feasibility of a nonpolluting, combined chemical-electrochemical system for generating electrical power. The process entails the use of coal to reduce lead oxide to a 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. To date it has been demonstrated that reduction of lead oxide by solid petroleum coke in a molten sodium-lithium-potassium carbonate eutectic is a two-step process whose overall rate is generally limited by the rate of reaction of solid carbon with CO<sub>2</sub>. The rate of this latter reaction, in turn, is directly proportional to the external surface area of the coke. (Modified author abstract) GRA

**N74-27592#** Bureau of Mines, Laramie, Wyo. Energy Research Center  
**RETORTING INDEXES FOR OIL-SHALE PYROLYSES FROM ETHYLENE ETHANE RATIOS OF PRODUCT GASES**

I. A Jacobson, Jr., A W Decora, and G. L Cook 1974 25 p refs Sponsored in part by Wyo Univ (BM-RI-7921) Avail NTIS HC \$4.25 CSCL 10A

In a closely controlled laboratory retorting system for oil shale, a relationship was developed between the temperature in the retort and the weight ratio of ethylene to ethane in the gases produced. Reciprocal temperature was shown to be directly proportional to the log (ethylene/ethane). From this relationship, a number, called retorting index, was developed. The retorting index has the dimension of temperature, but its magnitude depends on both temperature and residence time for the reactants in the heated zone in the oil shale retort. The slopes of the lines relating reciprocal temperature and the logarithm of the ethylene-ethane ratios are nearly constant for each of the retorting processes for which data were presented. The retorting index should be a valuable tool to control the operation of oil shale retorts, either aboveground or in situ. If an optimum operating condition can be established, the maintenance of the optimum or the departure from it should be easily monitored by use of the index. Author

**N74-27610#** R and D Associates, Santa Monica, Calif.  
**ARPA WORKSHOP ON NEEDS OF THE DEPARTMENT OF DEFENSE FOR CATALYSIS, VOLUME 2**  
 Leona M Libby, Joe W Hightower (Rice Univ.), and Willard F. Libby (Calif Univ., Los Angeles) Nov. 1973 441 p refs Prog. Held at Santa Monica, Calif., 5-6 Nov. 1973  
 (Contract DAHC15-73-C-0312)  
 (AD 777734 RDA-TR 3501 002 Vol-2) Avail NTIS CSCL 07/1

Volume II contains the proceedings of the workshop on Needs of the Department of Defense for Catalysis consisting of talks given by 26 research scientists in industry and the universities, and discussions following the talks. Topics include fuel refinement, processing, and conversion, exhaust gas control, catalysis theory and kinetics, and fuel cells GRA

**N74-27611#** Scientific Research Instruments Corp., Baltimore, Md  
**GASIFICATION OF FOSSIL FUELS UNDER OXIDATIVE, REDUCTIVE, AND PYROLYTIC CONDITIONS** Final Report  
 A L Yerger, F W Lampe, M L Vestal, E J Gilbert, and G J Ferguson Dec 1973 184 p refs  
 (Contract EPA 6B 02-0206)  
 (PB-228668/0, SRIC-72EPA-650/2-73-042) Avail NTIS HC \$12.25 CSCL 07A

Kinetic reaction data are described, produced in a nonisothermal kinetics laboratory while gasifying selected types of coal under oxidative, reductive, and pyrolytic conditions. Types of coal cover the range, including lignite and anthracite. Evolution of thermal decomposition products under study conditions were investigated at different fuel heating rates and gasification pressures. Gaseous product evolution rates, as the function of temperature, were graphed for different coals, exposed to indicated gasification regimes. The evolution of such gaseous species as H<sub>2</sub>O, CO, CO<sub>2</sub>, O<sub>2</sub>, SO<sub>2</sub>, NO, H<sub>2</sub>, CH<sub>4</sub>, H<sub>2</sub>S, and C<sub>2</sub>H<sub>2</sub> was followed up in conjunction with 13 different coal gasification reactions GRA

**N74-27719#** National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.  
**LOW-COST, AIR MASS 2 SOLAR SIMULATOR**  
 Kenneth Yass and Henry B Curtis Washington Jun 1974 26 p refs  
 (NASA-TM-X-3059; E-7885) Avail NTIS HC \$3.25 CSCL 14B

A low cost air mass 2 solar simulator for testing flat-plate solar collectors was developed and operated at Lewis. Total cost was less than \$10,800/sq m (\$1000/sq ft). It consists of an array of 143 tungsten-halogen 300-watt lamps, each having integral dichroic coated reflectors. A second array of 143 respective hexagonal-shaped plastic Fresnel lenses are located approximately 1 focal length from the lamps. The simulator will

produce a uniform collimated beam covering an area of 1.2 by 1.2m(4 by 4 ft). Design features, construction details, and component costs are given, as well as measured results on a 12-lamp prototype

Author

**N74-27820# Massachusetts Inst. of Tech., Cambridge  
SECOND ANNUAL SEA GRANT LECTURE AND SYMPOSIUM**

18 Oct 1973 46 p refs Symp. held at Cambridge, Mass. (MITSG-74-7) Avail. NTIS HC \$5.50

The use of the ocean as a world energy source is discussed. Special attention was given to offshore oil. Heat disposal in ocean waters was also discussed

**N74-27827 Westinghouse Electric Corp., Pittsburgh, Pa  
WORLD ENERGY AND THE OCEANS**  
William E Shoupp /in MIT Second Ann. Sea Grant Lecture and Symp. 18 Oct 1973 10 p

Energy sources and means by which they are converted to usable energy forms are outlined. Special attention was given to means and programs by which these sources are utilized. Data cover: (1) location, evaluation, and utilization of known reserves, (2) removal of nonessential constraints that limit construction and operation of atomic power plants, (3) increased technical capability in substituting electric power for more than current uses, and (4) location of large electric power generating stations near the ocean where coolants for the system are provided by the ocean. The alternate energy sources of coal gasification and ethanol are discussed.

E.H.W.

**N74-27828 Massachusetts Inst. of Tech., Cambridge  
KEY ISSUES IN OFFSHORE OIL**  
John W Devaney, III /in its Second Ann. Sea Grant Lecture and Symp. 18 Oct 1973 14 p

The Georges Bank analyses of offshore oil, oil quality, and environmental damage caused by oil spillage are presented. Data cover biological effect of oil, particularly toxicity, spill statistics, hydrocarbon plumes emanating from oil water separator discharges and refinery wastewater outfalls, and fish and larval kill possible from a spill. Economic factors associated with offshore and nearshore oil are discussed.

E.H.W.

**N74-27918# Pennsylvania State Univ., University Park Dept of Mineral Engineering**

**EVALUATION OF MINE ELECTRICAL SYSTEMS WITH RESPECT TO SAFETY, TECHNOLOGY, ECONOMICS, AND LEGAL CONSIDERATIONS. VOLUME 1: TEXT, TABLES AND ANALYSES Final Report**

Robert Stefanko, Lloyd A Morley, and Atmesh K. Sinha 18 Jul 1973 60 p refs  
(Grant DI-BM GO-1011729)  
(PB 225476/1. BM-OFR-70(1)-73) Avail. NTIS HC \$5.25 HC also available from NTIS \$11.00/set of 2 reports as PB-225475-SET CSCL 081

The aim of the research was to develop instruments and techniques and then make measurements of suitable power parameters, ground fault currents and ground resistance beds. With such information available, it was possible to develop a meaningful simulator which would permit investigating electrical systems and components on paper without costly trial and error procedures. In the third year, a cable splice testing program was added to the project. While there were the usual delays attendant in such original research, these objectives were achieved. Evaluation of several mine electrical systems and components are presented.

GRA

**N74-28008\* Scientific Translation Service, Santa Barbara, Calif  
STUDY OF THE POSSIBILITY OF USING SOLAR RADIANT ENERGY FOR WELDING AND BRAZING METALS**

V S Dvernyakov / N Frantsevich, V V Pasichnyy, N A Shiganov Yu I Korunov, and I Ye Kasich-Pilipenko /in its Space Studies in the Ukraine, No. 1 (NASA-TT-F-15535) Jun. 1974 p 9-18 refs Transl. into ENGLISH from the book "Kosmicheskkiye Issledovaniya Ukraine. Vypusk 1. Kosmicheskoye Materialovedenie i Tekhnologiya" Kiev. Naukova Dumka, 1973 p 9-14

CSCL 13H

**N74-28020# Bureau of Mines, Grand Forks, N Dak Energy Research Lab  
TECHNOLOGY AND USE OF LIGNITE**

Wayne R. Kube, comp and James L. Elder, comp 1972 145 p refs Presented at Bur. of Mines-Univ of North Dakota Symp. Bismarck, N. Dak. 12-13 May 1971 (BM-IC-8543) Avail. SOD HC \$1.50 as C 12B 27 8543

Utilization and technology of Western coal and lignites for power production is considered

**N74-28021 Bureau of Mines, Jackson, Miss  
A PROGRESS REPORT ON COAL MINE HEALTH AND SAFETY**

Henry P Wheeler, Jr /in its Technol. and Use of Lignite 1972 p 12-14

Progress in implementation of the Federal Coal Mine Health and Safety Act of 1969 is presented. Three major approaches are being followed: inspection and enforcement, research and development, and education and training. In the first year in excess of 3,000 coal mine inspections were conducted and over 52,000 notices of violation of standards and 2,800 withdrawal orders were issued. To fully implement the 40,000 inspections that will be required each year, sufficient personnel have been hired but their training will not be completed for a few months. Although physical conditions in underground mines have been improved, the fatality rate has not. Lack of improvement may be caused by new inexperienced workers, opening of new mines, less adequate supervision, and loss of experienced foremen who are training as mine inspectors

Author

**N74-28022 Peabody Coal Co., St. Louis, Mo  
PIPELINE TRANSPORT OF LIQUID COAL**

Jack J Ellis and Pete Bacchetti /in Bur. of Mines Technol. and Use of Lignite 1972 p 15-31

The 273-mile coal pipeline from Black Mesa, Ariz., to the Mohave generating station at Davis Dam, Nev., is described. Five million tons of coal are to be transported each year. Strip mined coal is reduced in size to minus one eighth in and made into a 50-percent water slurry. Water is obtained from five wells, each over 3,500 ft deep. Four pumping stations are required to move the slurry through the 18 in pipeline. At the generating station, the slurry is dewatered, using centrifuges, to 25-percent moisture and fed to the pulverizers. Effluent from the centrifuges is clarified, the clear water is used in plant operations and the concentrated slurry returned to the centrifuge. No water is discharged as the excess is solar evaporated from holding ponds

Author

**N74-28023 Bureau of Mines, Pittsburgh, Pa Energy Research Center  
LIQUEFACTION OF LIGNITE WITH CARBON MONOXIDE AND WATER**

Herbert R Appell, Irving Wender, and Ronald D Miller /in its Technol. and Use of Lignite 1972 p 32-39 refs

Lignite was treated with carbon monoxide and steam with the objective of preparing a low sulfur heavy fuel oil. At temperatures of 380 to 400 C and pressures of 3,000 to 5,000 psig, conversions of about 90 percent of lignite and oil yields near 75 percent have been obtained. These conversions were obtained using freshly pulverized lignite, a solvent, and pressures above 4,000 psig. Under these conditions, the

liquefaction of lignite required only 15 minutes at 380 to 400 C, exclusive of heating and cooling periods. Alkaline compounds which are present in lignite are good catalysts for the liquefaction reaction. In order to obtain high yields at pressures near 3,000 psig, it was necessary to increase the reaction time to about 2 hr and use larger quantities of a solvent fortified with a heterocyclic nitrogen base. At these conditions, mixtures of hydrogen and carbon monoxide worked almost as well as carbon monoxide

Author

**N74-28024 Minnesota Power and Light Co., Duluth  
USE OF WESTERN COAL AND AIR WATER QUALITY  
CONTROL BY MINNESOTA POWER AND LIGHT COMPANY**

E F McGuire and W F Arndt (Abe W Mathews Eng. Co., Hibbing, Minn.) *In Bur of Mines Technol. and Use of Lignite* 1972 p 40-48

Conversion of thermal generating stations to use of sub-bituminous coal is discussed. The major conversion requirement is for installation of increased pulverizer capacity. In some cases modification of the superheater section, addition of burners, and use of oil for peak load are required. Unloading and handling facilities are described. In order to meet the requirements set by pollution control, it is planned to install wet scrubbers. A spray chamber, low gas velocity scrubber was selected after a preliminary testing program. Indications are such a unit will have a high collection efficiency for particulates and allow control of effluents to meet water quality standards. Required modification to existing thermal units are given

Author

**N74-28026 Environmental Protection Agency, Research Triangle Park, N.C. Development Engineering Branch  
NITROGEN OXIDES, SULFUR OXIDES, AND PARTICULATE  
CONTROL TECHNOLOGY FOR FOSSIL FUEL COMBUSTION**

R E Harrington *In Bur of Mines Technol. and Use of Lignite* 1972 p 56-89 refs

Five methods for reduction of SO<sub>2</sub> in air are classified as first generation processes and are discussed in some detail. These are: (1) Use of low-sulfur fuel, (2) dry limestone injection, (3) lime/limestone scrubbing, (4) magnesium scrubbing, and (5) catalytic oxidation. Limitations of first generation processes require development of improved second generation processes. Reduction in NO<sub>x</sub> sub x emissions is at present limited to methods that lower flame temperatures. Particulate control in the utility industry has generally been by electrostatic precipitation, with only moderate success. To achieve sufficiently high removal efficiency, the size and subsequent cost of the precipitator increases rapidly. Fabric filters may prove to be satisfactory substitutes. The application of wet scrubbers for control of both particulate and SO<sub>2</sub> needs additional development.

Author

**N74-28027 Montana Power Co., Butte  
LOW GAS TEMPERATURE SOLUTION TO HIGH RESISTIVITY ASH PROBLEMS**

D T Berube *In Bur of Mines Technol. and Use of Lignite* 1972 p 70-82 ref

Efforts to improve the performance of an installed electrostatic precipitator by lowering the temperature of flue gas are presented. Fly ash from the low sulfur subbituminous coal has a high electrical resistivity and the precipitator efficiency was about 85 percent compared to the design efficiency of 97 percent. Laboratory and in situ measurements of ash resistivity indicated a reduction in resistivity at lower gas temperature. Gas temperature was lowered by air dumping and increasing the area of the economizer. In addition a mixing baffle was installed at the air heater outlet and two transformer rectifier sets were installed on the precipitator

Author

**N74-28028 Joy Mfg Co., Los Angeles, Calif. Western  
Precipitation Div  
COLLECTING FLY ASH FROM WESTERN LOW SULFUR  
COALS**

James L Ma *In Bur of Mines Technol. and Use of Lignite* 1972 p 83-97 refs

Two types of wet scrubbers were tested on a flue gas stream from a utility boiler. One was a flooded variable throat venturi unit and the other a direct impingement type. Both were effective in removing fly ash with the variable throat unit slightly more efficient. Either can be considered as a practical alternate to the electrostatic precipitator. Efficiency increases with pressure drop through the unit. Both liquid recirculation and bleed-off rates effect efficiency to a lesser extent. A flowsheet of a proposed unit for a full size power plant is presented.

Author

**N74-28029 Joy Mfg Co., Los Angeles, Calif.  
PILOT STUDY OF ELECTROSTATIC PRECIPITATION FOR  
REMOVING FLY ASH AT BASIN ELECTRIC'S LELAND OLDS  
STATION**

Kent E Janssen (Basin Elec. Power Coop., Stanton, N. Dak.) and Floyd W Redman *In Bur of Mines Technol. and Use of Lignite* 1972 p 98-104 ref

A pilot scale electrostatic precipitator was used to remove fly ash from a side stream of flue gas originating from an operating power plant. The electrical generating station burns low sulfur pulverized lignite. Under test conditions, 99-percent removal of fly ash was achieved, indicating suitability of this method for practical and effective removal of high resistivity lignite fly ash from boiler exit gases. The power input has a significant effect on precipitator performance with a marked decrease in efficiency below 80 percent of maximum power. Within the range tested, face velocity of gases was not a factor. Rappers were operated at high impact intensity and relatively high frequency to obtain adequate cleaning.

Author

**N74-28030 American Petroleum Inst., New York.  
FUTURE ENERGY SUPPLY. APPROACHES AND OP-  
TIONS**

Wilson M. Laird *In Bur of Mines Technol. and Use of Lignite* 1972 p 105-111

Domestic gas and oil deliverability should reach a peak about 1974. Use of coal will be severely restricted by air quality standards. At present the only method to fill the energy gap is by increased imports of foreign oil. If no action is taken, the nation will be dependent for a major share of its energy supply upon sources over which there can be little control. If such dependence is the result of a conscious, studied policy decision with full understanding of the consequences, the situation may be acceptable. A national energy policy should be formulated with a clear understanding of all facets including environmental considerations. An organization for formulating and articulating the policy is necessary. A strong team effort of government and industry is important to integrate and activate a national energy policy.

Author

**N74-28031 Minnkota Power Cooperative, Inc., Grand Forks,  
N. Dak  
LIGNITE AND THE CYCLONE BURNER IN A NEW 235-mw  
GENERATING STATION**

Lloyd Hillier and B W Rudiger (Sanderson and Porter, New York) *In Bur of Mines Technol. and Use of Lignite* 1972 p 112-126

Major operational systems are described with the most significant departure from the conventional lignite-fired boiler being the use of cyclone burners. The cyclone burners have performed well and only minimal startup difficulties were encountered. No fireside tube fouling has been experienced. Peak power production has reached 274 mw and was limited by the capacity of the boiler feedwater pump. Use of 1/4- by 0-in crushed lignite rather than pulverized lignite has eliminated pulverization problems. Some drying of lignite during crushing was necessary to maintain temperature levels in the cyclone sufficiently high to melt the lignite ash. Lignite was mined at an adjacent strip pit, trucked to the station and crushed. A mechanized lignite handling system conveyed the lignite to plant silos or storage. Cooling water was available from a nearby lake.

Author

N74-28032 Minnkota Power Cooperative, Inc., Grand Forks, N. Dak.

**DETAILED CONSTRUCTION AND EQUIPMENT COSTS FOR THE 236-mw MILTON R. YOUNG GENERATING STATION**

Kenneth S. Vig *In Bur of Mines Technol and Use of Lignite* 1972 p 127-145

A total of \$38,710,211 was required for equipment and construction of the 236 mw lignite fired, cyclone burner unit. This total included all items such as land, structures, roads, a dam to impound cooling water, mechanical and electrical equipment, lignite handling facilities, transformer and switchboard, engineering, overhead, interest, and inventory as well as the generating unit. Arranged in categories, costs are given in sufficient detail, including the year incurred, so that more accurate estimates can be made in planning new units. Author

N74-28035# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

**DESIGN AND EVALUATION OF EXPERIMENTAL CERAMIC AUTOMOBILE THERMAL REACTORS**

Philip L. Stone and Charles P. Blankenship Washington Jul 1974 28 p refs (NASA-TN-D-7706, E-7175) Avail: NTIS HC \$3.25 CSCL 11B

The results obtained in an exploratory evaluation of ceramics for automobile thermal reactors are summarized. Candidate ceramic materials were evaluated in several reactor designs by using both engine-dynamometer and vehicle road tests. Silicon carbide contained in a corrugated-metal support structure exhibited the best performance, lasting 1100 hr in engine-dynamometer tests and more than 38,600 km (24000 miles) in vehicle road tests. Although reactors containing glass ceramic components did not perform as well as those containing silicon carbide, the glass-ceramics still offer good potential for reactor use with improved reactor designs. Author

N74-28106# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md

**A POWER CONDITIONING SYSTEM FOR RADIOTOISOTOPE THERMOELECTRIC GENERATOR ENERGY SOURCES**

Joseph A. Gillis Jun 1974 27 p ref (NASA-TM-X-70678, X-711-74-164) Avail: NTIS HC \$4.50 CSCL 18E

The use of radioisotope thermoelectric generators (RTG) as the primary source of energy in unmanned spacecraft is discussed. RTG output control, power conditioning system requirements, the electrical design, and circuit performance are also discussed. F.O.S

N74-28108# Los Alamos Scientific Lab., N Mex  
**NUCLEAR HEAT AND HYDROGEN IN FUTURE ENERGY UTILIZATION**

L. A. Booth and J. D. Balcomb Nov 1973 28 p  
(Contract W-7405-eng-36)

(LA-5456-MS) Avail: NTIS HC \$4.00

Future demand for the world's supply of carbon-based fuels will eventually deplete this supply to the point at which their use becomes economically infeasible. Hydrogen, which is virtually inexhaustible in the form of water, could be substituted for natural gas and petroleum-based fuels for industrial and residential heating and for transportation. Nuclear energy, either fusion or fission, would be the primary energy source. Thermal energy from the nuclear heat source would be converted to electric energy in a conventional heat engine cycle. Hydrogen could be produced from water by a cyclic thermochemical process. Gaseous hydrogen for industrial and residential heat would be transported in a high-pressure pipeline system. Liquid hydrogen or hydrogen stored in metal hydrides could be used for transportation fuels. Author (NSA)

N74-28138# Oak Ridge National Lab., Tenn Cryoelectrics Section

**CRYOGENIC POWER TRANSMISSION TECHNOLOGY: CRYOGENIC DIELECTRICS** Quarterly Report, 1 Jul. - 30 Sep.

1973

Jan 1974 16 p refs

(Contract W-7405-eng-26)

(ORNL-TM-4433) Avail: NTIS HC \$3.00

The investigation of the dielectric properties of fluids and solids for use in superconducting systems is reported. The objectives of the project are identified to be the determination of scaling laws applicable to various models of superconducting cables and other cryogenic apparatus. Studies include the investigation of: (1) ac and dc breakdown and prebreakdown phenomena in liquid helium, and in a variety of solids in liquid helium; (2) the influence of electrode surfaces and impurities; (3) the influence of pressure and temperature on the dielectric properties of liquid helium; (4) the behavior at large gaps; (5) breakdown and surface flashover of bulk and laminated solids. Impulse measurements are also planned. Author (NSA)

N74-28168# Joint Publications Research Service, Arlington, Va

**ON THE APPROACHES TO MHD-POWER GENERATION**

7 Jun. 1974 24 p refs Transl. into ENGLISH from Nauka Zhizn (Moscow), no. 4, Apr. 1974 p 14-23

(JPRS-62196) Avail: NTIS HC \$4.25

A round table discussion on magnetohydrodynamic generation of electric power is reported. Author

N74-28205# Brookhaven National Lab., Upton, N.Y. Dept. of Applied Science

**SURVEY OF LARGE-SCALE APPLICATIONS OF SUPERCONDUCTIVITY** Informal Report

J. R. Powell 1973 167 p refs Presented at Conf. on Advan. Study Inst on Large Scale Appl. of Superconductivity and Magnetism, Entrev. Italy, 5 - 14 Sep. 1973 Sponsored by AEC

(BNL-18376, Conf-730970) Avail: NTIS HC \$10.50

A survey is made of potential future large-scale uses of superconductivity, including fusion, MHD, magnetic energy storage, power transmission, high-speed ground transport, and magnetic separation. The superconducting technological requirements for each application are examined with regard to present and projected capabilities. The requirements of the nonsuperconducting system components in each application are also examined, together with an investigation of how advances in superconducting technology can ease demands on the nonsuperconducting components. Economic and social factors relating to each application are also discussed. An assessment of the likelihood of success for each application is made. (89 references)

Author (NSA)

N74-28230# American Airlines, Inc., New York

**ECONOMIC EFFECTS OF PROPULSION SYSTEM TECHNOLOGY ON EXISTING AND FUTURE TRANSPORT AIRCRAFT**

G. Philip Sallee Jul 1974 345 p

(Contract NAS3-17326)

(NASA-CR-134645) Avail: NTIS HC \$7.50 CSCL 21A

The results of an airline study of the economic effects of propulsion system technology on current and future transport aircraft are presented. This report represents the results of a detailed study of propulsion system operating economics. The study has four major parts. (1) a detailed analysis of current propulsion system maintenance with respect to the material and labor costs encountered versus years in service and the design characteristics of the major elements of the propulsion system of the B707, B727, and B747 (2) an analysis of the economic impact of a future representative 1979 propulsion system is presented with emphasis on depreciation of investment, fuel costs and maintenance costs developed on the basis of the analysis of the historical trends observed (3) recommendations concerning improved methods of forecasting the maintenance cost of future propulsion systems are presented. A detailed method based on the summation of the projected labor and material repair costs for each major engine module and its installation along with a shorter form suitable for quick, less detailed analysis are presented.

and (4) recommendations concerning areas where additional technology is needed to improve the economics of future commercial propulsion systems are presented along with the suggested economic benefits available from such advanced technology efforts

Author

**N74-28388\*** Kanner (Leo) Associates, Redwood City, Calif  
**REDUCTION OF DIESEL ENGINE EXHAUST NOISE IN THE PETROLEUM MINING INDUSTRY**

Tatiana Marinov *In its* The 4th Nati Conf on Acoustics, Vol 1A (NASA-TT F-15375) Jun 1974 p 156-162 refs Transl into ENGLISH from A 4-A Conferinta Nationala de Acustica Vol 1A Combatarea Zgomotului Si Vibratiilor. Bucharest, 29-31 May 1973 p 205-211

CSCL 21A

**N74-28439#** Kentucky Univ, Lexington Dept of Economics  
**THE WESTERN KENTUCKY COAL INDUSTRY: AN ECONOMIC ANALYSIS**

Curtis E Harvey May 1973 99 p refs Revised (UKY TR76-73-IMMR1) Avail NTIS HC \$8 00

An economic analysis and investigation into the structure of the Western Kentucky coal industry are provided. Employment and the relative size of the coal industry are discussed along with estimated remaining coal reserves in the state. Demand and supply factors and the regional structure of the markets for coal mined in the eastern interior basin are considered. Mining operations, costs of production, transportation, and the price of coal are reported and the prospects for economic change in the Kentucky coal industry considered

AAD

**N74-28440#** Committee on Foreign Affairs (U. S House)  
**THE ENERGY CRISIS: IMPACT OF CANADIAN POLICIES**

Washington GPO 1974 132 p Hearings before Comm on Foreign Affairs. 93d Congr. 1st Sess. 14-15 Nov 1973 (GPO 27-709) Avail Subcomm on Inter-American Affairs

The hearings are reported concerning the impact on the US of the Canadian actions to restrict the export of oil. The immediate effects on the border States are discussed with emphasis on the impending shortage of heating fuels. The Canadian-American energy relationship is also discussed. FOS

**N74-28441#** Committee on Agriculture (U S House)  
**AGRICULTURE AND THE FUEL CRISIS**

Washington GPO 1974 140 p refs Hearings before Comm. on Agr. 93d Congr. 1st Sess. 14 Nov and 4 and 14 Dec 1973 (GPO 27-899) Avail Comm on Agr

A Congressional hearing concerning the impact of the fuel shortage on farming operations was conducted. The manner in which fuel is allocated according to Federal legislation was analyzed. The need for changes in the legislation was discussed and many examples of the inequities created by the current restrictions were explained. Testimony of specified witnesses from the agricultural community and the oil industry is submitted. The economic aspects of the fuel shortage on various phases of domestic and foreign relations are examined

PNF

**N74-28445#** Committee on Public Works (U S Senate)  
**COMPLIANCE WITH TITLE 2 (AUTO EMISSION STANDARDS) OF THE CLEAN AIR ACT**

Washington GPO 1973 960 p refs Hearings before Comm on Public Works 93d Congr 1st Sess. 5 6 Nov 1973 (GPO 25 424) Avail Comm on Public Works

The acceptability of emission control technologies slated by the auto and fuel industries to meet the 1975 deadlines of the Clean Air Act was the subject of a Congressional hearing. Questions regarding the ramifications of national application of catalytic converters are discussed and the costs, both public and private, of antipollution technologies are outlined. Fuel economy factors as they relate to emission control efforts, are

reported. Results of tests on pollution control configurations and fuels are presented along with their performance comparisons. Air quality indexes are presented and recommendations are made throughout on how best to accomplish compliance with the Clean Air Act at minimum cost and maximum efficiency

AAD

**N74-28449#** Committee on Banking, Housing and Urban Affairs (U S Senate)

**RETAIL PRICING OF PETROLEUM PRODUCTS**

Washington GPO 1973 99 p Hearings on S 2415, S. 2400, and S 2453 before Comm on Banking, Housing and Urban Affairs. 93d Congr. 1st Sess. 9 Oct. 1973 (GPO-23-614) Avail Comm on Banking, Housing and Urban Affairs

A Congressional hearing was conducted to consider the retail pricing of petroleum products. The specific purposes of the hearing were (1) to amend the Economic Stabilization Act of 1970 to permit the passthrough of certain cost increases, (2) to amend the Economic Stabilization Act of 1970 to adjust ceiling prices applicable to certain petroleum products and to permit retailers to pass through the increased costs, and (3) to amend the Economic Stabilization Act with regard to the authority conferred by Section 203 with respect to petroleum products. The findings of the committee are based on the testimony of selected witnesses with experience in the petroleum market.

PNF

**N74-28460#** Committee on Armed Services (U. S Senate)  
**NAVAL PETROLEUM RESERVE NUMBERED 1, ELK HILLS, CALIFORNIA**

Washington GPO 1973 114 p refs Hearing on S.J. Res. 176 before Comm on Armed Services. 93d Congr., 1st Sess. 10 11 Dec 1973 (GPO-25 650) Avail Subcomm on Natl Stockpile and Naval Petrol Reserve

A Congressional hearing was conducted to consider a resolution which would authorize production of petroleum from the Elk Hills Naval Petroleum Reserve for national defense purposes and to provide for further exploration of the reserve. The nature of the petroleum shortage in the US is examined. The capacity of the petroleum reserve to alleviate the situation is evaluated. Restrictions on the exploitation of the reserves are defined. The findings of the committee are based mainly on the testimony of selected witnesses who are knowledgeable of the crude oil situation

PNF

**N74-28462#** Joint Economic Committee (U. S. Congress).

**ECONOMIC IMPACT OF PETROLEUM SHORTAGES**

Washington GPO 1974 197 p refs Hearings before Joint Econ Comm. 93d Congr. 1st Sess. 11-13 Dec 1973 (GPO 27-213) Avail SOD HC \$1 50

Both the short run and long run implications of the energy crisis are discussed in a Congressional hearing conducted to gather information towards the formulation of an effective energy policy. The Arab oil embargo is analyzed for its effect on real growth forecasts and rising inflation. A summary of the oil shortages in the US petrochemical industry includes tabulation of production decline in the manufacture of organic chemicals, plastic resins, synthetic fibers and rubber, and related industries. Administration projection of near term petroleum shortfall are reported and proposed remedies include reduction in jet aircraft flights, reduction in residential heating, reduction in business, government, and industry power use, expansion of rail and bus transit systems, conversion of power plants to coal, and a gasoline tax. The impact of the fuel shortage on Canada is presented for comparison

AAD

**N74-28463#** Committee on Finance (U S Senate)

**PROFITABILITY OF DOMESTIC ENERGY COMPANY OPERATIONS**

Washington GPO 1974 222 p refs Hearings before Comm on Finance. 93d Congr. 2d Sess. 13 14 Feb 1974 (GPO-28 572) Avail Comm on Finance

A Congressional hearing was conducted to present testimony relating to the problem for excess or windfall profits in the oil industry. Tax legislation proposals are emphasized. Information is presented by private firms and by petroleum trade associations, and the topics include the following: (1) percent of U.S. production by medium and small companies; (2) petroleum exploration and development expenditures; (3) profitability ratios; (4) sources of U.S. sales of petroleum products and foreign investments; (5) imports of crude oil and refine products; (6) gasoline and residual fuel consumption; (7) return on petroleum shareholders equity; and (8) earning growth and return calculations. Recommendations are made for the formulation of tax and price policies as well as effective government/industry roles in the management of the energy market.

A A D

**N74-28463#** Bureau of Mines, Washington, D.C. Div. of Fossil Fuels.

**SALES OF FUEL OIL AND KEROSINE IN 1972**

10 Oct 1973 14 p

Avail: NTIS HC \$4.00

Domestic sales of distillate fuel oils, residual fuel oils, and kerosine in thousands of barrels are presented and compared to sales volume in 1971. Data are arranged by fuel type, intended uses, and state and year in which the transactions were made.

A A D

**N74-28464#** Bureau of Mines, Washington, D.C. Div. of Fossil Fuels

**WORLD NATURAL GAS: 1972**

29 Apr 1974 10 p

Avail: NTIS HC \$4.00

Both gross and marketed production volumes in million cubic feet are presented for all countries engaged in the natural gas industry. World trade volumes in billion cubic feet are also shown by year and importing country. A brief account of natural gas trends in domestic production and international trade is included.

A A D

**N74-28465#** Atomic Energy Commission, Washington, D.C. **NATION'S ENERGY FUTURE Report to the President of the United States**

Dixy Lee Ray 1 Dec 1973 182 p

(WASH-1281) Avail: NTIS MF \$1.45, SOD HC \$1.95

This report, developed under the general guidance of the Energy Policy Office, is in response to the directive of the President on June 29, 1973, to the Chairman of the Atomic Energy Commission to review Federal and private energy R and D and to recommend an integrated program for the Nation. The report recommends: (1) a national energy R and D program, (2) a five-year, \$10 billion Federal energy R and D program, and (3) the FY 1975 Federal budget for energy R and D. The recommended program, based on what is now known, is both necessary and sufficient to maximize energy R and D's contribution to the Nation's energy goals; even so, 1985 is the earliest date by which self-sufficiency can reasonably be expected. By 1980, the recommended program can reduce oil imports to half those currently projected; other extraordinary measures will be required to displace the other half.

NSA

**N74-28534** Massachusetts Univ., Amherst

**A PLANNING METHODOLOGY FOR THE ANALYSIS AND DESIGN OF WIND-POWER SYSTEMS Ph.D. Thesis**

Ismael Gerardo Dambolena 1974 156 p

Avail: Univ. Microfilms Order No. 74-15005

A computer model is developed which evaluates the economics of offshore wind-power systems and simulates the behavior of alternate designs. Wind-powered generators either satisfy consumer demand directly or produce hydrogen by the electrolysis of water. The hydrogen can later be transformed back into electricity by fuel cells. Using the characteristics of the system components as input parameters, the model simulates system performance over time using historical or computer-

generated wind-speed and demand data. Various statistics associated with the energy produced and costs are used to evaluate and compare alternative systems.

Dissert. Abstr.

**N74-28536#** Arkla Industries, Inc., Evansville, Ind. Engineering Dept.

**DESIGN, EVALUATION AND RECOMMENDATION EFFORT RELATING TO THE MODIFICATION OF A RESIDENTIAL 3-TON ABSORPTION CYCLE COOLING UNIT FOR OPERATION WITH SOLAR ENERGY**

Richard H. Merrick and Philip P. Anderson Nov. 1973 23 p  
(Contract NASB-25996)

(NASA-CR-120277) Avail: NTIS HC \$4.25 CSCL 10A

The possible use of solar energy powered absorption units to provide cooling and heating of residential buildings is studied. Both the ammonia-water and the water-lithium bromide cycles are considered. It is shown that the air cooled ammonia-water unit does not meet the criteria for COP and pump power on the cooling cycle and the heat obtained from it acting as a heat pump is at too low a temperature. If the ammonia machine is water cooled it will meet the design criteria for cooling but can not supply the heating needs. The water cooled lithium bromide unit meets the specified performance for cooling with appreciably lower generator temperatures and without a mechanical solution pump. It is recommended that in the demonstration project a direct expansion lithium bromide unit be used for cooling and an auxiliary duct coil using the solar heated water be employed for heating.

Author

**N74-28537#** Denver Research Inst., Colo. Industrial Economics Div.

**APPLICATIONS OF AEROSPACE TECHNOLOGY IN THE ELECTRIC POWER INDUSTRY**

Aug 1973 116 p refs  
(Contract NASW-2382)

(NASA-CR-138947) Avail: NTIS HC \$9.00 CSCL 10B

An overview of the electric power industry, selected NASA contributions to progress in the industry, linkages affecting the transfer and diffusion of technology, and, finally, a perspective on technology transfer issues are presented.

Author

**N74-28538#** Mitre Corp., McLean, Va.

**PROPOSED PROGRAM AND BUDGET FOR PHOTOVOLTAIC SYSTEMS**

Frank R. Eldridge Feb 1974 147 p  
(Contract NSF C 831, Proj. 2950)

(MTR 8613, NSF/RA/N-73-111) Avail: NTIS HC \$10.50

A study of the NSF 5-year Solar Energy Research Program is presented. The goals, suggested approach, funding, phasing, basis for funding estimates and task priorities are described, that would be conducted during the course of the proposed program for photovoltaic systems. This proposed program was designed to demonstrate, by basic and applied research and proof-of-concept experiments, the technical feasibility, economic viability, environmental impact, sociological desirability, institutional constraints, and potential utilization of photovoltaic systems that would derive replenishable energy from the sun to help satisfy future U.S. energy needs.

Author

**N74-28539#** Washington State Univ., Pullman Dept. of Physics.

**TRANSPORTATION AND ENERGY CONSERVATION IN THE PACIFIC NORTHWEST**

J. Thomas Dickinson Feb 1974 33 p refs Prepared in cooperation with Idaho Univ. and Oregon State Univ.

(Contract E-3002) Avail: NTIS HC \$4.75

A study was conducted to determine the energy requirements for transportation in the Pacific Northwest region. It was determined that transportation uses 30 percent of all energy consumed in the region. A table of data is developed for the states of Washington, Oregon and Idaho to show the amounts of energy used by automobile, truck, bus, airlines, and rail

transportation. Comparisons of the energy consumed in the region are made with the nationwide energy consumption. Methods for reducing the fuel consumption are proposed. Author

**N74-28540#** MITRE Corp., Washington, D.C.  
**DISSEMINATION AND UTILIZATION OF SOLAR ENERGY RESEARCH RESULTS**  
Dec. 1973 67 p refs  
(Contract NSF C-831; Proj. 2950)  
(MTR-6544; NSF/RA/N-73-3) Avail: NTIS HC \$6.50

Recommendations have been made for establishing groups within or reporting to, the NSF Solar Energy Program Office, and initiating activities for the dissemination and utilization of solar energy research results. The primary recommendations include establishing an Advisory Commission and an information office reporting to the Program Director, and constructing visitor centers on the sites of each Proof of Concept Experiment. Training courses and public education would be conducted at each center following successful operation of the POCE system. Author

**N74-28541#** MITRE Corp., Washington, D.C.  
**SOLAR ENERGY, PROOF OF CONCEPT EXPERIMENTS**  
Dec. 1973 104 p refs  
(Contract NSF C-831; Proj. 2950)

(MTR-6537; NSF/RA/N-73-3) Avail: NTIS HC \$8.25

Critical experiments are described which are intended to prove the technical feasibility and socio-economic desirability of specific applications or techniques for the widespread utilization of solar energy. These experiments fall within the following areas: heating and cooling of buildings, process heat, solar-thermal-electric, photovoltaic, ocean thermal, wind energy, organic materials, and common applications. The specific concept which the experiment is intended to prove, and a rationale for the experiment are given. Each experiment is described in terms of the system to be constructed, its pacing and high-risk items, the intended users, desired interfaces with other systems and users, and estimated costs for the experiment. Each experiment is described and costs estimated for two levels of funding: a moderate risk, minimum program, and a low-risk accelerated program. Author

**N74-28542#** MITRE Corp., Washington, D.C.  
**SYSTEMS ANALYSIS OF SOLAR ENERGY PROGRAMS. APPENDIX: RESEARCH TASKS**  
Dec 1973 142 p refs  
(Contract NSF C-831; Proj. 2950)  
(MTR-6513-App: NSF/RA/N-73-3-App) Avail: NTIS HC \$10.25 CSCL 10A

Research programs involving the application of solar energy systems are discussed. The subjects considered are: (1) heating and cooling of buildings, (2) solar-thermal energy systems, (3) ocean-thermal gradient systems, (4) photovoltaic energy systems, (5) wind energy sources, (6) utilization of organic material, and (7) common applications. Author

**N74-28543#** Scientific Translation Service, Santa Barbara, Calif.  
**COST EFFECTIVENESS OF TUNGSTEN CARBIDE-CARBON FUEL CELLS**  
Heinz Carl, Herold Bohm, and Franz A. Poh Washington NASA Jul 1974 31 p refs Transl. into ENGLISH from Wiss. Ber. AEG-Telefunken (West Germany), v. 46, no. 3-4, 1973 p 109-116  
(Contract NASW-2483)  
(NASA-TT-F-15748) Avail: NTIS HC \$4.75 CSCL 10A

It is shown that the WC/C fuel cell offers an excellent alternative to conventional power sources for many applications. Three demonstration examples are presented for illustration: (1) electric trucks for industrial warehouse and plant applications; (2) fork lift trucks; and (3) power supply for radio link stations. Author

**N74-28544#** North Carolina State Univ., Raleigh. Semiconductor Device Lab.

**A THEORETICAL ANALYSIS OF THE CURRENT-VOLTAGE CHARACTERISTICS OF SOLAR CELLS** Annual Report J. R. Hauser and P. M. Dunbar Jun. 1974 172 p refs (Grant NGR-34-002-195)  
(NASA-CR-138828) Avail: NTIS HC \$11.75 CSCL 10A

The current-voltage characteristics and efficiencies of solar cells are discussed. For one solar cell structure detailed curves are presented which include carrier densities, current densities, potential, and quasi-Fermi levels at different voltage levels both with and without optically generated carriers (AMO conditions). In addition some results are presented concerning the influence of various parameter variations such as lifetime, cell thickness, and high-low junction width on solar cell performance. Author

**N74-28545#** Bureau of Mines, Washington, D.C. Div. of Fossil Fuels

**COAL: BITUMINOUS AND LIGNITE IN 1972**  
15 Nov 1973 78 p  
Avail: NTIS HC \$7.00

A survey of bituminous coal and lignite production in the United States is presented. The factors considered in the survey are (1) increased production, (2) increased costs, (3) foreign and domestic distribution, (4) fuel consumption. Tables of data are developed to present the economic factors involved in coal production, transportation, and availability. Author

**N74-28546#** Battelle Northwest, Richland, Wash.  
**STUDY OF HANFORD CAPABILITY FOR SOLAR ENERGY RESEARCH AND DEVELOPMENT**  
K. Drumheller Nov 1973 55 p refs  
(Contract AT(45-1)-1830)  
(BNWL-1801) Avail: NTIS HC \$5.45

The Hanford site provides unique capability for solar energy research and development. The basic attributes include large available land areas, consistent sunshine during much of the year (although not comparable to Arizona and the southwest U.S.), extreme temperatures for test purposes (-27 to 115 F); cooling water availability; ecology approximating ecology in some other solar areas; R and D facilities applicable to most solar technology; equipment immediately useful for solar energy programs; technology background in most areas of solar energy; experience with large energy systems, and background in systems analysis. From the solar energy production standpoint, the energy that falls on the 600 square miles at the Hanford site would produce 100,000 megawatts if 33 1/3% efficiency can be achieved. NSA

**N74-28547#** California Univ., Livermore. Lawrence Livermore Lab.

**ECONOMICS OF THERMODYNAMIC SOLAR POWER SYSTEMS. PART 2: THE TURBINE TRADE-OFF**  
L. F. Wouters 19 Sep 1973 7 p  
(Contract W-7405-ENG-48)  
(UCID-16386-Pt-2) Avail: NTIS HC \$3.00

It has been indicated that a more expensive, higher efficiency thermodynamic subsystem could result in a less-expensive, more cost-effective solar power system, overall. It is interesting to see how severe a trade-off this really is. A primitive two-component system model consisting of (1) the collector and (2) the turbine was constructed. Of course there are lots of other pieces between and around these items, but these two are the ones to which most cost leverages can be associated, in some way. A given collector design is assumed, having a defined specific efficiency and unit area cost. The turbine efficiency is varied parametrically from a reference value, and an allowable cost trade-off as a ratio to reference turbine price is obtained. No attempt is made to relate a particular cost change to a particular design change. The maximum that can be afforded for any and all changes is established. Author (NSA)

N74-28883# Engelhard Minerals and Chemicals Corp., Newark, N.J. Systems Dept.

LOW WATTAGE HYDROGEN: AIR FUEL CELLS Final Report, 21 Jun. 1972 - 31 Mar. 1974  
O. J. Adlhart 1974 48 p  
(Contract DAAK02-72-C-0474)

(AD-778550; USAMERDC-21583) Avail: NTIS CSCL 10/1

Low wattage fuel cells based on the matrix type phosphoric acid cell are discussed. Nominal ratings of 5-watts or less are considered. Bottled hydrogen or metal hydrides are used as fuel. Two approaches are taken. One relying on a conventional bipolar cell design with water removal by the air stream. In an alternate approach, metal hydrides are integrated with the fuel cell into a device resembling a primary battery. Hydrogen is generated by reaction of the hydride fuel with the fuel cell product water. Power sources based on the phosphoric acid cell exhibit favorable life characteristics and power densities comparable to or exceeding low rate primary batteries

Author (GRA)

N74-28851# Applied Dynamics Research Corp., Huntsville, Ala. DYNAMIC MODELING AND ANALYSIS OF LIQUID-METAL MAGNETOHYDRODYNAMIC POWER SYSTEMS Annual Report, 18 Nov. 1972 - 28 Feb. 1974

Chun Hsu and Ho-Tien Shu Mar. 1974 150 p refs  
(Contract N00014-73-C-0196; NR Proj. 274-164)

(AD-778757; NTI/T1065A) Avail: NTIS CSCL 10/2

A comprehensive survey of the current development status of all MHD power cycles was made to assess the relative merit of the various cycles for naval applications. Dynamic System model was formulated to analyze the system performance. First, detailed component model was formulated and component designs were performed to determine the geometric configuration of each component. Next, a method based on variational 27 principle and the steady-state system solutions was developed to determine the component node models. A manageable dynamic system model and a simplified linear system model were then formulated. Finally, system stability analysis on the linear node model was performed to examine the local system stability.

Author (GRA)

N74-28852# Bureau of Mines, Laramie, Wyo. Laramie Energy Research Center.

THERMAL DEGRADATION OF GREEN RIVER KEROGEN AT 150 TO 350 C

J. J. Cummins, F. G. Doolittle, and W. E. Robinson 1974 21 p refs

(BM-RI-7924) Avail: NTIS HC \$4.25

The Bureau of Mines heated at 150 to 350 C for 0.5 to 300 days Green River oil shale that had been previously extracted by benzene to provide information on in situ processing conditions, to determine the effect of low-temperature heating on the unconverted kerogen, and to determine the composition of benzene-soluble thermal products. In general, it was concluded that significant increases in the degradation of kerogen to oil occurred between the temperature range of 250 to 350 C; that the composition of the soluble products depends upon the temperature at which they are formed; and that the n-alkanes are pyrolytically degraded from the kerogen structure. In particular, the 250 C heating temperature is beneficial to the formation of branched plus cyclic alkanes. Also, the heated and unconverted oil shale kerogen and the soluble thermal products become more aromatic as the temperature increases from 150 to 350 C.

Author

N74-28864# National Center for Energy Management and Power, Philadelphia, Pa.

THERMOCHEMISTRY OF SALT HYDRATES  
Geoffrey Belton and Fouad Ajami May 1973 98 p refs  
(Grant NSF GI-27876)

(PB-227966/9; NSF-RA/N-73-079)

NSF-RANN/SE/GI-27976/TR-73-4) Avail: NTIS HC \$4.00

#### CSCL 07D

A description is given of research performed on materials suitable for thermal energy storage (TES) as applied to solar-heating and air conditioning of buildings. Criteria for candidate materials are developed, and the various classes of materials that undergo a phase transformation at the required temperatures are briefly reviewed. Most of the data concentrates on one class of materials: inorganic salt hydrates. An extensive literature survey on phase diagrams and thermodynamic properties of salt hydrates was carried out. The kinetics of nucleation of the solid from the melt are considered from the theoretical point of view. It is found that salt hydrates are half-way between the good glass formers and the non-glass formers; as a result, it is suggested that the use of outside agents, such as a small weak supersonic field, may prevent supercooling. (Modified author abstract) GRA

N74-28818# Wolf Research and Development Corp., Pocomoke City, Md.

APPLICABILITY OF SKYLAB REMOTE SENSING FOR DETECTION AND MONITORING OF SURFACE MINING ACTIVITIES Quarterly Progress Report, 1 Apr. - 30 Jun. 1974

R. L. Brooks, Principal Investigator and J. D. Pennewell Jul. 1974 4 p EREP  
(Contract NAS9-13310)  
(E74-10572; NASA CR-138647, QPR-5) Avail: NTIS HC \$4.00 CSCL 081

There are no author-identified significant results in this report.

N74-28897# Geological Survey, Washington, D.C. THE WORLDWIDE SEARCH FOR PETROLEUM OFFSHORE Status Report, 1947 - 1972

Henry L. Berryhill, Jr. 1974 30 p refs  
(USGS-CIRC-694) Avail: NTIS

At the end of 1972, offshore petroleum exploration was in progress on the submerged continental margins of 80 countries. Some 780 oil and gas fields had been discovered. Estimated worldwide volume of oil discovered offshore as of January 1, 1973, is 172.8 billion barrels of oil, or about 28 percent of the world total and 168.4 trillion cu ft of natural gas. Present reserves of oil are 135.5 billion barrels, of which 70 percent is in the Persian Gulf. Some 90 percent of the oil discovered offshore has been found in 60 giant fields having reserves of 500 million or more barrels each.

Author

N74-28911# Bureau of Mines, Laramie, Wyo. Energy Research Center

PROPERTIES OF UTAH TAR SANDS: THREEMILE CANYON AREA, P. R. SPRING DEPOSIT  
Leland C. Marchant, L. A. Johnson, and C. Q. Cupps 1974 17 p refs

(BM-RI-7923) Avail: NTIS HC \$4.00

Detailed analyses of four cores from the Threemile Canyon area in the P. R. Spring tar sand deposit in Utah are reported. Average properties of the oil zone in the Threemile Canyon area as determined from these cores are as follows: Oil saturation, 67.4 pct of pore volume; porosity, 29.2 pct; permeability before oil extraction, 133 millidarcies, and permeability after oil extraction, 2,855 millidarcies. Average net thickness of the oil zone is 23.8 ft and average depth to the top of the oil zone is 188 ft.

Author

N74-28919# Bureau of Mines, Pittsburgh, Pa. Pittsburgh Mining and Safety Research Center

GEOLOGIC STRUCTURE ANALYSIS USING RADAR IMAGERY OF THE COAL MINING AREA OF BUCHANAN COUNTY, VA.

C. H. Elder, P. W. Jeran, and D. A. Keck Jan. 1974 36 p refs  
(PB-228689/6, BM-RI-7869) Avail: NTIS HC \$3.25 CSCL 081

An analysis of the geologic structure of an area of Buchanan

County, Va. was made by the Bureau of Mines using imagery from an airborne AN/APQ 97 side-looking radar system to evaluate that mapping technique for delineating structural features which may cause mining problems. Side-looking radar (SLAR) was found to be a useful remote sensing tool for geologic structural analysis. Fault and joint systems identified by lineaments and linear patterns in the imagery were verified by surface and in-mine observations. SLAR imagery accurately delineated structural features that are known to affect gas migration and accumulation and that weakened the rock forming the immediate roof to mine workings, causing mining problems. (Modified author abstract)

GRA

N74-28990# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio.

**EVALUATION OF ALLOYS AND COATINGS FOR USE IN AUTOMOBILE THERMAL REACTORS**

Charles P. Blankenship and Robert E. Oldrieve Washington Jul. 1974 52 p refs  
(NASA-TN-D-7699 E-7856) Avail. NTIS HC \$3.75 CSCL 11F

Several candidate alloys and coatings were evaluated for use in automobile thermal reactors. Full-size reactors of the candidate materials were evaluated in cyclic engine dynamometer tests with a peak temperature of 1040 C (1900 F). Two developmental ferritic-iron alloys, GE-1541 and NASA-18T, exhibited the best overall performance by lasting at least 60 percent of the life of test engine. Four of the alloys evaluated warrant consideration for reactor use. They are GE-1541, Armco 18 SR, NASA-18T, and Inconel 601. None of the commercial coating substrate combinations evaluated warrant consideration for reactor use.

Author

N74-29015# Kentucky Univ., Lexington Inst. for Mining and Minerals Research.

**A KENTUCKY COAL UTILIZATION RESEARCH PROGRAM. PROJECT 6: CAKING CHARACTERISTICS OF KENTUCKY COAL** Annual Report, 1 Jul. 1972 - 30 Jun. 1973

Jul. 1974 53 p refs Reprinted  
Avail. NTIS HC \$5.75

The caking characteristics of Kentucky coal were evaluated and suggestions were made for the solution to the problem in gasification processes. Prevailing in process decaking treatment methods penalties in the form of increased costs, reduced efficiency, or complications in operation. Two decaking methods, simultaneous decaking and transportation of coal from mine to gasification plant via a coal-water slurry pipeline and using a dilute alkaline solution, were evaluated.

E.H.W.

N74-29207# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div

**FUEL FOR SUPERSONIC PASSENGER AIRCRAFT**

I. P. Blagovidov, I. E. Bespolov, V. M. Vul, K. V. Minkner, V. V. Malyshev, A. A. Tupolev, Ye. R. Tereshchenko, M. D. Khayin, and V. V. Yakovlevskiy 17 Apr. 1974 16 p Transl. into ENGLISH of the publ. "Neftyanye Topliva Dlya Dvigatelei Vnutrennogo Sgoraniya i Gazovykh Turbin" USSR. 1971 p 3-13  
(AD 778801; FTD HT 23 701 74) Avail. NTIS CSCL 21/4

The feasibility of obtaining a base fuel for supersonic airliners has been examined and the problems of improving the antiwear, anticorrosive, deicing, antistatic and other properties connected with operating conditions have not been touched upon. For these purposes it is possible to use special additives, as well as to saturate fuel with nitrogen.

Author (GRA)

N74-29332# Stuttgart Univ (West Germany) Inst. fuer Kernenergetik

**FEASIBILITY STUDY AND DEVELOPMENT OF A CONSTANT TEMPERATURE HEAT PIPE SYSTEM. PHASE 2: EXPERIMENTAL DESIGN** Final Report

M. Hage Oct 1973 123 p

(Contract ESTEC-1703/72-SK)

(ESRO-CR(P)-430) Avail. NTIS HC \$9.25

Results of preliminary tests carried out with alternative heat pipe designs, the selection of the prototype design, its analysis, manufacture, and extended theoretical and experimental investigations are presented. According to preliminary tests the modular artery heat pipe concept was chosen for the prototype. Measurements showed that the artery heat pipe suffered a performance degradation by a factor of about 3 when noncondensable gas was present in the heat pipe. Therefore the experimental program was modified and power steps between 20 and 100 watts were applied to the heat pipe instead of power steps between 40 and 200 watts. The agreement between theoretical predictions and experimental results was good for the steady-state as well as the transient behavior. The mechanical analysis of the system indicated that it should be able to withstand launch conditions.

Author (ESRO)

N74-29339# National Aeronautics and Space Administration, Washington, D.C.

**SPACESHIP EARTH: A LOOK AHEAD TO A BETTER LIFE**

James C. Fletcher 1973 29 p Statement before Senate Comm. on Aeron. and Space Sci., 6 Mar. 1973  
(NASA-TM-X-70139) Avail. NASA Office of Public Affairs, Washington, D. C. 20546 CSCL 03C

The text of a prepared statement given before Congress is presented which describes NASA's long range objectives. Emphasis is on the impact and proposed benefits of various space and aeronautical programs which are slated for operational status within the next 10 to 15 years. The programs discussed include improvements or developments in the following: (1) airport congestion, (2) short-haul aircraft capabilities, (3) air cargo systems, (4) hydrogen-fueled aircraft; (5) space shuttle capabilities, (6) space communications, (7) transportation; (8) preventive medicine, rapid diagnostics, and emergency medical care, (9) water and land resources management; (10) air and water pollution control; (11) global weather and disaster alert networks; and (12) space and lunar exploration.

A.A.D.

N74-29342# Library of Congress, Washington, D.C. Environmental Policy Div

**THE IMPACT OF ENERGY SHORTAGES ON US ENVIRONMENTAL STANDARDS**

31 Jan 1974 54 p refs  
(TP-450-USB, Rept 74-78EP) Avail. NTIS HC \$5.75

The desirability of environmental controls regarding the production and use of various fuels is discussed along with the present imbalance in energy supply and demand. Petroleum, natural gas, coal, and nuclear energy are discussed in terms of their availability and consumption rates. The conflict between air quality goals and current emission levels from automobiles and power plants are reviewed, and the environmental trade-offs of nuclear power generation, identified as thermal pollution, air pollution, water pollution, radioactive waste, and the accidental release of radioactive materials, are discussed in terms of their environmental costs. Other topics covered include the problems of power plant siting, and the environmental and economic impacts of development of the Outer Continental Shelf, and surface mining of coal and oil shale in the western United States.

A.A.D.

N74-29343# Library of Congress, Washington, D.C. Environmental Policy Div

**SOME SIMPLE CALCULATIONS TO SUGGEST THE EFFECTS OF SIX NATIONAL POLICIES UPON USE AND SUPPLY OF ENERGY**

Warren H. Donnelly 11 Mar. 1974 18 p ref  
(TP-360; Rept-74-13-EP) Avail. NTIS HC \$4.00

Policy options for total national energy use and supply from domestic and imported sources are considered. Estimated balances for the years 1970, 1975, 1980, and 1985 for domestic and imported energy supplies are presented to illustrate the use that can be made of single energy models, and to test the major

implications of any policies that may be proposed. Synthetic fuel production is considered in the analysis of a policy based on energy independence. Best and worst energy supply situations are also calculated as an additional aid in policy decision making. A.A.D.

**N74-29344# Committee on Public Works (U. S. House).**  
**GASOLINE, DIESEL, AND HEATING OIL SHORTAGES**  
 Washington GPO 1973 797 p refs Hearings before Comm. on Public Works, 93d Congr., 1st Sess., 24-26 and 31 Jul. and 1 Aug. 1973  
 (GPO-24-116) Avail: Subcomm. on Energy

Statistical information and predictions of the future needs and availability of gasoline, diesel, and heating oil energy in the U.S. were presented before a Congressional hearing. Energy consumption is discussed according to industrial uses, transportation, electric power, household, and miscellaneous needs, and the percentages of coal, petroleum, and natural gas involved in that consumption are presented. Statistics are shown for expected increases in demand for each form of energy, and refinery and power plant capacities are commented upon. Estimated reserves of fossil fuels in the U.S., and expected future supply in terms of the law of exponential growth are discussed. An FTC report on its investigation of the petroleum industry is also presented. A.A.D.

**N74-29346# Committee on Public Works (U. S. House).**  
**TO CONSERVE ENERGY ON THE NATIONAL SYSTEM OF INTERSTATE AND DEFENSE HIGHWAYS**  
 Washington GPO 1973 97 p refs Hearing on H.R. 11372 on Comm. on Public Works, 93d Congr., 1st Sess., 27 Nov. 1973  
 (GPO-25-702) Avail: Subcomm on Energy

A Congressional hearing was conducted to investigate means of conserving energy on the interstate and defense highway systems. The legislation was concerned with establishing a maximum speed limit on any highway on the United States, territories, and possessions. The Secretary of Transportation was given authority to impose the lower speed limits after consulting with the Governor of the jurisdiction involved. Author

**N74-29347# Committee on Public Works (U. S. House).**  
**ARCHITECTURAL GUIDELINES TO PROMOTE EFFICIENT ENERGY USE**  
 Washington GPO 1973 38 p Hearing on H.R. 11714 before Comm. on Public Works, 93d Congr., 1st Sess., 11 Dec. 1973  
 (GPO-28-428) Avail: Comm. on Public Works

A Congressional hearing was conducted to provide for the development of improved design lighting, insulation, and architectural standards to promote efficient energy use in residential, commercial, and industrial buildings. The administrator of the General Services Administration in cooperation with the Secretary of Defense, the Secretary of Housing and Urban Development, and the National Bureau of Standards is authorized to carry out the provisions of the legislation. Testimony regarding the need for such action and the benefits to be derived was provided by selected witnesses. Author

**N74-29352# Committee on Interior and Insular Affairs (U. S. Senate).**  
**ENERGY EMERGENCY LEGISLATION, PART 2**  
 Washington GPO 1973 403 p refs Executive Markup Session and Appendix on S. 2589 before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 9 and 12 Nov. 1973  
 (GPO-24-846) Avail: SOD HC \$2.65

Committee prints of a bill to declare by Congressional action a national energy emergency are presented. Statements of findings and purpose are included with the prints which outline the energy shortages and disruptions of energy supplies which initiated the action. A discussion of the issues follows and includes information on the distillate fuel oil situation during the winter of 1973 and 1974, environmental properties of an alternate high sulphur fuel oil, highway transportation fuel conservation measures, and speed limit authority. The text of a petition for the elimination of gateways for motor common carriers of property, routes, and

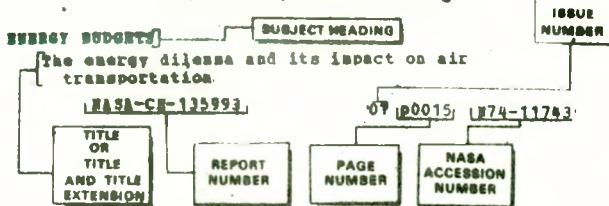
gateways for motor common carriers of property, routes, and services in interstate commerce is presented, along with a paper on family household moving. Proposed amendments to the bill are also considered. For Vol. 1, see N74-16662. A.A.D.

# SUBJECT INDEX

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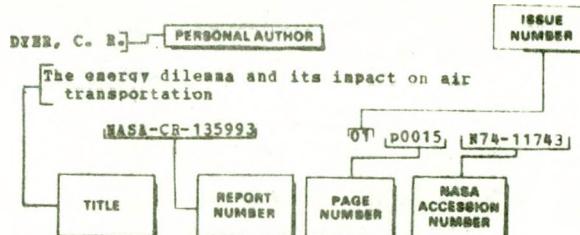
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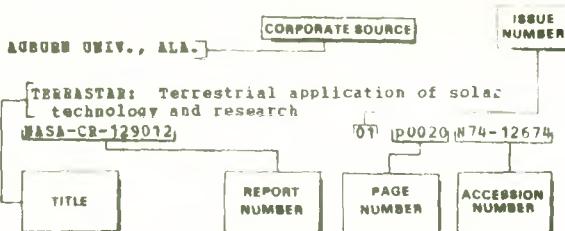
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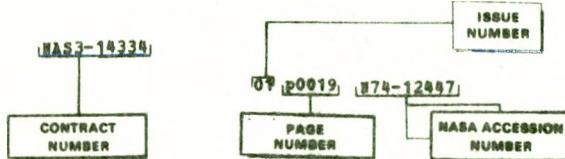
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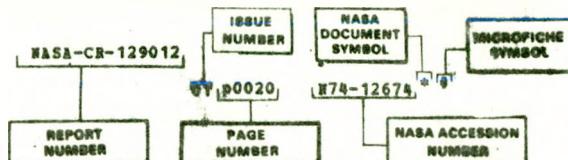
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NSP-RANN/SE/GI-27976/TR-73-4	03	p0121	N74-28664	#	PB-225331/8GA	02	p0070	N74-18633	#
NSP-RANN/SE/GI-34872-73-4	03	p0110	N74-26522	#	PB-225476/1	03	p0115	N74-27918	#
NSP-RANN/SE/GI-36731X/PR/73/3	03	p0106	N74-25616	#	PB-225977/8	03	p0105	N74-23337	#
NSP-RANN/SE/GI-39114/PR-73-1	03	p0110	N74-26520	#	PB-226139/4GA	03	p0101	N74-21697	#
NSRDC-4195	02	p0078	N74-19717	#	PB-226580/9GA	03	p0102	N74-22091	#
NTC-74-11868	03	p0108	N74-26496	#	PB-227097/3	03	p0105	N74-23190	#
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ONE-TR-20	01	p0012	N74-10949	#	PB-228067/5	03	p0110	N74-26523	#
ONEL-C-10-73	01	p0025	N74-14408	#	PR-228068/3	03	p0110	N74-26519	#
ORNL-EIS-73-52-VOL-1-NO-9	02	p0062	N74-17680	#	PR-228069/1	03	p0110	N74-26520	#
ORNL-EIS-73-52-VOL-1-NO-11	03	p0114	N74-27537	#	PB-228668/0	03	p0110	N74-27611	#
ORNL-EIS-73-65	02	p0080	N74-20627	#	PB-228689/6	03	p0121	N74-28919	#
ORNL-EIS-73-65-REV-1	01	p0022	N74-12695	#	PB-228708/4	03	p0111	N74-27162	#
OBBL-NSP-8P-39	01	p0019	N74-12577	#	PR-37	02	p0080	N74-20647	#
ORNL-TB-4243	01	p0025	N74-14377	#	PWA-PR-5673	02	p0050	N74-16483	#
ORNL-TB-4305	01	p0030	B74-15449	#	PWA-4635	01	p0022	N74-12742	#
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P-5046	01	p0017	N74-11791	#	QPR-3	02	p0049	N74-16019	#
P-5048	01	p0017	N74-11790	#	QPR-5	03	p0121	N74-28816	#
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P-5107	02	p0054	N74-16674	#	R-991-NSP/CSRA	02	p0053	N74-16673	#
P-5109	02	p0054	N74-16675	#	R-1106-NSP/CSRA	02	p0054	N74-16679	#
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