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ENERGY

**A CONTINUING BIBLIOGRAPHY
WITH INDEXES**

MAY 1975

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ENERGY

A Continuing Bibliography

With Indexes

ISSUE 04

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 October 1 through December 31, 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(04)) lists 335 reports, journal articles, and other documents announced between October 1, 1974 and December 31, 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 solar energy. Also included are methods of locating or using new energy resources. Of special interest is energy for heating, lighting, for powering aircraft, surface vehicles, or other machinery.

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

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

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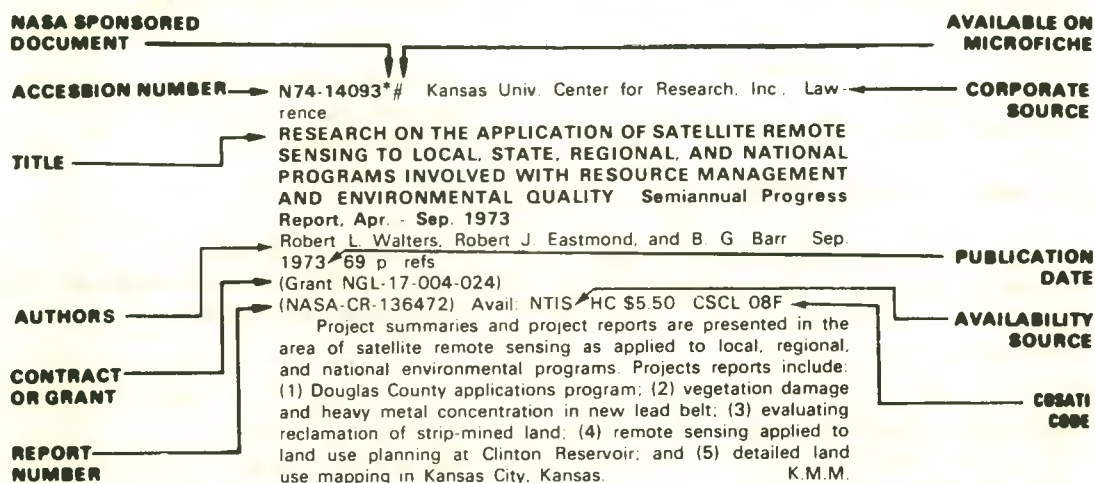
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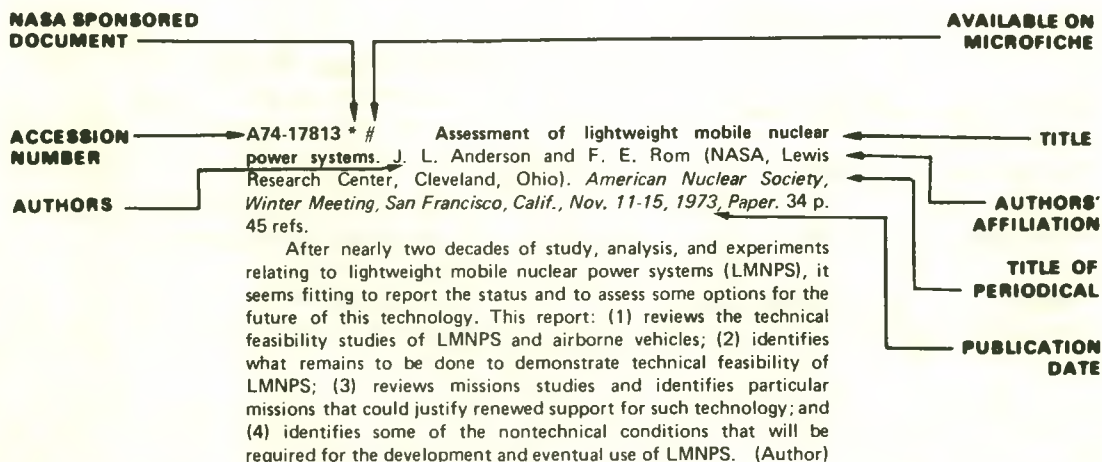
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TYPICAL CITATION AND ABSTRACT FROM IAA



A Listing of Energy Bibliographies Contained In This Publication:

1. Hydrogen energy: A bibliography with abstracts.
Cumulative volume, 1953-1973 N74-29411 p 0137
2. Inventory of current energy research and development
---bibliography N74-30393 p 0142
3. Inventory of current energy research and development
---bibliography N74-30394 p 0142
4. NSF-RANN energy abstracts. A monthly abstract
journal of energy research---bibliography
N74-30396 p 0143
5. Comprehensive bibliography of literature on non-
cryogenic storage and recovery of hydrogen
N74-34240 p 0162



IAA ENTRIES

A74-38044 # Fundamentals of unmanned flight vehicle design with allowance for economic efficiency (Osnovy proektirovaniia bespilotnykh letatel'nykh apparatov s uchetom ekonomicheskoi effektivnosti). I. I. Drakin. Moscow, Izdatel'stvo Mashinostroenie, 1973. 224 p. 133 refs. In Russian.

An exposition of design principles used in determining the specifications of unmanned flight vehicles (UFV) and optimizing their structural, energetic, ballistic, and stochastic parameters. Economic considerations are taken as the basic criterion for comparative analysis and optimization of UFV designs. Computational formulas are derived for the comparative structural analysis of several types of UFV. Considerable space is allotted to problems of random engineering, among them, the optimization of the reliability of radioelectronic systems and primary structures. Most of the analyses are illustrated by numerical examples. J.K.K.

A74-38171 The end effect in an MHD generator with metallic walls at the inlet separated by insulating parts from the sectional electrode zone. A. B. Vatazhin and N. G. Nemkova (Akademiia Nauk SSSR, Nauchno-Issledovatel'skii Institut Vysokikh Temperatur, Moscow, USSR). (Teplofizika Vysokikh Temperatur, vol. 11, Nov.-Dec. 1973, p. 1250-1259.) *High Temperature*, vol. 11, no. 6, July 1974, p. 1117-1124. 7 refs. Translation.

A74-38271 # Some contributions to optimization theory of nonequilibrium diagonal MHD generator duct. M. Ishikawa and J. Umoto (Kyoto University, Kyoto, Japan). *Kyoto University, Faculty of Engineering, Memoirs*, vol. 36, Jan. 1974, p. 32-45. 12 refs.

For the purpose of contributing to the optimum design of the nonequilibrium diagonal MHD generator duct, the authors derive a new digital calculation from the basic quasi one-dimensional MHD equations of the diverging rectangular duct and the integrals which express the duct size or isentropic efficiency. The calculation is intended to minimize the duct size or maximize the efficiency for a given thermal input, when the applied magnetic flux density, the mass flow rate and the duct inlet or outlet stagnation temperature and pressure of the working gas are held constant. (Author)

A74-38315 The energy crisis of fuel and the procedures of cruising flight (La crisis energética de combustible y los procedimientos de vuelo de crucero). M. Cuesta Alvarez. *Revista de Aeronáutica y Astronáutica*, vol. 34, June 1974, p. 444-460. In Spanish.

The energy crisis has focused attention on questions concerning the aircraft type with the lowest operational fuel consumption. Other important questions are related to the flight procedures which have optimum characteristics with regard to fuel consumption and total operational costs. It has been found that aircraft equipped with turbojet engines require the lowest amount of fuel for their

operation. Details of turbojet design and operation are discussed along with questions of cruising range, thrust, and velocity, taking into account conditions at various altitudes. The characteristics of cruising flight undertaken under conditions of constant Mach number and constant altitude and of constant thrust and constant altitude are considered. G.R.

A74-38603 # Establishment of quasi-steady conditions in a blow-down nonequilibrium MHD generator. J. J. Rosciszewski and T. T. Yeh (California, University, San Diego, Calif.). *A/AA Journal*, vol. 12, Aug. 1974, p. 1021-1024. 5 refs. Contracts No. N00014-72-C-0019; No. F44620-69-C-0109.

Numerical calculations of a nonsteady nonequilibrium flow in a divergent linear MHD generator section are presented. The objective of this work was to find the time necessary for the establishment of a steady-state condition at different generator loads and reservoir parameters. The working gas was argon, seeded with 1% cesium. Results indicate that, as a general rule, the time needed to establish quasi-steady conditions is of the order of 2 to 3 msec. (Author)

A74-38725 * # Air transportation - Energy cost-effective or not. D. V. Maddalon (NASA, Langley Research Center, Aeronautical Systems Office, Hampton, Va.). *American Institute of Aeronautics and Astronautics, Aircraft Design, Flight Test and Operations Meeting, 6th, Los Angeles, Calif., Aug. 12-14, 1974, Paper 74-959*. 20 p. 17 refs.

Current technology aircraft have energy intensities comparable to ground transport modes. Operational changes can further improve their relative energy performance. Wide-body aircraft have already significantly improved fleet energy intensity and will continue to do so as they become more predominant. This is reflected in the 1972 fleet-wide energy intensity data which show both the domestic and international carriers at the lowest jet aircraft intensity levels ever attained. Technological improvements decreased the energy requirements of wide-body aircraft while also significantly reducing aircraft noise and pollution emission levels. Load factor is the most significant parameter affecting existing aircraft energy intensity and therefore should be raised. Fuel scarcity is now forcing such a change. F.R.L.

A74-38745 * # The case for a high-speed research airplane - Results from an in-house study. F. S. Kirkham, L. R. Jackson, and J. P. Weidner (NASA, Langley Research Center, Hypersonic Vehicles Div., Hampton, Va.). *American Institute of Aeronautics and Astronautics, Aircraft Design, Flight Test and Operations Meeting, 6th, Los Angeles, Calif., Aug. 12-14, 1974, Paper 74-988*. 11 p. 14 refs.

Results of a study aimed at determining the feasibility of developing a single versatile high-speed research airplane (HSRA) which will meet flight research needs of both Mach 3 to 5 JP-fueled military aircraft and of hydrogen-fueled aircraft, both military and civil, for speeds up to Mach 10. The proposed HSRA design concept is an air-launched, rocket-boosted research aircraft designed to accommodate a wide variety of large-scale propulsive and structural flight research experiments. The aircraft is a 60-foot-long discrete wing-body concept with high wings and a center-line vertical tail. Heat sink shields are proposed as an effective and versatile method of achieving low-cost, low-risk thermal protection of the all-aluminum primary structure. A.B.K.

A74-38752 # Important aspects of international air cargo. R. M. Jackson (Seaboard World Airlines, Inc., Jamaica, N.Y.). *American Institute of Aeronautics and Astronautics, Aircraft Design, Flight Test and Operations Meeting, 6th, Los Angeles, Calif., Aug. 12-14, 1974, Paper 74-998*. 7 p.

Review of some of the factors affecting further growth of the international air cargo industry. Following a brief discussion of the growth trend of the U.S. air cargo market and the possibility of dramatic innovation in all-cargo aircraft, a comparison is made between U.S. domestic and international air freight rate making, to the detriment of the latter. The relationship between regularly scheduled service rates and charter rates is also discussed. An urgent need for a simplification of the international freight rate structure is noted. Progress that can be anticipated due to the use of intermodal air/truck container systems is envisioned. Finally, the effect of the current worldwide fuel crisis on the profitability of air cargo shipments is assessed. A.B.K.

A74-38860 # Forming the magnetic field by distribution of the current density in the coils for MHD generators. O. Coufal (Vysoke Ucení Technické, Brno, Czechoslovakia). *Acta Technica CSAV*, vol. 19, no. 3, 1974, p. 299-316. 9 refs.

A74-38898 Aircraft fuel conservation: An AIAA view; *Proceedings of a Workshop Conference, Reston, Va., March 13-15, 1974*. Edited by J. Grey. New York, American Institute of Aeronautics and Astronautics, Inc., 1974. 43 p. Members, \$4.00; nonmembers, \$7.00.

Technical aspects of aircraft fuel conservation are reviewed and discussed, and measures to be taken having the best prospects for short-term and long-term impact are recommended. Fuel conservation is discussed from the viewpoint of aircraft operations, design, propulsion systems, and fuels. Some of the principal measures identified included: increasing load factors, achieved by revised rerouting and scheduling and routing patterns, matching aircraft size to demand, and better matching of total service to the market; research on advanced onboard avionics which will give the pilot sufficient information for him to make real-time selection of fuel-optimum flight profiles and airspeeds; drag reduction by the use of a properly designed small vertical 'winglet' located just inboard of each wingtip; the implementation of supercritical aerodynamic wing designs; increase in frequency and tightening the standards of regular engine maintenance procedures; and modification of hydrocarbon fuels currently used by relaxation of freeze point and flash point specifications and by use of wider fractions and more aromatics. P.T.H.

A74-38913 Direct energy transformation by fuel cells - Present state of development and possible technological applications (Energie-Direktumwandlung durch Brennstoffzellen - Heutiger Entwicklungsstand und technische Anwendungsmöglichkeiten). H. B. Gutbier (Siemens AG, Forschungslaboratorien, Erlangen, West Germany). *Forschung und Technik*, Oct. 22, 1973, p. 3-10. In German.

The basic principles behind the operation of fuel cells are reviewed, and the current state of fuel cell technology is summarized. The present work gives descriptions not only of some fuel cell units developed for space applications, but also of fuel cells being developed for general industrial and commercial use. Some of these further applications of fuel cells are indicated, including use in television translators, meteorological stations, certain automatic signal stations, and in emergency power units. P.T.H.

A74-39129 # Evaluation of a large size, modular heat pipe/radiator for cryogenic thermal control. B. E. Nelson and W. Petrie (Perkin-Elmer Corp., Danbury, Conn.). *SAE, AIAA, ASME, ASMA, and AIChE, Intersociety Conference on Environmental Systems, Seattle, Wash., July 29-Aug. 1, 1974, ASME Paper 74-ENAs-29*. 8 p. 9 refs. Members, \$1.00; nonmembers, \$3.00.

A strong, current interest exists in cooling spaceborne devices to cryogenic temperatures. Such devices include space communication lasers and infrared detectors for earth resources. A cryogenic heat pipe, isothermalizing a space radiator, provides a very attractive, passive means of thermal control. It must, however, have low thermal resistance to provide design feasibility. The Lobar wicking arrangement proved extremely efficient in previous experiments at 5 W. A series of experiments was, therefore, conducted on a very large cryogenic heat pipe/radiator to determine the wicking limits and performance at higher power levels. The current status of the on-going program is described in this paper. Research goals of a 6-m-long space radiator, rejecting 20 W with a temperature drop of less than 2 K, have been met. Details of the design and experimental phases of the work are discussed. (Author)

A74-39134 * # Heat pipe thermal conditioning panel. E. W. Saaski (Donald W. Douglas Laboratories, Richland, Wash.), J. D. Loose, and K. E. McCoy (NASA, Marshall Space Flight Center, Huntsville, Ala.). *SAE, AIAA, ASME, ASMA, and AIChE, Intersociety Conference on Environmental Systems, Seattle, Wash., July 29-Aug. 1, 1974, ASME Paper 74-ENAs-37*. 9 p. Members, \$1.00; nonmembers, \$3.00. Contract No. NAS8-28639.

Thermal control of electronic hardware and experiments on future space vehicles is critical to proper functioning and long life. Thermal conditioning panels (cold plates) are a baseline control technique in current conceptual studies. Heat generating components mounted on the panels are typically cooled by fluid flowing through integral channels within the panel. However, replacing the pumped fluid coolant loop within the panel with heat pipes offers attractive advantages in weight, reliability, and installation. This report describes the development and fabrication of two large 0.76 x 0.76 m heat pipe thermal conditioning panels to verify performance and establish the design concept. (Author)

A74-39135 # Space Shuttle heat pipe thermal control systems design and test. J. Alario (Grunman Aerospace Corp., Bethpage, N.Y.). *SAE, AIAA, ASME, ASMA, and AIChE, Intersociety Conference on Environmental Systems, Seattle, Wash., July 29-Aug. 1, 1974, ASME Paper 74-ENAs-38*. 13 p. 7 refs. Members, \$1.00; nonmembers, \$3.00.

This paper presents the design details and test results for three heat pipe thermal control systems designed for possible shuttle applications. Two of the systems are for electronics cooling and the third for compartment temperature control. The test results support the feasibility of using these selected heat pipe systems to satisfy shuttle thermal control requirements. (Author)

A74-39472 # 3-D energy management for supersonic aircraft. H. J. Kelley (Analytical Mechanics Associates, Inc., Jericho, N.Y.). *IFAC, IIC, and ANIPLA, Symposium on Automatic Control in Space, 5th, Genoa, Italy, June 4-8, 1973, Paper*. 16 p. 15 refs.

Turn-dash-turn and turn-cruise-turn approximations to optimal 3-D aircraft flight paths are studied on the basis of asymptotic expansions. Modeling assumptions and constraints are discussed, and some computational results presented. Possibilities for using families of pre-computed control commands in flight are examined. (Author)

A74-39738 # Development of alternate sources of JP-5 fuel. L. Maggitti, Jr. (U.S. Naval Air Propulsion Test Center, Trenton, N.J.). In: National Conference on Environmental Effects on Aircraft and Propulsion Systems, 11th, Trenton, N.J., May 21-23, 1974, Proceedings. Trenton, N.J., U.S. Naval Air Propulsion Test Center, 1974. 19 p.

Limits in the U.S. and world-wide resources of petroleum make it desirable to exploit domestic nonpetroleum resources for applications now served by liquid petroleum derivatives. An investigation was, therefore, conducted to explore the possibilities for obtaining a JP-5 type fuel for naval aircraft from nonpetroleum materials available in sufficient quantities in the U.S. Questions of Navy fuel usage are considered along with gas turbine engine fuel consumption trends. Attention is given to the possibility to obtain the jet fuel from oil shale and from coal. G.R.

A74-39965 # The CF6-6 engine - The first million hours. P. C. Setze (General Electric Co., Aircraft Engine Group, West Lynn, Mass.). In: International Symposium on Air Breathing Engines, 2nd, Sheffield, England, March 24-29, 1974, Proceedings. London, Royal Aeronautical Society, 1974. 14 p.

Review of the history and performance of the high by-pass ratio turbofan CF6-6 engine from its initial conceptual stages through the first one million hours of commercial airline service. It is shown that the performance of this engine has met the expectations of both the manufacturers and users. Component improvement programs currently in progress are expected to improve further the fuel consumption margin. M.V.E.

A74-39966 # Hydrogen as a turbojet engine fuel - Technological, economical and environmental impact. D. T. Pratt, K. J. Allwine, and P. C. Malte (Washington State University, Pullman, Wash.). In: International Symposium on Air Breathing Engines, 2nd, Sheffield, England, March 24-29, 1974, Proceedings.

London, Royal Aeronautical Society, 1974. 15 p. 27 refs. Research supported by the General Motors Corp. and NIH.

The present energy crisis has created an increased level of concern with respect to availability of petroleum fuels within the next decade. This consideration, together with the fact that turbojet engines are a significant and increasing contributor of NO(x) and other pollutants, led to a critical examination of the technological, economic and environmental considerations of using hydrogen (LH2) as a jet engine fuel. In addition to reviewing U.S. literature on technological and economic considerations, an assessment is made of combustion and pollutant kinetics of hydrogen in supersonic and hypersonic aircraft engines, by means of a perfectly stirred reactor model. Conclusions are drawn concerning the short-range, mid-term, and long-range possibilities of adapting aircraft to hydrogen fuel.

(Author)

A74-40201 The realization of an electrically propelled motor vehicle with fuel cells as energy source (Die Realisierbarkeit eines elektrisch angetriebenen Kraftfahrzeuges mit Brennstoffzellen als Energiequelle). A. Michel and W. Frie (Siemens AG, Forschungslaboratorien, Erlangen, West Germany). *Elektrotechnische Zeitschrift, Ausgabe A*, vol. 94, no. 11, 1973, p. 699-705. 5 refs. In German.

The characteristics of fuel cells available for electric traction applications are discussed, giving particular attention to a system which uses for its operation oxygen and hydrogen. Requirements regarding the energy source are considered along with payload and operational range. The energy sources considered include a combination of fuel cells with a storage battery, a system employing only a storage battery, and a system based on fuel cells as sole energy source. It is concluded that the employment of an electric vehicle

utilizing fuel cells for the intracity traffic is technically possible. The economic feasibility of fuel cell operation will depend essentially on the operational life of the fuel cell system. G.R.

A74-40212 * # Parametric performance of extruded axial grooved heat pipes from 100 to 300 K. K. R. Schlitt, J. P. Kirkpatrick (NASA, Ames Research Center, Moffett Field, Calif.), and P. J. Brennan. *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 74-724*. 10 p. 8 refs. Members, \$1.50; nonmembers, \$2.00.

Extensive performance data derived from tests with an aluminum axial grooved extruded heat pipe is presented for oxygen, methane, ethane, and ammonia as working fluids. The effects of operating temperature, fluid inventory, heat flux, and elevation on the transport capability and the evaporator and condenser film coefficients are measured and compared to theory. The data correlation indicates that, in addition to the viscous pressure drop of the fluid, a vapor induced liquid pressure drop must be taken into account at temperatures near or below the normal boiling point of the fluid. Methane, ethane, and ammonia are all suitable working fluids for this groove geometry; however, oxygen, because of its low static height, is at best marginal in the 100-120 K range. (Author)

A74-40215 * # Cryogenic and low temperature heat pipe/cooler studies for spacecraft application. A. Sherman (NASA, Goddard Space Flight Center, Greenbelt, Md.) and P. Brennan. *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 74-753*. 10 p. 7 refs. Members, \$1.50; nonmembers, \$2.00.

The prime purpose of the present work is to examine cryogenic heat pipe/cooler feasibility in the 80 to 100 K temperature range and in the regimes of operation required for NASA spacecraft. Present requirements within these regimes are (1) cooling load of less than 1 to 2 watt per cooler, (2) small detector/heat pipe interface area, and (3) high system reliability and long lifetime operations. The cooling capacity of practical radiant coolers is very low in this temperature range, and very temperature sensitive. Detector performance is also strongly dependent on temperatures in this regime. It is, therefore important to understand the interplay of the heat pipe and its effects on overall system performance. F.R.L.

A74-40216 * # Development of a blocking orifice thermal diode heat pipe. R. L. Kosson, J. A. Quandrini (Grumman Aerospace Corp., Bethpage, N.Y.), and J. Kirkpatrick (NASA, Ames Research Center, Moffett Field, Calif.). *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 74-754*. 7 p. Members, \$1.50; nonmembers, \$2.00. Contract No. NAS2-7492.

A new geometry is described for low temperature diode heat pipes employing excess liquid to block the vapor space of the evaporator and part of the transport section during reverse mode conditions. An orifice plate is placed in the pipe at the blocking meniscus location, with the opening arranged to permit proper liquid distribution in both ground tests and zero 'g' operation. Parametric analytical results are presented for several fluids (carbon tetrafluoride, methane, and ethane). Experimental data is presented for a room temperature diode verifying feasibility, and a 1/4 in. O.D. cryogenic diode with methane working fluid. (Author)

A74-40273 # Experience in operating a hydrogen fueled internal combustion engine. S. R. Thomas, Jr. *Combustion Institute, Spring Meeting, Madison, Wis., Mar. 26, 27, 1974, Paper. 8 p.* 19 refs.

Problem areas encountered in operating a hydrogen fueled internal combustion engine are reviewed, and it is shown that none of them are of a nature to put the practical feasibility of such an engine in doubt. Desirable objectives for further experimental studies include engine performance and emissions as functions of cam timing, exhaust gas recirculation, water injection, fuel-air ratio, and ignition timing. M.V.E.

A74-40309 # Contribution to the study of the effect of a transverse magnetic or electric field on an ionized argon supersonic stream: Case of a pure discharge; case of MHD conversion (Contribution à l'étude de l'action d'un champ magnétique ou électrique transversal sur un courant supersonique d'argon ionisé: Cas d'une décharge pure; cas de la conversion M.H.D.). B. Fontaine. Aix-Marseille I, Université, Docteur ès Sciences Mathématiques /Mécanique/ Thesis, 1973. 241 p. 96 refs. In French. Research supported by the Direction des Recherches et Moyens d'Essais.

Theoretical and experimental study of the mutual actions occurring between a high-velocity plasma flow created by a shock wave and orthogonally applied magnetic or electric fields. Following a brief review of the theoretical properties of an argon flow created by a shock wave, the experimental arrangement which includes the shock tube is described together with related equipment. Then the optical diagnostic methods employed are described, particular attention being paid to a light source consisting of a pulsed ion laser particularly adapted by its power, its monochromaticity, and its coherence to this work. Also described is a laser interferometer which uses infrared radiation and is particularly adapted by its spatial and temporal resolution and its sensitivity to shock tube measurements of electron density. An experimental study is made of an argon column ionized by a shock wave. The results of the action of an intense electric field, perpendicular to the flow, on the plasma column are reviewed, as well as the results of the action of a magnetic field on the flow in the case of MHD conversion. A.B.K.

A74-40398 The third industrial revolution - The exploitation of the space environment. G. H. Stine (Flow Technology, Inc., Phoenix, Ariz.). *Spaceflight*, vol. 16, Sept. 1974, p. 327-334. 7 refs.

The elements of a deepening worldwide mega-crisis are related to an energy crisis, a population explosion, increasing pollution, growing food shortages, ecological imbalance, and a depletion of natural resources. It is suggested that astronautics might perhaps provide the most important approach for solving these problems. Industrial operations in the space environment will not disturb the biosphere of the planet Earth. The transfer of industrial operations into space will make it possible to utilize the raw materials of the solar system outside the earth, tap the energy of the sun, and recycle the waste materials and energy back into the continuum of the universe. The feasibility of the various developments involved in such a 'third industrial revolution' is investigated, giving attention to raw materials, energy, equipment, the locations for the industrial facilities, environment, personnel, heat sinks, garbage disposal systems, warehouses, the market, the space product, and questions of transportation. G.R.

A74-40593 Passive cryogenic cooling of electrooptics with a heat pipe/radiator. B. E. Nelson and G. A. Goldstein (Perkin-Elmer Corp., Danbury, Conn.). *Applied Optics*, vol. 13, Sept. 1974, p. 2109-2111. 16 refs.

The current status of the heat pipe is discussed with particular emphasis on applications to cryogenic thermal control. The competitive nature of the passive heat pipe/radiator system is demonstrated through a comparative study with other candidate systems

for a 1-year mission. The mission involves cooling a spaceborne experiment to 100 K while it dissipates 10 W. (Author)

A74-40643 # Integral characteristics of an MHD-generator with a duct of circular cross section under conditions of inhomogeneous electrical conductivity of the flow (Integral'nye kharakteristiki MGD-generatora s kanalom krugovogo secheniia pri neodnorodnoi elektroprovodnosti potoka). S. A. Medin and I. M. Rutkevich. *Magnitnaia Gidrodinamika*, Apr.-June 1974, p. 98-107. 7 refs. In Russian.

A74-40954 Photocatalytic hydrogen production - A solar energy conversion alternative. S. N. Paleogras (Tri-State College, Angola, Ind.). *Solar Energy*, vol. 16, Aug. 1974, p. 45-51. 19 refs.

Photocatalytic solar energy conversion methods are reviewed and classified according to the photosensitizer type in an attempt to evaluate the chances of harnessing solar energy for man's use. An assessment of these methods concludes that photolysis of water as a solar energy conversion process does not seem feasible at present or for the immediate future, but may have a long-term future potential if it is given an appropriate research emphasis. Specifically, the electrochemical photolysis of water via semiconductor electrodes is felt to be the most promising scheme deserving further consideration. M.V.E.

A74-41152 Energy transfer organic dye mixture lasers. S. A. Ahmed, J. S. Gergely, and D. Infante (City College, New York, N.Y.). *Journal of Chemical Physics*, vol. 61, Aug. 15, 1974, p. 1584, 1585.

Experimental study of the energy transfer processes and laser action of organic dye mixture lasers, including the achievement of simultaneous laser action at three primary colors from a mixture of three dyes. Quantitative measurements are shown to have demonstrated that, in a mixture of two or more laser dyes in a solution, the excitation energy may be very efficiently transferred from an excited molecule of one dye species to an unexcited molecule of another species, and that this process may be extended successively to a third and fourth dye, with the excitation energy being efficiently cascaded to longer wavelengths. M.V.E.

A74-41303 # High power lasers in space and aeronautics. A. Kantrowitz (Avco Everett Research Laboratory, Inc., Everett, Mass.). *International Council of the Aeronautical Sciences, Congress, 9th, Haifa, Israel, Aug. 25-30, 1974, Paper 74-01.* 7 p. 6 refs.

Two applications of lasers to aerospace technology will be discussed. First is the development of laser metal fabrication which could have an impact in improving welding technology to the point where use of welding in aircraft structures could become much more widespread. Applications of high-power lasers to surface heat treating and alloying will also be discussed. The second laser application is to the propulsion of objects from earth to low orbit. If the energy received from a ground-based laser were efficiently converted into the kinetic energy of a propellant at suitable specific impulse (800 seconds), then propulsion to orbit seems a definite possibility with possible large savings in access to space. (Author)

A74-41337 # Matched propulsion for advanced vehicles. G. Rosen (United Aircraft Corp., Hamilton Standard Div., Windsor Locks, Conn.). *International Council of the Aeronautical Sciences, Congress, 9th, Haifa, Israel, Aug. 25-30, 1974, Paper 74-36.* 7 p. 10 refs.

Increasing demands for improved transportation in the face of today's fuel and environmental constraints calls for advanced vehicles with better matching of propulsion to their specialized needs. The very high-bypass variable-pitch fan is described as a new and effective

means to this end. It offers good low-speed performance, low fuel consumption, and low noise level in a compact, lightweight propulsion package. Representative advanced commercial and military aircraft are examined to show the potential benefits from the marriage of optimum higher-bypass fans with existing core engines. (Author)

A74-41397 Small gas turbines for helicopters /Halford Memorial Lecture/. R. M. Lucas (Rolls-Royce /1971/, Ltd., Small Engine Div., Leavesden, Herts., England). *Aeronautical Journal*, vol. 78, July 1974, p. 305-314.

The thermodynamic cycle on which the performance of a gas turbine engine basically depends is not directly affected by engine size. For a given pressure ratio and maximum cycle temperature, the overall power and efficiency are unaffected by size except for secondary effects as a change in the efficiencies of compression and expansion. Within the engine energy is added to, and extracted from, the working fluid in the processes of compression and expansion by the generation of kinetic energy and its subsequent conversion to pressure or potential energy. Thus gas velocity (expressed non-dimensionally as Mach number) emerges as the all-important parameter, and this velocity is independent of engine size. As an engine gets smaller the level of required gas velocity remains the same and this calls for a retention of blade velocity and axial through-flow velocity. It follows that as the engine gets smaller cross sectional flow areas diminish and rotational speeds rise. F.R.L.

A74-41440 Mechanism and kinetics of formaldehyde oxidation using a new fuel cell catalyst. W. R. Wolfe and K. B. Keating (Du Pont de Nemours and Co., Inc., Wilmington, Del.). *Electrochemical Society, Journal*, vol. 121, Sept. 1974, p. 1125-1129. 11 refs.

Recently a new class of nonprecious metal anode catalysts has been disclosed. The catalysts are based on the Mo-O-S system and are excellent catalysts for the oxidation of formaldehyde. IR free polarization data have been obtained as a function of temperature and formaldehyde concentration and at constant hydrogen ion concentration for formaldehyde in hydrochloric acid electrolyte. The data indicate that the catalyst disassociates the formaldehyde, i.e., H_2CO reversibly yields $CO + H_2$ with subsequent oxidation of the carbon monoxide and hydrogen. The adsorption of the formaldehyde on the catalyst appears to be the rate determining step. (Author)

A74-41441 High power facility for testing electrochemical power sources. E. J. Dowgiallo, Jr., J. B. O'Sullivan, I. R. Snellings, and R. B. Anderson (U.S. Army, Mobility Equipment Research and Development Center, Fort Belvoir, Va.). (*Electrochemical Society, Meeting, Boston, Mass., Oct. 7-11, 1973.*) *Electrochemical Society, Journal*, vol. 121, Sept. 1974, p. 1134-1137. 11 refs.

A 125-kW programmable power supply has been constructed for testing electrochemical propulsion systems and components. This facility has a number of features which are of value to others for use in broader applications. These features are: voltage programmable for both current and voltage levels, change from charge to discharge in a fraction of a second, fast response, low ripple content, and integral load dissipation. Typical applications are: direct control by field generated profiles, simulation of rapidly changing hybrid charge-discharge regimes, and control techniques such as constant power. (Author)

A74-41484 * Tri- and tetraterpenoid hydrocarbons in the Messel oil shale. B. J. Kimble, J. R. Maxwell, R. P. Philp, G. Eglinton (Bristol, University, Bristol, England), P. Albrecht, A. Ensminger, P. Arpino, and G. Ourisson (Université Louis Pasteur, Strasbourg, France). *Geochimica et Cosmochimica Acta*, vol. 38, July 1974, p. 1165-1181. 58 refs. Research supported by the Entrepise de Recherches et d'Activités Pétrolières; Natural Environmental Research Council Grant No. GR/3/655; Grant No. NGL-05-003-003.

The high-molecular-weight constituents of the branched and cyclic hydrocarbon fraction of the Messel oil shale (Eocene) have been examined by high-resolution gas chromatography and combined gas chromatography/mass spectrometry. The following compounds are present: perhydrocyclopene, together with one or more unsaturated analogs with the same skeleton; a series of 4-methylsteranes in higher abundance than their 4-desmethyl analogs; two series of pentacyclic triterpanes, one series based on the hopane structure, and the other based on the 17 α -H hopane structure; and an intact triterpene hop-17(21)-ene. Only two additional triterpanes were detected in minor concentrations - namely, 30-normoretane and a C31 triterpene based on the hopane/lupane-type skeleton. The presence of these compounds suggests a significant microbial contribution to the forming sediment. (Author)

A74-41658 # YC-15 powerplant system design and development. J. D. Thompson (Douglas Aircraft Co., Long Beach, Calif.). *American Institute of Aeronautics and Astronautics, Aircraft Design, Flight Test and Operations Meeting, 6th, Los Angeles, Calif., Aug. 12-14, 1974, Paper 74-973*. 9 p.

The development of the YC-15 engine installation was based upon the existing low-cost, reliable JT8D-17 engine and makes maximum use of off-the-shelf systems and components. New problems were posed resulting from the exhaust jet being reacted against aircraft structure to achieve propulsive augmented lift. Design of the nacelle, pylon, engine inlet, exhaust nozzle, and thrust reverser were all influenced by requirements unique to the externally blown flap STOL concept. Engine ground tests with flight-nacelle hardware have demonstrated operational functions, structural integrity, and fulfillment of performance goals. (Author)

A74-41675 # Corrections for the performance of gas turbines under varying atmospheric conditions. I. Ushiyama (Ashikaga Institute of Technology, Ashikaga, Japan). *JSME, Bulletin*, vol. 17, June 1974, p. 791-802. 9 refs.

Analysis of the effects of atmospheric conditions on the performance of gas turbines, and development of a theoretical correction formula by which gas turbine performance predictions can be adjusted from arbitrary to standard atmospheric conditions. The relative importance of the different atmospheric variables is discussed. M.V.E.

A74-41739 # Effect of tube relocation on the transfer capabilities of a fin and tube heat exchanger. F. E. M. Saboya and E. M. Sparrow (Minnesota, University, Minneapolis, Minn.). *ASME, Transactions, Series C - Journal of Heat Transfer*, vol. 96, Aug. 1974, p. 421, 422.

Using a naphthalene sublimation technique described by Saboya and Sparrow (1974), local and average transfer coefficients were obtained on the fins of a one-row plate fin and tube heat exchanger, whose tube had been relocated toward the rear of the fin in order to investigate the effect of this relocation on the transfer capabilities of the heat exchanger. The results indicate that, although the overall transfer capability of the system is increased by the rearward relocation of the tubes, the extent of the improvement is too small to justify the cost of the improvement. M.V.E.

A74-41784 # Thermodynamics of a multistage air-cooled gas turbine (K termodinamike mnogostupenchatoi gazovoi turbiny s vozdushnym okhlazhdeniem). E. N. Bogomolov. *Aviatsionnaya Tekhnika*, vol. 17, no. 2, 1974, p. 132-140. In Russian.

Expressions for the efficiency and the heat recovery factor of an open-loop air-cooled gas turbine are derived from the parameters of the individual stages, assuming that the mixing of the cooling air with the main flow is completed within the flow area of a stage. It is shown that the thermodynamic process in such a turbine may be characterized by three types of efficiency: one that reflects the influence of cooling on the energy conversion in the turbine; another

that reflects the contribution of the coolant to effective-power generation, and a third that reflects the degree of conversion of the gas and coolant energies to effective power. Several particular cases, including a closed-loop air-cooled turbine and an uncooled turbine with identical stage parameters are examined. V.P.

A74-41797 # A display of energy-maneuverability performance information for fighter aircraft. J. M. Loh (USAF, Aeronautical Systems Div., Wright-Patterson AFB, Ohio) and A. H. Lusty, Jr. (General Dynamics Corp., Fort Worth, Tex.). *American Institute of Aeronautics and Astronautics, Mechanics and Control of Flight Conference, Anaheim, Calif., Aug. 5-9, 1974, Paper 74-814*. 10 p. 5 refs. Members, \$1.50; nonmembers, \$2.00.

The need for a computer-generated head-up display of energy-maneuverability performance information is established for the new generation of high-performance fighter aircraft. Display requirements are outlined, and a recommended display is discussed with respect to the relevancy of the parameters and the effectiveness of the formats. The functional behavior of the display parameters is discussed in relation to the simplifications required to ensure the compatibility of the mechanization procedure with a small storage capacity onboard computer. Finally, the utilization of the display is described relative to training and combat applications, and suggestions for further refinement and enhancement are outlined. (Author)

A74-41896 # Flight vehicle electrical power supply systems (Sistemy elektrosnabzheniia letatel'nykh apparatov). V. T. Morozovskii, I. M. Sindeev, and K. D. Runov. Moscow, Izdatel'stvo Mashinostroenie, 1973. 420 p. 40 refs. In Russian.

An analysis is made of the static and dynamic characteristics of modern flight vehicle electrical power supply systems. Particular attention is paid to stable-frequency ac electrical power supply systems. In this analysis electrical power supply systems are considered as multidimensional mutually coupled automatic control systems. A method of analyzing and synthesizing devices for controlling and protecting electrical power supply systems is developed which is based on the use of contact and contactless logic elements and integrated circuits. Methods of choosing the optimal structures of electrical power supply systems are presented. It is shown that a special feature of aeronautical electrical power supply systems - namely, the fact that the electrical power generation channels operating in parallel are of the same type - makes it possible to considerably simplify the study of such systems. A.B.K.

A74-41900 # Testing of fuels for jet aviation engines (Ispytaniia topliv dlia aviatsionnykh reaktivnykh dvigatelei). V. A. Piskunov and V. N. Zrel'ov. Moscow, Izdatel'stvo Mashinostroenie, 1974. 200 p. 127 refs. In Russian.

Methods of determining the properties and quality of jet fuels for a variety of engines and purposes are described. All the standard and experimental methods, ground and flight testing, equipment, testing benches, and fuel rating procedures are covered. Topics include the interdependence of fuel and engine characteristics, classification of test methods, fuel composition, determination of the hydrocarbon content, oxygen and nitrogen compounds, sulphur derivatives, solid microimpurities, determination of operating properties, evaluation of volatility, flash point in air, tendency to electrification, burning characteristics, carbon deposition, corrosiveness, low temperature properties, use of proving stands, stands with pumps and filters, injection-nozzle stands, application of information gained from tests on the proving stand, testing of fuels under flight conditions, organization of flight testing, and the future of fuel testing in jet aviation. J.K.K.

A74-41959 # A study of the antiwear properties of certain foreign jet fuels on the basis of their adsorptivity (Issledovanie protivoiznosnykh svoistv nekotorykh zarubezhnykh reaktivnykh topliv po ikh adsorbtsionnoi sposobnosti). V. P. Lazarenko, I. V. Rozhkov, A. A. Markov, Z. A. Sablina, G. B. Shirokova, and V. N. Gusevskii. *Khimiia i Tekhnologiiia Topliv i Masel*, no. 8, 1974, p. 46. 47. 7 refs. In Russian.

A74-42055 # The feasibility of an aircraft propelled by solar energy. F. G. Irving and D. Morgan (Imperial College of Science and Technology, London, England). *AIAA, MIT, and SSA, International Symposium on the Technology and Science of Low Speed and Motorless Flight, 2nd, Cambridge, Mass., Sept. 11-13, 1974, AIAA Paper 74-1042*. 10 p. 14 refs.

In 1954, Raspet proposed that a solar-powered aircraft might be possible. Solar cells would be incorporated in the wing and the electrical output used for propulsion. This proposal is reexamined in the light of current technology and it is concluded that machines with power requirements less than 100 w/sq n of wing area are feasible. For a given power per unit wing area, there is an optimum combination of span and aspect ratio giving minimum total power. Optimum aspect ratios all lie between 12.5 and 15. Likely configurations would have large wing spans, upward of 25 m. A machine capable of flying for several hours per day under favorable conditions is feasible, but the cost would be high and the payload small. The performance of sailplanes of more normal size could be improved significantly by the use of solar energy. Thermal-cycle power plants do not seem to offer any advantage compared with electrical systems. (Author)

A74-42059 # Investigation of a stored energy launch system for gliders. D. R. Jackson and M. K. Pearson (Connecticut University, Storrs, Conn.). *AIAA, MIT, and SSA, International Symposium on the Technology and Science of Low Speed and Motorless Flight, 2nd, Cambridge, Mass., Sept. 11-13, 1974, AIAA Paper 74-1047*. 10 p. 6 refs.

The energy required to launch a glider to soaring altitude may be readily stored in the form of compressed air in a package of sufficiently small size and weight to replace the passenger in a two-place glider. Although the candidate propulsion system, a compressed air driven rocket nozzle package chosen for simplicity and light weight, was found to be incapable of providing the full amount of impulse necessary to reach soaring altitude, the concept could find use as a source of impulse-producing ballast capable of an altitude gain of several hundred feet. A computer program to predict glider flight characteristics during propulsor operation was prepared and a 1/4 scale operating propulsion system was fabricated and tested on a thrust stand. The total impulse measured agreed well with that predicted by a thermodynamic analysis of system performance. (Author)

A74-42076 * # Skylab technology electrical power system. A. P. Woosley (NASA, Marshall Space Flight Center, Huntsville, Ala.), O. B. Smith, and H. S. Nassen (Martin Marietta Aerospace, Denver, Colo.). *American Astronautical Society, Annual Meeting, 20th, Los Angeles, Calif., Aug. 20-22, 1974, Paper 74-129*. 19 p.

The solar array/battery power systems for the Skylab vehicle were designed to operate in a solar inertial pointing mode to provide power continuously to the Skylab. Questions of power management are considered, taking into account difficulties caused by the reduction in power system performance due to the effects of structural failure occurring during the launching process. The performance of the solar array of the Apollo Telescope Mount Power System is discussed along with the Orbital Workshop solar array performance and the Airlock Module power conditioning group performance. A list is presented of a number of items which have been identified during mission monitoring and are recommended for electrical power system concepts, designs, and operation for future spacecraft. G.R.

A74-42367 Survey of space applications of monopropellant hydrazine propulsion systems. R. L. Sackheim (TRW Systems Group, Combustion Systems Laboratory, Redondo Beach, Calif.). In: *International Symposium on Space Technology and Science*, 10th, Tokyo, Japan, September 3-8, 1973, Proceedings. Tokyo, AGNE Publishing, Inc., 1973, p. 149-175. 17 refs.

The principal purpose of this paper is to review developments in the field of hydrazine propulsion systems and to look at how this experience might be used to meet future requirements for more advanced spacecraft applications. In particular, this experience can help the spacecraft designer narrow down the various design options to a given set of proven hardware that best meets his set of design constraints. To provide proper insight into the current level of technology, typical problems encountered during design and ground testing of hydrazine propulsion systems are described. Requirements typical of current spacecraft applications and how they translate into specific component design details are reviewed. A summary of existing hardware for representative programs such as ATS, Intelsat III and IV, CTS, Pioneer 10 and 11, Mariner 69, Mariner 73, Viking and many others is presented. A brief discussion of the thrust levels currently available ranging from 0.1 lbf to 600 lbf and the qualification and flight status of the hardware is included. (Author)

A74-42411 **Theoretical analysis of molecular interaction with surface in heat pipes.** T. Matsushita (National Space Development Agency of Japan, Minatoku, Tokyo, Japan) and K. Oshima (Tokyo, University, Tokyo, Japan). In: International Symposium on Space Technology and Science, 10th, Tokyo, Japan, September 3-8, 1973, Proceedings. Tokyo, AGNE Publishing, Inc., 1973, p. 571-578.

In order to analyze the characteristics of a heat pipe, the one-dimensional evaporation-condensation flow field between two parallel liquid surfaces with different temperatures is treated in the context of the kinetic theory of gas using the one-dimensional BGK equation, assuming that the vapor gas is one dimensional. The finite element method is applied to this problem. The distributions of the temperature and the number density between the two surfaces and the net mass flux from the hot surface to the cold one are obtained for flows with several temperature ratios and Knudsen numbers.

(Author)

A74-42413 **Theoretical study of heat pipe.** H. Kimura (Mitsubishi Electric Corp., Kamakura, Kanagawa, Japan) and Y. Kuriyama (Tokyo, University, Tokyo, Japan). In: International Symposium on Space Technology and Science, 10th, Tokyo, Japan, September 3-8, 1973, Proceedings. Tokyo, AGNE Publishing, Inc., 1973, p. 587-593.

A technique for controlling the effective condensing area of a heat pipe by a noncondensable gas is very useful to keep the heat source temperature within a small range of variation, regardless of a large heat flux variation. In order to determine the design factors of a gas-loaded heat pipe, the temperature distribution in the pipe must be known. Analytical methods were developed to predict the temperature distribution in that region, using the finite-element method. These methods were programmed for solution by digital computer, which, using the input information regarding the fluid and vapor characteristics, the condenser dimension, and the operating condition, gives the distributions of the gas mole-fraction and the temperature.

(Author)

A74-42427 **Cadmium sulphide thin film solar cell for power generation.** N. J. Nair, M. P. R. Panicker, and M. K. Mukherjee (Indian Space Research Organization, Vikram Sarabhai Space Centre, Trivandrum, India). In: International Symposium on Space Technology and Science, 10th, Tokyo, Japan, September 3-8, 1973, Proceedings. Tokyo, AGNE Publishing, Inc., 1973, p. 705-712. 9 refs.

In the background of the ever increasing power crisis associated with air pollution and dwindling earth resources, the critical application of solar cells not only for the satellite energy conversion system but also for generation of electricity by solar power station on geosynchronous orbit is reviewed. An assessment of the efficiencies of various solar cell materials has revealed the comparative advantage of thin film CdS solar cells for which the development process is described, including proposed methods to further improve upon the performance of the cell. (Author)

A74-42428 **Increased power for spacecraft by cooler solar cell panels.** R. L. Statler, F. J. Campbell, B. J. Faraday, and J. A. Eisele (U.S. Navy, Naval Research Laboratory, Washington, D.C.). In: International Symposium on Space Technology and Science, 10th, Tokyo, Japan, September 3-8, 1973, Proceedings.

Tokyo, AGNE Publishing, Inc., 1973, p. 713-718. Navy-supported research.

Since solar cells are more efficient as the temperature is lowered, a significant increase in available power can be achieved by improved techniques of heat conduction and dissipation. Solar cell temperatures can be reduced during illumination by providing heat conducting paths to cooler parts of the satellite such as internal satellite structural members and to surfaces having high thermal emittance. This has been carried out by the replacement of conventional solar cell panel substrates with materials which combine the advantages of lighter weight, improved structural strength, and increased thermal conductivity. Other techniques are the use of printed circuit technology and wrap-around contact solar cells for more effective heat conduction from the solar cell panels to the cooler satellite interior. (Author)

A74-42429 **Shadow effect analysis of solar array.** S. Tsushima, T. Orii, M. Mizushima, and H. Hara (Nippon Electric Co., Ltd., Yokohama, Japan). In: International Symposium on Space Technology and Science, 10th, Tokyo, Japan, September 3-8, 1973, Proceedings. Tokyo, AGNE Publishing, Inc., 1973, p. 719-727. 6 refs.

This paper describes the method of shadowed solar array analysis when the solar array is shadowed by elements such as antennas or probes and the computer program with its calculated data. The method of shadowed solar array analysis consists of two calculating portions. In the first portion, the shadow effect of solar array is calculated by the assumed method when any sized solar array is effected by any sized shadow. In the second portion, using these data as the input data of solar panel power program, the total power of shadowed solar array is predicted. The predicted power can be displayed by the V-I curve, or V-P curve of solar array characteristic on the X-Y plotter analogically, and this display is very significant for the solar array design. (Author)

A74-42994 # **Thermodynamic analysis of a solar power generator with a closed-cycle gas-turbine converter (Termodinamicheskii analiz solnechnoi energoustanovki s gazoturbinnym preobrazovatelem zamknutogo tsikla).** L. M. Drabkin (Tashkentskii Institut Inzhenerov Zhелеznodorozhnogo Transporta, Tashkent, Uzbek SSR). *Geliotekhnika*, no. 3, 1974, p. 13-22. 6 refs. In Russian.

A74-43138 # **Non-steady-state two-phase heat exchange during heating of a riser main with dry saturated steam (Nestatsionarnyi dvukhfaznyi teploobmen pri progreve vertikal'nogo truboprovoda sukhim nasyschennym parom).** D. A. Pereverzev and V. Ia. Shpak (Akademiia Nauk Ukrainskoi SSR, Institut Tekhnicheskoi Teplofiziki, Kharkov, Ukrainian SSR). *Teplofizika i Teplotekhnika*, no. 26, 1974, p. 132-136. In Russian.

A74-43202 # **Power plant controls - 'The system'.** C. G. White (Ministry of Defence /Procurement Executive/, London, England). In: Symposium on the Application of Electrical Control to Aircraft Propulsion Systems, London, England, February 20, 21, 1974, Proceedings. London, Royal Aeronautical Society, 1974. 4 p.

Some general considerations on the nature of total jet engine control systems are brought forward. System control by digital means opens the possibility of adaptive control systems using modern control theory. Using truly digital techniques for implementing and adapting control functions and by using new processing methods, enormous improvements can be made in the flexibility and

power of the tool that the digital engineer is offering to the accessory engineer. Interplay of ideas between the digital engineer and the accessory designer must inevitably lead to new digitally inspired methods of controlling fuel flow and aerodynamics of engines. P.T.H.

A74-43203 # The development of electrical systems for powerplant control. R. Kendell (Ultra Electronics, Ltd., London, England). In: Symposium on the Application of Electrical Control to Aircraft Propulsion Systems, London, England, February 20, 21, 1974, Proceedings. London, Royal Aeronautical Society, 1974. 15 p.

The present work traces the development of electrical control for aircraft engine power from 1946 to the present, summarizing the basic features of some representative designs. The period 1950-1960 saw the use of magnetic amplifiers in speed and temperature limiters. The first full authority electrical control system entered service in 1956. Developmental progress from then on meant increased safety and integrity. Integrated circuits suitable for analog controllers became available in 1963 in the form of monolithic dc amplifiers. By 1967, controllers designed with a mixture of proprietary silicon integrated circuits, tantalum thin-film resistor networks, and conventional components had been demonstrated. The impact of microelectronics has been such that functional packaging densities have increased by an order of magnitude compared with the magnetic amplifier systems which were predominant up until the early 1960's. P.T.H.

A74-43206 # Power complex - A suitable case for treatment. J. W. Howden and A. M. Lewis (Rolls-Royce /1971/, Ltd., Bristol, England). In: Symposium on the Application of Electrical Control to Aircraft Propulsion Systems, London, England, February 20, 21, 1974, Proceedings. London, Royal Aeronautical Society, 1974. 16 p.

The present work examines some of the factors governing the choice of control system for a new aircraft engine. A fully electronic control system is apt to be the most desirable one when the control requirements are complex, where there is high probability of increasing complexity during development, and when the equipment can be aircraft mounted. The problem of complexity growth during development is illustrated by a case in point: the development of the primary nozzle control philosophy for the Olympus 593 engines of the Concorde. Digital controllers are widely hailed as the systems of the future - they offer great advantages such as improved accuracy, simple modification by reprogramming, better safety, and flexibility in the use of space capacity. Several disadvantages of digital systems must, however, be considered. With them, it is not possible to make instant datum adjustments, and electrical interference, both emitted and received, is of far more consequence in digital than in analog equipment. P.T.H.

A74-43524 Hydrogen as energy carrier - Present status and future aspects (Wasserstoff als Energieträger - Gegenwärtiger Stand und zukünftige Aspekte). C. Keller (Gesellschaft für Kernforschung mbH, Karlsruhe, West Germany). *Naturwissenschaftliche Rundschau*, vol. 27, Sept. 1974, p. 370-372. In German.

It is pointed out that hydrogen is currently being widely considered as the secondary energy source of the future to be used in addition to the electric current. Basic questions of hydrogen technology are concerned with the processes for obtaining the hydrogen and approaches for its transportation and storage. Neither the direct decomposition of water nor a cyclic process provides at present an economic answer for acquiring the needed hydrogen. It is concluded that the utilization of hydrogen as a basic secondary energy carrier lies still as much in the future as possibly the use of fusion or solar energy for the solution of mankind's energy problems. G.R.

A74-43812 Direct energy conversion - A materials problem. S. P. Seth (Regional Engineering College, Kurukshetra, India). *Institution of Electronics and Telecommunication Engineers, Journal*, vol. 20, Jan.-Feb. 1974, p. 19-24. 7 refs.

Electrical energy is the most convenient form of energy to which all other forms of energy may be converted. With increasing understanding of the physical behavior of matter and with progress in material technology, it is becoming possible to convert energy more and more directly into electricity. The object of the paper is merely to point out the multiplicity of the problems in the materials field which arise from some of these new developments. (Author)

A74-43973 A thermoelectric device based on beta-alumina solid electrolyte. N. Weber (Ford Motor Co., Dearborn, Mich.). *Energy Conversion*, vol. 14, Aug. 1974, p. 1-8. 15 refs.

Design description and theoretical analysis of a model beta-alumina solid electrolyte thermoelectric generator (TEG). The beta-alumina TEG possesses several attractive features. Under ideal no-load conditions the thermodynamic efficiency approaches the Carnot limit. Electrical power outputs of 500 mW/sq cm appear achievable. If an electromagnetic pump or wick is used, the only moving part is circulating sodium. The engineering of a practical device can take advantage of current technologies for fabrication of beta-alumina ceramics and for handling of molten alkali metals. The utility of such a device depends largely on the long term durability of the solid electrolyte in sodium or sodium vapor at high temperature about which little is known. M.V.E.

A74-43974 The potential impacts of solar energy. M. Wolf (Pennsylvania, University, Philadelphia, Pa.). *Energy Conversion*, vol. 14, Aug. 1974, p. 9-20. 14 refs.

It is shown that solar energy, available within the country in abundant, inexhaustible, distributed supply, can fill an important role in the future mix of energy sources, without causing chemical or thermal pollution or waste disposal problems. While an all-solar energy future should not be considered, neither should an all-nuclear or all-coal future be. Solar energy can be expected to be utilized in applications in which it will be most practical and economical, particularly for the supply of distributed consumers. It is expected that 5 per cent of the total national energy consumption of the year 2000 could be supplied from solar energy, and 25-30% of the consumption of the year 2020. M.V.E.

A74-44040 An 8% efficient layered Schottky-barrier solar cell. W. A. Anderson, A. E. Delahoy, and R. A. Milano (Rutgers University, New Brunswick, N.J.). *Journal of Applied Physics*, vol. 45, Sept. 1974, p. 3913-3915. 11 refs. Research supported by the Exxon Enterprises and NSF.

An 8.1% efficient 1-sq cm Schottky-barrier solar cell has been fabricated using a layered Schottky barrier on 2-ohm-cm p-type silicon with a 100 crystallographic line orientation. Reproducible results have been obtained on the layered structure which involves 44-A Cr adjacent to the silicon to obtain good photovoltaic voltage and a 58-A Cu overlayer to decrease cell resistance. The layered structure provides good control of barrier height, resistance, and optical transmission. Application of this approach should produce a 15% efficient Schottky solar cell and be readily applied to thin-film silicon solar cells when high-quality thin silicon films have been developed. (Author)

A74-44126 Combustion technology: Some modern developments. Edited by H. B. Palmer (Pennsylvania State University, University Park, Pa.) and J. M. Beer (Sheffield, University, Sheffield, England). New York, Academic Press, Inc., 1974. 468 p. \$32.50.

Recent works dealing with both fundamental and advanced concepts in the analysis of the combustion process are presented. Some of the topics covered include equilibria and chemical kinetics in flames, corrosion and deposits in combustion systems, flame stabilization in high velocity flow, heat transfer from nonluminous

flames in furnaces, magnetohydrodynamics and electrogasdynamics of combustion systems, temperature measurements and gas analysis in flames and plasmas using spectroscopic methods, and an introduction to stirred reactor theory applied to design of combustion chambers.

P.T.H.

A74-44132 Magnetohydrodynamics /MHD/ and electrogasdynamics /EGD/ of combustion systems. J. Swithenbank (Sheffield, University, Sheffield, England). In: Combustion technology: Some modern developments. New York, Academic Press, Inc., 1974, p. 275-290. 11 refs.

Theoretical analysis of magnetohydrodynamic and electrogasdynamic processes taking place in combustion systems. The parameters of an efficient MHD generator are calculated in order to determine what would be the requirements for the MHD duct and the combustion products. Analysis of an EGD generator is performed, calculating various factors that affect conversion efficiency.

P.T.H.

A74-44133 Combustion aspects of MHD power generation. S. Way (Westinghouse Research Laboratories, Pittsburgh, Pa.). In: Combustion technology: Some modern developments.

New York, Academic Press, Inc., 1974, p. 291-319. 29

refs.

The present work describes and compares various approaches to obtaining high-temperature gases with good conducting properties from the combustion of fuels for use as the working element in an open-cycle MHD power generating system. Combustors described include laboratory-scale combustion chambers, combustors for liquid or gaseous fuels for pilot or prototype MHD plants, and coal-fired combustion chambers such as those that might be used in MHD central stations. For liquid or gaseous fuels, combustion chambers can be designed and built for MHD systems either by following the principles of vortex burner design, or using a straight-through flow with a mixing device at the upstream end. For coal-fired combustion chambers, experimental work with ram-jet or plug-flow-type combustors has shown that coal can be burned successfully.

P.T.H.

A74-44225 # Wind power and the vertical-axis wind turbine developed at the National Research Council. R. S. Rangi, P. South, and R. J. Templin (National Aeronautical Establishment, Ottawa, Canada). *Canada, National Research Council, Division of Mechanical Engineering and National Aeronautical Establishment, Quarterly Bulletin*, no. 2, 1974, p. 1-14.

A contour line map is given for estimated wind power distribution over Canada. The map shows large areas with high wind power potentials. A comparison of wind energy with alternate energy sources in terms of cost indicates that the capital cost of current wind machines has to be reduced considerably in order to make wind power competitive with existing sources. The design features, performance and economics of a vertical-axis wind turbine are discussed. The turbine was developed at the National Research Council in Ottawa.

V.Z.

A74-44408 # Heat pipe model accounting for variable evaporator and condenser lengths. C. L. Williams (Westinghouse Bettis Atomic Power Laboratory, Pittsburgh, Pa.) and G. T. Colwell (Georgia Institute of Technology, Atlanta, Ga.). *AIAA Journal*, vol. 12, Sept. 1974, p. 1261-1267. 15 refs.

A correlation model is established for the steady-state performance of a horizontal heat pipe operating below the capillary limited heat rate and with internally self adjusting evaporator and condenser lengths. The length along which condensation occurs is found to depend on the axial vapor Reynolds number. The partially saturated evaporator length, and the corresponding length along which evaporation occurs is found to depend on the detail wick geometry and the evaporator meniscus radius. These dependencies are corroborated by experimental data from a cylindrical heat pipe with working fluids of water and methanol. The experimental wick consists of two layers of 100 mesh stainless steel screen separated by a thin liquid region. Comparison of correlation predictions to experimental results of this study and others show agreement to within 15%.

(Author)

A74-44423 # Fuel optimality of cruise. R. L. Schultz (Honeywell, Inc., Minneapolis, Minn.). *Journal of Aircraft*, vol. 11, Sept. 1974, p. 586, 587.

Consideration of the problem of finding the aircraft trajectory from an initial velocity, altitude, and range to a final velocity, altitude, and range using minimum fuel. It is shown that for a higher order set of equations which has lift and thrust as control variables, the necessary condition for optimization including the generalized Legendre-Clebsch condition are satisfied at the cruise point, so that the partial throttle cruise condition is a candidate for the minimum fuel/fixed range problem.

P.T.H.

A74-44470 Semiconductor-electrolyte interface devices for solar energy conversion. T. S. Jayadeviah (Wisconsin, University, Milwaukee, Wis.). *Applied Physics Letters*, vol. 25, Oct. 1, 1974, p. 399, 400. 5 refs.

A new application of the well-known semiconductor-electrolyte interface is reported. The space-charge layer necessary for photovoltaic processes is simply created in the semiconductor-electrolyte interface by the charge transfer process. Application of this interface for solar energy conversion is quite interesting. These cells avoid the costly and elaborate p-n junction fabrication and allow the use of polycrystalline and amorphous semiconductors for photovoltaic conversion.

(Author)

A74-44564 # Plasma heating and confinement in systems with beta much less than 1. M. S. Rabinovich (Akademii Nauk SSSR, Fizicheskii Institut, Moscow, USSR). In: International Conference on Phenomena in Ionized Gases, 11th, Prague, Czechoslovakia, September 10-14, 1973, Invited Papers. Prague, Československá Akademie Ved, 1973, p. 509-539. 30 refs.

Review of the present state of research on plasma confinement in toroidal systems with beta much less than 1. Following some comments on cost estimates in connection with the construction of a thermonuclear power station and a suggested schedule of development of a demonstration reactor, the results of research on particle diffusion in toroidal systems according to neoclassical and pseudoclassical theories are cited, as well as the results of studies of plasma confinement in tokamaks and stellarators. Finally, some attempts to achieve ion confinement in tokamak systems and stellarators by ohmic or high-frequency plasma heating are described.

A.B.K.

A74-44844 A critical review of the theorems of thermodynamic availability, with concise formulations. I - Availability. R. W. Haywood (Cambridge University, Cambridge, England). *Journal of Mechanical Engineering Science*, vol. 16, June 1974, p. 160-173. 44 refs.

A74-45022 # Optimization of an ultralow-voltage transistorized converter (Optimizatsiia sverkhnizkovol'nogo tranzistornogo preobrazovatel'ia). M. M. Glibitskii, S. F. Kravtsov, L. A. Sukhman, and G. I. Khanukov (Khar'kovskii Politekhicheskii Institut, Kharkov, Ukrainian SSR). *Problemy Tekhnicheskoi Elektrodinamiki*, no. 45, 1974, p. 90-94. 5 refs. In Russian.

Consideration of the problem of optimizing autonomous energy sources consisting of an isotopic heat source and a thermoelectric or thermionic converter of thermal energy into electrical energy. A method of analytically determining the optimal values of the

induction, the transformer current density, the conversion frequency, and the number of parallel-connected transistors of an ultralow-voltage converter of an autonomous energy system is considered for the case where the optimization criterion is minimum weight of the system as a whole. A.B.K.

A74-45025 # **Electrodynamic forces in a MHD engine (Elektrodinamicheskie usiliia v MGD-dvizhitеле).** V. I. Bondarenko, A. A. Afonin, and I. V. Khimiuk (Akademiia Nauk Ukrainskoi SSR, Institut Elektrodinamiki, Kiev, Ukrainian SSR). *Problemy Tekhnicheskoi Elektrodinamiki*, no. 46, 1974, p. 94-99. In Russian.

Analysis of the electrodynamic characteristics of a cylindrical inductive MHD engine. The electromagnetic field and electrodynamic forces are calculated for a liquid metal circuit. Expressions are derived for computer calculation of the electrodynamic forces as functions of dimensionless geometrical and electrical parameters of the circuit. V.Z.

A74-45135 **A linear synchronous motor for high-speed ground transport.** G. R. Slemmon, R. A. Turton, and P. E. Burke (Toronto, University, Toronto, Canada). (*Institute of Electrical and Electronics Engineers, Annual International Magnetism Conference, 12th, Toronto, Canada, May 14-17, 1974.*) *IEEE Transactions on Magnetism*, vol. MAG-10, Sept. 1974, p. 435-438. 9 refs. Research supported by the Canadian Institute for Guided Ground Transport.

This paper describes a linear synchronous motor which has been designed to propel a 500 km/hr electro-dynamically-levitated vehicle. Superconducting magnets on the vehicle interact with an aluminum-cable winding built into the guideway. Following a description of the motor, a coupled-circuit model is derived and used to optimize the winding configuration and to predict the performance of the motor. An inverter which acts as a controllable current source is used with the motor. (Author)

A74-45139 **The calculation of eddy losses in guideway conductors and structural members of high-speed vehicles.** P. E. Burke, R. A. Turton, and G. R. Slemmon (Toronto, University, Toronto, Canada). (*Institute of Electrical and Electronics Engineers, Annual International Magnetism Conference, 12th, Toronto, Canada, May 14-17, 1974.*) *IEEE Transactions on Magnetism*, vol. MAG-10, Sept. 1974, p. 462-465. 5 refs. Research supported by the Canadian Institute of Guided Ground Transport.

Magnetic fields produced by superconducting magnets on high speed guided vehicles may produce intolerably large eddy losses in armature and stabilization windings as well as in structural steel components unless proper precautions are taken. This paper describes an approximate method of calculating the eddy losses and illustrates the method by calculating the losses for a proposed linear synchronous motor. (Author)

A74-45299 **Absorber for solar power.** W. R. Powell (Johns Hopkins University, Silver Spring, Md.). *Applied Optics*, vol. 13, Oct. 1974, p. 2430-2435. 9 refs.

A simple, economical absorber utilizing a new principle of operation to achieve very low reradiation losses while generating temperatures limited by material properties of quartz is described. Its performance is analyzed and indicates approximately 90% thermal efficiency and 73% conversion efficiency for an earth-based unit with moderately concentrated (about tenfold) sunlight incident. It is consequently compatible with the most economic of concentrator mirrors (stamped) or mirrors deployable in space. Space applications are particularly attractive, as temperatures significantly below 300 K are possible and permit even higher conversion efficiency. (Author)

A74-45300 * # **Overview of NASA aeronautical propulsion research and technology program.** H. W. Johnson (NASA, Office of Aeronautics and Space Technology, Aeronautical Propulsion Div.,

Washington, D.C.). *International Council of the Aeronautical Sciences, Congress, 9th, Haifa, Israel, Aug. 25-30, 1974, Paper 74-51*. 10 p.

The program discussed is aimed at improving performance within an extended operating range, reducing weight, increasing service life, achieving greater cost effectiveness, reducing noise and exhaust pollution, and improving means of energy conservation. The program places emphasis on basic research in numerous related technical disciplines, system analysis, component technology, full scale propulsion system studies, and technology demonstrations. Much attention in the discussion is given to noise and pollution minimization research. V.P.

A74-45377 * # **A brief summary of the attempts to develop large wind-electric generating systems in the U.S.** J. M. Savino (NASA, Lewis Research Center, Cleveland, Ohio). *Styrelsen for Teknisk Utveckling, Wind Energy Conference, Stockholm, Sweden, Aug. 29, 30, 1974, Paper*. 16 p. 11 refs.

Interest in developing large wind-electric generating systems in the United States was stimulated primarily by one man, Palmer C. Putnam. He was responsible for the construction of the largest wind-power system ever built - the 1250 kilowatt Smith-Putnam wind-electric plant. The existence of this system prompted the U.S. Federal Power Commission to investigate the potential of using the winds as a source energy. Also, in 1933 prior to Putnam's effort, there was an abortive attempt by J. D. Madaras to develop a wind system based on the Magnus effect. These three projects comprise the only serious efforts in America to develop large wind driven plants. In this paper, the history of each project is briefly described. Also discussed are some of the reasons why wind energy was not seriously considered as a major source of energy for the U.S. (Author)

A74-45380 * # **The NASA Langley building solar project and the supporting Lewis solar technology program.** R. G. Ragsdale and D. Namkoong (NASA, Lewis Research Center, Cleveland, Ohio). *International Solar Energy Society, Annual Meeting, Fort Collins, Colo., Aug. 19-23, 1974, Paper*. 33 p. 8 refs.

A solar energy technology program is described that includes solar collector testing in an indoor solar simulator facility and in an outdoor test facility, property measurements of solar panel coatings, and operation of a laboratory-scale solar model system test facility. Early results from simulator tests indicate that non-selective coatings behave more nearly in accord with predicted performance than do selective coatings. Initial experiments on the decay rate of thermally stratified hot water in a storage tank have been run. Results suggest that where high temperature water is required, excess solar energy collected by a building solar system should be stored overnight in the form of chilled water rather than hot water. (Author)

A74-45381 * # **Flat-plate collector performance determined experimentally with a solar simulator.** R. W. Vernon and F. F. Simon (NASA, Lewis Research Center, Cleveland, Ohio). *International Solar Energy Society, Annual Meeting, Fort Collins, Colo., Aug. 19-23, 1974, Paper*. 20 p. 11 refs.

The NASA is constructing a new office building at Langley Research Center that will utilize solar energy for heating and cooling. A collector technology program is described which includes testing collectors in an indoor facility under simulated solar radiation. Tests have been conducted on five collectors to date and performance data are presented. The collector performance obtained with the solar simulator will be correlated with data obtained by conducting tests outdoors at Lewis. (Author)

A74-45382 * # **Spectral reflectance properties of black chrome for use as a solar selective coating.** C. E. McDonald (NASA, Lewis Research Center, Cleveland, Ohio). *International Solar Energy*

Society, Annual Meeting, Fort Collins, Colo., Aug. 19-23, 1974, Paper, 11 p.

The NASA-Lewis Research Center has determined that a widely available commercially electroplated decorative finish known as black chrome has desirable solar selective properties. Black chrome electroplated coating has high absorbance in the solar spectrum and low emissivity in the 250 F blackbody thermal spectrum. The spectral reflectance properties of a commercially prepared black chrome on steel have been measured. Values are presented for reflectance of the black chrome, and compared with the reflectance of black paint and with two available samples of black nickel which had been prepared for solar selective properties. The reflectance of black chrome, of the two black nickels, and of black paint integrated over the solar spectrum for air mass 2 were 0.132, 0.123, 0.133, and 0.033, respectively. The reflectance of the black chrome, two black nickels, and of the black paint integrated over the blackbody spectrum for 250 F from 3 to 15 microns are 0.912, 0.934, 0.891, and 0.033, respectively. These reflectance measurements indicate absorptivity-to-emissivity values of 9.8, 13.8, 8.0, and 1.00, respectively. (Author)

A74-45383 * # **Terrestrial applications of FEP-encapsulated solar cell modules.** A. F. Forestieri and A. F. Ratajczak (NASA, Lewis Research Center, Cleveland, Ohio). *Deutsche Gesellschaft für Luft- und Raumfahrt, International Conference on Photovoltaic Power Generation, Hamburg, West Germany, Sept. 25-27, 1974, Paper, 22 p.*

FEP-encapsulated solar cell modules and arrays have been designed and built expressly for terrestrial applications. System design including solar cell array mechanical design and the approach to system sizing is outlined. Such solar cell systems have been installed at six sites. Individual modules have undergone marine environment tests. Results from seven months of operation indicate that the system is meeting its electrical design requirements. No mechanical degradation has been reported. An array on Mammoth Mountain, California has been damaged by rime ice but shows no loss in electrical output. Marine environment tests on single modules have shown that elements of the module must be completely sealed by the FEP. Based on the limited test data available, the FEP-encapsulated solar cell module appears well suited to terrestrial applications. (Author)

A74-45384 * # **Advanced Rankine and Brayton cycle power systems - Materials needs and opportunities.** S. J. Grisaffe and D. C. Guentert (NASA, Lewis Research Center, Cleveland, Ohio). *American Society for Metals, Materials for Power Systems Meeting, Seven Springs, Pa., June 17-19, 1974, Paper, 26 p. 10 refs.*

Conceptual advanced potassium Rankine and closed Brayton power conversion cycles offer the potential for improved efficiency over steam systems through higher operating temperatures. However, for utility service of at least 100,000 hours, materials technology advances will be needed for such high temperature systems. Improved alloys and surface protection must be developed and demonstrated to resist coal combustion gases as well as potassium corrosion or helium surface degradation at high temperatures. Extensions in fabrication technology are necessary to produce large components of high temperature alloys. Long-time property data must be obtained under environments of interest to assure high component reliability. (Author)

A74-45721 **Surface-catalyzed anodes for hydrazine fuel cells. I - Preparation of the substrate.** S. G. Meibuhr (GM Research Laboratories, Warren, Mich.). *Electrochemical Society, Journal*, vol. 121, Oct. 1974, p. 1264-1270. 18 refs.

A74-45951 # **Fundamentals of the theory and calculation of heat pipes (Osnovy teorii i rascheta teplovykh trub).** M. M. Levitan and T. L. Perel'man (Akademiia Nauk Belorusskoi SSR, Institut Teplo- i Massoobmena, Minsk, Belorussian SSR). *Zhurnal Tekhnicheskoi Fiziki*, vol. 44, Aug. 1974, p. 1569-1591. 25 refs. In Russian.

Construction of a consistent theory of heat pipes, and rigorous formulation of the problem of calculating heat pipes, considering the processes of heat and mass transfer in the shell and in the cavity of the heat pipe simultaneously. A detailed analysis is made of the coupling conditions on the inner surface of the shell. For the case of high-temperature pipes in which alkali metals are used as the coolant the problem is formulated with allowance for chemical transformations of the vapors of these coolants. For a correct formulation of the problem of heat-pipe optimization a condition of operation of heat pipes is formulated which allows for the reaction between flows of vaporizing and condensing material onto the phase-transition surface. The results of two series of computer calculations of heat pipes are presented, one of these series being devoted to a determination of the nature of the large variations of the vapor temperature in the pipe cavity observed by Ivanovskii et al. (1970), while the other series concerns problems of heat-pipe optimization. A.B.K.

A74-46001 **Heat transfer - A review of 1973 literature.** E. R. G. Eckert, E. M. Sparrow, R. J. Goldstein, C. J. Scott, E. Pfender, and W. E. Ibele (Minnesota, University, Minneapolis, Minn.). *International Journal of Heat and Mass Transfer*, vol. 17, Nov. 1974, p. 1287-1317. 746 refs.

A74-46110 **Convective heat transfer in a pipe in the case of a heat supply varying over the length.** Iu. N. Kuznetsov and A. I. Dostov (Vsesoiuznyi Teplotekhnicheskii Institut, Moscow, USSR). *(Teplofizika Vysokikh Temperatur*, vol. 12, Jan.-Feb. 1974, p. 111-115.) *High Temperature*, vol. 12, no. 1, Sept. 1974, p. 96-99. 7 refs. Translation.

Construction of formulas for calculating the convective heat transfer in a turbulent coolant flow in a pipe with an arbitrary heat-load distribution along the pipe length. The heat-transfer characteristics in arbitrary cross sections for an arbitrary heat-supply law are determined on the basis of a study of the stabilized heat transfer far from the inlet, using a certain specially chosen heat-supply law. This approach involves determining the Green's function for a boundary value problem which describes the temperature field in a fluid flow in the presence of turbulence in a circular pipe. The calculations are performed for a range of Reynolds numbers from 10,000 to 1,000,000 and for Prandtl numbers from 0.7 to 100. A.B.K.

A74-46446 **New knowledge concerning liquid propellant preparation and its application to rocket engines (Neue Erkenntnisse in der Flüssigtreibstoffaufbereitung und ihre Anwendung auf Raketenriebwerke).** W. Buschulte (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Trauen, West Germany). *(Hermann-Oberth-Gesellschaft, Raumfahrtkongress, 23rd, Salzburg, Austria, June 25-29, 1974.) Astronautik*, vol. 11, no. 3, 1974, p. 85-89. 19 refs. In German.

It is pointed out that adequate theoretical models exist for the vaporization and combustion of liquid propellants. However, for the application of these models in the design of rocket combustion chambers it is necessary to have information regarding the drop-size distribution of the propellant at the start of the vaporization process. Investigations were, therefore, conducted with the objective to develop a general system of relations concerning the drop-size distribution as a function of injection system variables. Basic considerations regarding liquid atomization are discussed along with the design and the operational parameters of the studied injection systems. The application of the derived drop-size distribution relations in the calculation of the combustion characteristics is also described. G.R.

A74-46641 # Efficiency of charged particle source for electrodynamic generators. G. W. Malaczynski (Polska Akademia Nauk, Instytut Maszyn Przeplywowych, Gdansk, Poland). *Académie Polonaise des Sciences, Bulletin, Série des Sciences Techniques*, vol. 22, no. 6, 1974, p. 49 (537)-53 (541). 7 refs.

A two-fluid model of a charged particle source for an electrodynamic generator is presented and treated theoretically. Adopting the well known field-charging model, a system of partial differential equations which constitute the charge conservation laws for free ions and ions associated with neutral particles was found and solved for a moving medium with the aid of related boundary conditions. It is proven that the algebraic system obtained, which is transcendental with respect to the volume distribution of ions associated with initially neutral particles, is suitable for source efficiency estimation. (Author)

A74-46700 # Numerical methods of solving a class of extremal problems (Numericke metode za resavanje jedne klase ekstremalnih problema). V. Simonovic (Beograd, Univerzitet, Belgrade, Yugoslavia). In: Yugoslav Aerocosmonautics Conference, 1st, Belgrade, Yugoslavia, May 19, 20, 1973, Communications. Number 2. Belgrade, Jugoslovensko Aerokosmonauticko Drustvo, 1973, p. 141-145. In Serbo-Croatian.

Development of an approach to the solution of a class of extremal control problems which is based on the approximation of a partial differential equation by a finite-difference equation. The theoretical bases for the use of the gradient method in solving this problem are outlined, and certain numerical difficulties that can arise in the application of this method are indicated. A.B.K.

STAR ENTRIES

N74-29411* + New Mexico Univ., Albuquerque. Energy Information Center.

HYDROGEN ENERGY: A BIBLIOGRAPHY WITH ABSTRACTS. CUMULATIVE VOLUME, 1953 - 1973

Kenneth E. Cox 1 Jan. 1974 633 p refs Sponsored by NASA
(NASA-CR-138940; TAC-H-74-500) Avail: NTIS HC \$34.75 CSCL 10A

A bibliography on hydrogen as an energy source is presented. Approximately 8,000 documents are abstracted covering the period 1953 through 1973. Topics covered include: production, utilization, transmission, distribution, storage, and safety. E.J.O.

N74-29413* # TRW Systems Group, Redondo Beach, Calif.
DEVELOPMENT OF A UNINTERRUPTED POWER SYSTEM: ac AND dc TO dc CONVERTER

D. L. Cronin and A. D. Schoenfeld Jul. 1973 30 p refs
(Contract NAS3-15827)
(NASA-CR-134497) Avail: NTIS HC \$4.50 CSCL 10B

This program covered the design, fabrication and testing of an advanced development model uninterrupted power system. The input and output requirements imposed on the power processor were specified such that the unit is electrically interchangeable with existing power systems used by the Federal Aviation Administration in installations which have a history of failure due to electrical transient conditions. Input power is from either of two single-phase ac power sources or batteries with electronic selection and transfer between power sources. Battery reconditioning is automatic when either ac source is present. The output power is rated at 840W; the nominal output is 24V at 35A. Within the 840W limit, the regulated output voltage is adjustable from 22V to 30Vdc. Protection against continuous overloading or short circuit is provided. The unit is packaged in a standard 19-inch rack mount configuration with 7-inch panel height. Controls are on the front panel with power input and output through connectors on the rear surface. Cooling is by free convection from fin areas located on the side and rear panels. The packaged unit weighs 52.8 lbs., which can be reduced significantly if a three-phase ac power source is used. Author

N74-29414* # Pennsylvania State Univ., University Park.
ELECTRODE KINETICS OF A WATER VAPOR ELECTROLYSIS CELL. Final Report, 15 Aug. 1971 - 30 Jun. 1974
Geoffrey Jacobs Jul. 1974 157 p refs
(Grant NGR-39-009-123)
(NASA-CR-139369) Avail: NTIS HC \$11.00 CSCL 10A

The anodic electrochemical behavior of the water vapor electrolysis cell was investigated. A theoretical review of various aspects of cell overvoltage is presented with special emphasis on concentration overvoltage and activation overvoltage. Other sources of overvoltage are described. The experimental apparatus controlled and measured anode potential and cell current. Potentials between 1.10 and 2.60 V (vs NHE) and currents between 0.1 and 3000 mA were investigated. Different behavior was observed between the standard cell and the free electrolyte cell. The free electrolyte cell followed typical Tafel behavior (i.e. activation overvoltage) with Tafel slopes of about 0.15, and the exchange current densities of 10 to the minus

9th power A/sq cm, both in good agreement with literature values. The standard cell exhibited this same Tafel behavior at lower current densities but deviated toward lower than expected current densities at higher potentials. This behavior and other results were examined to determine their origin. Author

N74-29415* # National Aeronautics and Space Administration.
Lewis Research Center, Cleveland, Ohio.
THE NASA PROGRAM FOR STANDARDIZING SILICON SOLAR CELLS

W. J. Bilano and A. F. Forestieri Aug. 1974 3 p ref Presented at the 9th Intersoc. Energy Conversion Eng. Conf., San Francisco, 26-30 Aug. 1974
(NASA-TM-X-71563; E-7995) Avail: NTIS HC \$3.00 CSCL 10A

The program is discussed which was initiated to formulate standard silicon solar cell and cover specifications. The program includes (1) compilation of solar cell and cover specifications, both past and present (2) elicitation of inputs from major users and suppliers and (3) establishment of tentative standardized solar cell and cover specifications. Author

N74-29416* # National Aeronautics and Space Administration.
Langley Research Center, Langley Station, Va.

ELECTROLYTIC CELL DESIGN Patent Application

David F. Putnam (McDonnell-Douglas Corp.) and Richard L. Vaughan, inventors (to NASA) (McDonnell-Douglas Corp.) Issued 8 Feb. 1974 10 p Sponsored by NASA
(NASA-Case-LAR-11042-1; US-Patent-Appl-SN-440916) Avail: NTIS HC \$4.00 CSCL 10A

An electrolytic cell is made up of a stack of polysulfone plates faced with sheets of platinum bonded by silicone rubber and mechanically secured to their plates by Teflon screws having heads serving as spacers between opposed platinum sheets. NASA

N74-29417* # Linguistic Systems, Inc., Cambridge, Mass.
SEA'S EXAMINATION OF WINDPOWER IN 1952: CHANGE OF A WIND POWER MILL FROM DIRECT CURRENT TO ALTERNATING CURRENT PRODUCTION

J. Juul Washington NASA Jul. 1974 19 p Transl. into ENGLISH from Elektroteknikeren (Copenhagen), no. 10, 22 May 1953 p 193-197
(Contract NASw-2482)

(NASA-TT-F-15439) Avail: NTIS HC \$4.00 CSCL 10A

A wind power mill built in 1942 in Denmark is described. Various factors influencing the amount of electricity supplied by the mill are indicated. An experiment is described for changing the mill so that it could produce alternating current to be channeled into SEAS's high voltage cable. The principal wiring diagram for the wind power mill is depicted. Author

N74-29418* # Bureau of Mines, Morgantown, W.Va.
BUREAU OF MINES ENERGY PROGRAM, 1973
John D. Spencer and Bill Linville 1974 80 p refs
(BM-IC-8651) Avail: NTIS HC \$7.00

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

N74-29419* # Kentucky Univ., Lexington. Inst. for Mining and Minerals Research.
GASIFICATION AND LIQUEFACTION OF KENTUCKY

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

O. W. Stewart and V. K. Dhir. Dec. 1973. 56 p. refs. Sponsored by the Dept. of Commerce, Frankfort, Ky.
 Avail: NTIS HC \$6.00

The feasibility for gasification and liquefaction of Kentucky coals is considered. The relationships between availability and the economics of production and transportation of coal and its conversion products are explored in some detail. In this regard, the present network of waterways, rail, and truck transportation, and large scale fluid pipelines to major consuming areas are analyzed.
 Author

N74-29420# National Science Foundation, Washington, D.C.

SOLAR ENERGY PROGRAM

A. J. Eggers, Jr. 13 Nov. 1973. 223 p. refs.
 (WASH-1281-9) Avail: NTIS \$14.25

Development of proof-of-concept experiments and demonstration projects are discussed for each of the following subprograms of the Solar Energy Program: (1) heating and cooling of buildings; (2) solar-thermal conversion; (3) wind energy conversion; (4) ocean-thermal conversion; (5) bioconversion; and (6) photovoltaic conversion. The objectives, particularly those of widespread application and commercialization, that will have been accomplished by 1979 are specifically delineated. Each of the six programs is analyzed under the following headings: (1) subprogram summary; (2) status of technology; (3) rationale for Federal involvement and institutional arrangements for implementation; (4) criteria and priorities; (5) alternative research and development programs; and (6) implementation. Research and project titles, and submitting organization of the proposals considered by the panel are listed.
 NSA

N74-29423# Texas Univ., Austin. Bureau of Economic Geology.

TOWARD A NATIONAL POLICY ON ENERGY RESOURCES AND MINERAL PLANT FOODS

Samuel P. Ellison, Jr. 1973. 138 p. refs.
 (PB-230248/7) Avail: NTIS HC \$4.75 CSCL 10A

A report is made on the first of the university conferences concerning what our national policy should be on oil, gas, coal, nuclear, geothermal, solar sources on energy resources and on all varieties of mineral plant foods. Directions on what policy should be taken on educational endeavor are included.
 GRA

N74-29424# Boston Coll., Chestnut Hill, Mass. Dept. of Physics.

RESEARCH ON LOW COST SILICON SOLAR CELL STRUCTURE FOR LARGE ELECTRICAL POWER SYSTEMS

Semiannual Progress Report, 1 Jan. - 30 Jun. 1973

P. H. Fang. Sep. 1973. 19 p.
 (Grant NSF GI-34975)

(PB-228879/3; NSF-RA/N-73-057;

NSF-RANN/SE/GI-34975-73-2) Avail: NTIS HC \$3.00 CSCL 10B

A wide variety of steel substrates, as well as molybdenum and tungsten substrates, were investigated for the deposition of Si films. It was concluded that Si film with a nominal thickness of 10 microns can be grown on all these metal substrates. Si films with preferential orientation with respect to the substrate plane were successfully grown by the evaporation method. The chemical vapor deposition method was investigated. Films are produced by this method with good uniformity and adherence to steel and other substrates that are used in the evaporation method.
 GRA

N74-29425# City Coll. of the City of New York. Dept. of Chemical Engineering.

COMBINED CYCLE SYSTEM STUDIES

Michael J. Gluckman. Jul. 1973. 16 p.
 (Grant NSF GI-34286)

(PB-228876/9; CCERI-102; NSF-RA/N-73-071) Avail: NTIS

The report discusses the effects of air compression ratio on the efficiency of combined gas and steam turbine power generating equipment. Described is a partially supercharged superheating system devised to reduce the high stack temperatures experienced from conventional exhaust fired systems when large amounts of saturated steam are introduced into the steam boiler superheating section.
 GRA

N74-29426# Colorado State Univ., Fort Collins. Dept. of Civil Engineering.

A RATIONAL METHOD FOR EVALUATING SOLAR POWER GENERATION CONCEPTS

George O. G. Lof and Susumu Karaki. May 1973. 12 p. refs.
 (Grant NSF GI-37815)

(PB-227822/4; NSF-RA/N-73-050) Avail: NTIS HC \$3.00 CSCL 10A

Important elements which must be included in a technical and economic analysis of solar power generation and the rationale behind them are discussed. Collector, thermal transport, storage, and heat engine subsystems are appraised and an integrated assembly providing for least cost per unit of electrical power output for varying conditions of operation is assessed. Solar thermal electric power systems are analyzed to establish a basis for more intensive research and development efforts of specific systems.
 Author (GRA)

N74-29427# Delaware Univ., Newark. Inst. of Energy Conversion.

DOMESTIC SOLAR ENERGY SYSTEMS FOR DELAWARE

Virendra Mohan Puri and F. A. Costello. May 1973. 184 p. refs

(Grant NSF GI-34872)

(PB-228039/4; NSF-RA/N-73-026) Avail: NTIS HC \$5.50 CSCL 10B

The economics and performance of domestic solar energy system for Delaware is analyzed. Various performance factors, such as solar array orientation, cell temperature, atmospheric attenuation of solar radiation due to cloud cover, dust and air particle scattering, and water vapor and carbon-dioxide absorption, reflectance from different glass surfaces radiation and convection loss to atmosphere, are accounted in the analysis. Three solar energy systems were analyzed, solar electric only, solar electric only is expensive compared to current fossil-produced electricity, whereas the solar thermal/electric system is promising for the future. The solar thermal only system appears economical even with the current state of art.
 Author (GRA)

N74-29428# Delaware Univ., Newark. Inst. of Energy Conversion.

FLAT PLATE COLLECTORS WITH Cds SOLAR CELLS AND FIRST INDICATIONS OF FEASIBILITY FOR THEIR LARGE SCALE USE

K. W. Boer, N. Freedman, H. Hadley, W. Nelson, K. Selcuk, C. E. Birchenall, J. Olson, and L. Partain. 1 Jun. 1973. 23 p. refs

(Grant NSF GI-34872)

(PB-227958/6; NSF-RA/N-73-018;

NSF-RANN/SE/GI-34872/TR-73-1) Avail: NTIS HC \$3.00 CSCL 10B

Results of life testing of CdS/Cu₂S solar cells indicate that life expectancies in excess of 20 years under terrestrial conditions may be possible if temperatures are limited to below 50C. Such solar cells are incorporated in flat plate collectors currently deployed on the roof of the Delaware solar house. These collectors are described together with a means to limit their operating temperature. The cells can be substantially simplified without marked loss of conversion efficiency and may be produced at a rate of 10th to the 7th power sq m/year for less than \$10/sq m.
 Author (GRA)

N74-29429# Office of Science and Technology, Washington, D.C. Energy Advisory Panel.

AN ASSESSMENT OF NEW OPTIONS IN ENERGY RESEARCH AND DEVELOPMENT

Nov. 1973 297 p refs Sponsored in part by NSF
(PB-229725/7; AET-9) Avail: NTIS HC \$6.75 CSCL 10A

The options for national energy research and development were considered. A framework was developed to intercompare the benefits of disparate R and D activities and, within that framework eleven technological areas were evaluated: resource extraction, solar energy, geothermal energy, coal utilization, advanced cycles for power generation, alternate breeder reactors, fusion, hydrogen and other synthetic fuels, electrical transmission, transportation and urban and residential energy use. R and D programs were recommended in each of these areas. GRA

N74-29430# Wisconsin Univ., Madison. Engineering Experiment Station.

MODELING OF SOLAR HEATING AND AIR CONDITIONING Semiannual Progress Report, 1 Jan. - 30 Jan. 1973

W. A. Beckman and J. A. Duffie 31 Jul. 1973 21 p refs
(Grant NSF GI-34029)
(PB-228877/7; NSF-RA/N-73-088;
NSF-RANN/SE/GI-34029/PR-73-2) Avail: NTIS HC \$4.00
CSCL 13A

Processes for application of solar energy to heating, cooling and service hot water supply of buildings are comprised of components which function in interrelated manner. The components include: solar energy collector, storage unit, service hot water facility, air conditioner, space heater, auxiliary energy source, associated controls and the building. In this work, the transient thermal performances of these components is mathematically modeled, the models are programmed, and the complete system is operated in particular climates using appropriate meteorological data. A first system has been modeled based on water heating collectors, water storage tanks, lithium bromide-water absorption cooler (with cooling tower) and associated equipment. It has operated on a residential type building in Albuquerque climate. The thermal analysis shows integrated energy supplied from solar and auxiliary energy through a year. Based on this thermal analysis a preliminary cost analysis is made to compare solar and conventional systems. GRA

N74-29431# Army Electronics Command, Fort Monmouth, N.J. LOW POWER METHANOL-AIR BATTERY

John Jr. Perry Apr. 1974 24 p ref
(DA Proj. 1S7-62705-AH-94)
(AD-779183; ECOM-4213) Avail: NTIS CSCL 10/2

An increased need for low power, long life power supplies has become apparent with the development of transistorized military communications and surveillance equipments. In view of this, a set of test specifications approximating characteristic performance requirements was defined in order to establish the feasibility criteria for a low power methanol-air-battery. An energy density of 88 Wh/lb was set as a goal, at a continuous drain of 45 mW for 2,000 hours, with the capability of response to 15 W pulses for 6 seconds at 10-minute intervals. A 9-cell battery stack was fabricated in-house for test and evaluation under the 45 mW/15 W load profile. The teflon-bonded anode was catalyzed with 75% palladium/25% platinum and the cathodes catalyzed with silver. The total weight of the battery stack, activated with 655 ml of methanol electrolyte mixture, was 5.6 lb. Performance is reported. GRA

N74-29432# Naval Ordnance Lab., White Oak, Md. THEORETICAL SIMULATION OF THE PERFORMANCE OF MOLTEN SALT THERMAL BATTERIES Technical Report, Jun. 1971 - Jun. 1973

Alan S. Kushner Aug. 1973 29 p refs
(AD-779269; NOLTR-74-24) Avail: NTIS CSCL 10/3

A computer program for the Thermal and Electrical Analysis of Batteries (TEAB) has been developed as a tool for the computer-aided design of molten salt thermal batteries. TEAB solves the coupled set of equations describing the temperature distribution within a molten salt cell and the electrical characteristics of the cell. Heat generation due to start-up heat source,

electrochemical phenomena, and the flow of electric current within the cell are all included. The program calculates the spatial and time temperature variation within the cell during start-up and during cell operation, checks for a satisfactory molten electrolyte zone for cell operation, and calculates the cell voltage-current characteristics as a function of time. TEAB has been utilized in the Li-Cl₂ Battery Development Program at the Naval Ordnance Laboratory. (Modified author abstract) GRA

N74-29433# EIC, Inc., Newton, Mass. LITHIUM - INORGANIC ELECTROLYTE BATTERIES Quarterly Report, 16 Dec. 1973 - 15 Mar. 1974

David R. Cogley and Michael J. Turchan May 1974 42 p refs
(Contract DAAB07-74-C-0030; DA Proj. 1T1-61102-A-34A)
(AD-779477; C-401-2; ECOM-0030-2-74; QR-2) Avail: NTIS
CSCL 10/3

An all-inorganic electrolyte, lithium primary battery operable over the temperature range -40 to -160F is being evaluated. The desired energy density is 150 watt-hours per pound of total battery weight and the desired power density is 50 watts per pound. Discharge characteristics of the Li/LiAlCl₄-SOCl₂/C system were obtained at -40, -72, and 160F. Chemical analysis of precipitates formed in carbon electrodes of cells discharged at ambient temperature provided information on reaction stoichiometry. For each equivalent of Li oxidized, one mole of LiCl precipitated in or on the carbon electrode. The weight gain of the carbon electrode was due solely to LiCl precipitation. No other insoluble salt was formed. There was evidence for sulfur formation on discharge at -40F. Pressures were observed when cells were discharged at 160F. They are higher than the expected SOCl₂ vapor pressures, and result from gases not condensable at room temperature. (Modified author abstract) GRA

N74-29434# Minnesota Univ., Minneapolis. RESEARCH APPLIED TO SOLAR-THERMAL POWER SYSTEMS Semiannual Progress Report, 1 Jul. - 31 Dec. 1972

G. Betz, W. B. Bienert, E. R. G. Eckert, J. M. Hammer, and R. C. Jordan Jan. 1973 56 p refs Prepared in cooperation with Honeywell, Inc., Minneapolis, Minn.
(Grant NSF GI-34871)
(PB-231591/9; NSF-RA/N-73-066;
NSF-RANN/SE/GI-34871/PR-72-4) Avail: NTIS HC \$5.75
CSCL 10B

The function of a solar-thermal power system is to supply solar-generated heat to the turbines of an electric power plant. The basic system presently being considered under this program is composed of an array of collectors (consisting of a parabolic reflector which concentrates and directs the solar radiation onto a heat pipe absorber tube in which the energy is transferred to a fluid), a transfer loop (a system of pipes which transports the energy to the power plant proper), and optionally an energy storage system to provide energy during no sunshine hours. Systems being studied represent current state of technology, but should not be construed as final designs. They represent only baselines from which trade-offs and component research can be conducted. GRA

N74-29435# Minnesota Univ., Minneapolis. RESEARCH APPLIED TO SOLAR-THERMAL POWER SYSTEMS Semiannual Progress Report, 1 Jan. - 30 Jun. 1973

E. R. G. Eckert Jul. 1973 221 p refs Prepared in cooperation with Honeywell, Inc., Minneapolis
(Grant NSF GI-34871)
(PB-231592/7; NSF-RA-N-73-101;
NSF-RANN/SE/GI-34871/PR-73-2) Avail: NTIS HC \$14.00
CSCL 10B

Research activities performed during the period from January 1, 1973 to June 30, 1973 are reported. The studies encompassed the solar concentrator the solar absorber coating, the heat pipe, the transfer loop, and heat storage containment vessels. With respect to the concentrator, analysis has provided

definitive information on tracking, shadowing of adjacent collectors, concentration ratio, and concentrator dimensions. Tests were made of the life characteristics of the concentrator reflective coatings and of the absorber surface coating. Operating characteristics of candidate heat pipes have been determined both by analysis and experiments. System studies provided information on heat loss and pressure drop for steady operation of the transfer loop and for the transient behavior initiated by the absence of insolation. The corrosion of containment walls in the presence of phase-change heat storage materials was studied by depth profiling with Auger electron spectroscopy. GRA

N74-29436# Minnesota Univ., Minneapolis.

RESEARCH APPLIED TO SOLAR-THERMAL POWER SYSTEMS Semiannual Progress Report, 1 Jul. - 31 Dec. 1973

E. M. Sparrow, J. W. Ramsey, and G. K. Wehner Jan. 1974 211 p refs Prepared in cooperation with Honeywell, Inc., Minneapolis (Grant NSF G1-34871)

(PB-231593/5; NSF-RA-N-74-005;

NSF-RANN/SE/G1-34871/PR/73/4) Avail: NTIS HC \$5.75

This report documents the research and development efforts during the period from July 1, 1973 to December 31, 1973. A scaled model of a solar collector module has been designed and fabricated. Life testing of candidate mirror coatings for the solar concentrator have continued. The performance of solar absorber coatings at various elevated temperatures has been investigated. Heat pipe tests were performed to examine the compatibility of stainless steel and copper containment materials, with water as a working fluid. The nighttime cooling and subsequent early morning warming of the pipelines and other fluid-carrying components of the transfer loop were analyzed. Computations were performed to determine the effect of daytime variations of insolation on the heat losses and pumping energy. Steady-state operating characteristics of three transfer loop configurations were computed. GRA

N74-29437# Tyco Labs., Inc., Waltham, Mass.

LITHIUM-NICKEL SULFIDE BATTERIES Final Report, 16 May - 14 Nov. 1973

Hari Vaidyanathan, Paul Malachuk, and Gerhard Holleck Feb. 1974 26 p refs

(Contract F19628-73-C-0271; AF Proj. 8659)

(AD-779691; AFCRL-TR-74-0081) Avail: NTIS CSCL 10/3

Studies have been carried out on the development of Ni3S2-impregnated plaque electrode structures for use as positive plates of high discharge rate capability in nonaqueous electrolyte lithium batteries. Achievement of reasonable Ni3S2 loadings in nickel plaques requires conversion of NiSO4 to Ni3S2 before each impregnation to avoid rehydration/dissolution of the nickel sulfate which apparently limits the attainable loadings. Electrochemical evaluation of Ni3S2-impregnated plaque structures in simple Li cells has shown that such positive electrode structures can be discharged at rates up to processor. (Modified author abstract) GRA

N74-29438# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

NEW ELECTROCHEMICAL SOURCES OF ENERGY

V. S. Bagotskii 16 Apr. 1974 21 p refs Transl. into ENGLISH from Zh. Vses. Khim. Obshchest. (USSR), v. 16, no. 6, 1971 p 685-690

(FTD Proj. T74-04-03)

(AD-779175; FTD-HT-23-0012-74) Avail: NTIS CSCL 10/3

The translation briefly reviews the history and state of the art of electrochemical current sources, including galvanic cells, storage batteries, and fuel cells. GRA

N74-29439# Oak Ridge National Lab., Tenn.

EFFECTS OF ELECTROMAGNETIC PULSE (EMP) ON THE

SUPERVISORY CONTROL EQUIPMENT OF A POWER SYSTEM Final Report

James K. Baird and Nicholas J. Frigo Oct. 1973 137 p refs Sponsored by AEC

(AD-779268; ORNL-4899) Avail: NTIS CSCL 10/2

The study assesses the damage caused by EMP to relays and other equipment forming the supervisory control circuits of a power system. Electromechanical relays are nearly impervious to damage and false operation due to EMP. Semiconductor relays are expected to be quite sensitive to both. Countermeasures are proposed to limit damage and prevent false operation of supervisory control circuits. Author (GRA)

N74-29440# Tennessee Univ., Knoxville. Dept. of Chemistry.

HIGH ENERGY CATHODES FOR FUSED SALT BATTERIES

Final Report, 11 Dec. 1972 - 10 Mar. 1974

G. Mamantov, R. Marassi, and J. Q. Chambers Apr. 1974

35 p refs

(Contract DAAB07-73-C-0060; DA Proj. 1T0-61102-A-34A)

(AD-779385; ECOM-0080-F-73) Avail: NTIS CSCL 10/3

Several compounds have been tested as potential cathodes in batteries using low-melting molten chloroaluminate (AlCl3-NaCl mixtures) solvents and aluminum metal anodes. Fluorinated graphite with different fluorine content, binary and ternary intercalation compounds, such as C-WCl6 and C-AlCl3-Cl2, several quinones, and positive iodine and sulfur cations have been studied. The latter, involving positive oxidation state of sulfur, is the most promising cathode system of those studied (S(sub n) (m-)/Al) (Modified author abstract) GRA

N74-29487# Bureau of Mines, Laramie, Wyo. Energy Research Center.

SOME EFFECTS OF PRESSURE ON THE HYDROCRACKING OF CRUDE SHALE OIL COBALT MOLYBDATE CATALYST

C. M. Frost and P. L. Cottingham Jan. 1974 16 p refs

(PB-229482/5; BM-RI-7835) Avail: NTIS HC \$3.00 CSCL 21D

Crude shale oil produced by gas-combustion retorting of Green River oil shale was hydrocracked over a cobalt molybdate catalyst at operating pressures of 500, 1,000, 1,500, and 3,000 psig, an operating temperature of 890F, and a liquid hourly space velocity of 1.0. Hydrogen feed rate was maintained at 6,000 scf/bbl. The volume-percent yields of total liquid product were directly proportional to the operating pressure. Weight-percent conversion and volume-percent yields of gasoline were directly proportional to the log of the operating pressure. Catalyst deposit percentages were inversely proportional to the log of the operating pressure. Nitrogen and sulfur removal rates as well as saturation of the liquid products increased as the operating pressure was increased. Author (GRA)

N74-29546# Battelle-Northwest, Richland, Wash.

USE OF LINEAR PROGRAMMING TO MODEL BUSINESS AND CONSUMER DECISION MAKING RELATED TO ENERGY CONSUMPTION

D. E. Deonigi 1973 32 p refs Presented at the Oper. Res. Soc. of Am., San Diego, 12-14 Nov. 1973 Sponsored by AEC (BNWL-SA-4843; Conf-731130-2) Avail: NTIS HC \$3.75

Models that predict the response of business and consumers to changes in energy cost have been made previously, but with today's erratic economy, the models do not apply. Prices are rising at an unprecedented rate and the availability and environmental controls also influence the choice of fuels as well as price. With these factors, the new linear programming was designed to determine the electrical generation supply for the next 50 years taking into account the advent of nuclear power. The model is formulated to simulate a schedule of building power plants that will supply projected energy requirements while also satisfying constraints representing material balances, technological introduction rate constraints, fuel price step functions, committed plant construction, and fuel-processing capacity. NSA

N74-29617# Army Foreign Science and Technology Center, Charlottesville, Va.

THE MOTOR VEHICLE WHICH AS YET DOESN'T EXIST
V. Demidov 24 Jan. 1974 11 p Transl. into ENGLISH from Znanie-Sila (USSR), no. 3, 1972 p 16-18

(AD-777644; FSTC-HT-23-171-73) Avail: NTIS CSCL 13/6

Concepts for propulsion systems to be used with automobiles which will reduce the air pollution produced by exhaust gases and also conserve finite sources of energy are presented. The use of a system consisting of electric motors, and electric battery, and a Stirling cycle engine to charge the battery is emphasized. External combustion engines producing steam for power are discussed. The advantages and disadvantages of the systems are analyzed. Author

N74-29620# Sundstrand Aviation-Rockford, Ill.
TRANSMISSION STUDY FOR TURBINE AND RANKINE CYCLE ENGINES

M. A. Cordner and D. H. Grimm 15 Dec. 1972 186 p refs (Contract EPA-68-04-0034) (PB-229879/2; SA/AER-657; APTD-1558) Avail: NTIS CSCL 13F

A study was initiated to quantitatively assess the technical and economic feasibility of existing and potential types of transmissions most suitable for the gas turbine and rankine cycle engines. The study was accomplished through a two-phase, multi-task program which included: (1) evaluation of transmission types through a feasibility study and ultimate selection of a transmission type, and (2) evaluation of the selected transmission type through design calculations and layouts, performance analysis, control system analysis, and cost analysis. A number of different types of transmission were initially evaluated including conventional multi-shift, hydrostatic, hydrokinetic, electric, belt/chain, hydromechanical, and traction types. GRA

N74-30069# California Univ., Los Angeles. School of Engineering and Applied Science.

CATALYSTS FOR AUTOMOTIVE POLLUTION CONTROL DEVICES Final Report, May 1971 - Jun. 1973

Ken Nobe and George L. Bauerle Sep. 1973 164 p refs Sponsored by the Air Resources Board of the State of Calif. (PB-229351/2; UCLA-ENG-7371; ARB-R-PCA-189-73-02) Avail: NTIS HC \$5.00 CSCL 13B

Various catalysts to control nitrogen oxide, carbon monoxide and hydrocarbon emissions from motor vehicle engines were investigated. Catalysts were tested in the laboratory for reactions between NO and CO, NO and H₂, CO and O₂, and for NH₃. Concentrations of the following substances were monitored: NO, CO, CO₂, NO₂, NH₃, hydrocarbons, and in some cases N₂O and O₂. Catalysts tested included rare earth and transition metal oxides, noble metals, Monel, tungsten bronzes, nickel and stainless steel. The best catalysts were exposed to exhaust gases from a dynamometer mounted engine, in a small reactor under simulated oxidizing or reducing conditions. Finally, several catalysts were tested in a prototype two stage converter. Author (GRA)

N74-30121*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

SPECTRAL REFLECTANCE PROPERTIES OF BLACK CHROME FOR USE AS A SOLAR SELECTIVE COATING

Glen E. McDonald 1974 12 p refs Presented at the US Sect. Ann. Meeting of the Intern. Solar Energy Soc., Fort Collins, Colo., 19-23 Aug. 1974

(NASA-TM-X-71596; E-7915) Avail: NTIS HC \$3.00 CSCL 20F

The NASA-Lewis Research Center has determined that a widely available commercially electroplated decorative finish known as black chrome has desirable solar selective properties. The spectral reflectance properties of a commercially prepared black chrome on steel were measured. Values are presented for reflectance of the black chrome, and compared with the reflectance of black paint (Nextel) and with two available samples

of black nickel which had been prepared for solar selective properties. The reflectance of black chrome, of the two black nickels, and of black paint integrated over the solar spectrum for air mass 2 were 0.132, 0.123, 0.133, and 0.033, respectively. The reflectance of the black chrome, two black nickels, and of the black paint integrated over the blackbody spectrum for 250 F from 3 to 15 microns are 0.912, 0.934, 0.891, and 0.033, respectively. These reflectance measurements indicate absorptivity-to-emissivity values of 9.8, 13.8, 8.0, and 1.00, respectively. Author

N74-30169# Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).

BASIC EQUATIONS AND FUNDAMENTAL DATA FOR COMBUSTION MHD GENERATORS

J. Raeder and R. Buende Jul. 1974 225 p refs In GERMAN; ENGLISH summary

(IPP-IV-60) Avail: AEC Depository Libraries HC \$13.25

The basic equations of magnetogasdynamics are summarized. From these general equations a set of stationary one-dimensional flow equations and a simplified Ohm's law are derived for special application to MHD channel flow. The method of calculating the plasma composition, thermodynamic functions and transport properties in general is described and applied to typical combustion MHD generator plasmas. This section also includes a collection of momentum transfer cross-sections for collisions between electrons and heavy particles typical of seeded combustion gases. The next section presents the treatment of turbulent boundary layers and closely related phenomena such as wall friction, heat losses and electrode drops. In the last section, these methods and data are applied to the calculation of real combustion MHD flows. The main part of this section presents the numerical methods used in our computer program and typical results. Author (NSA)

N74-30185# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MAGNETOHYDRODYNAMIC GENERATORS

E. I. Yantovskii and I. M. Tolmach 9 Apr. 1974 763 p refs Transl. into ENGLISH from the monograph "Magnitogidrodinamicheskiye Generatory" 1972 p 1-425

(AD-779787; FTD-MT-24-238-74) Avail: NTIS CSCL 10/2

The monograph discusses problems of the theory, calculation and design of magnetohydrodynamic generators, and also some experimental studies relating to them. GRA

N74-30367*# National Aeronautics and Space Administration, Washington, D.C.

HEAT TRANSFER AND THERMODYNAMICS: A COMPILATION Technology Utilization

[1974] 30 p

(NASA-SP-5959(01)) Avail: NTIS HC \$1.00 CSCL 20M

A compilation is presented for the dissemination of information on technological developments which have potential utility outside the aerospace and nuclear communities. Studies include theories and mechanical considerations in the transfer of heat and the thermodynamic properties of matter and the causes and effects of certain interactions. M.C.F.

N74-30372# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.

DEVELOPMENT OF HEAT PIPE COOLED ANODE FOR XENON ARC LAMP Final Technical Report, Jan. 1973

Jan. 1974

Lloyd A. Nelson Mar. 1974 64 p

(Contract DAAK02-73-C-0113; DA Proj. 1F6-62701-D-466) (AD-777505; FR-74-10-223) Avail: NTIS CSCL 13/10

A heat pipe cooled anode for a 10 KW xenon lamp has been designed, fabricated and tested. The heat pipe was designed to operate at 700C and transfer 4 KW from the anode tip to

ambient air. The heat pipe cooled anode was designed to be integrated into a 10 KW lamp and give normal arc characteristics. The heat pipe anode was fabricated, processed and tested. The heat pipe anode operated successfully, demonstrating the feasibility of heat pipe cooling of lamp anodes, although some problems were encountered and the heat pipe did not reach full design power. Author (GRA)

N74-30382# Committee on Armed Services (U. S. House).
NAVAL PETROLEUM RESERVES

Washington GPO 1973 156 p refs Hearings under authority of H. Res. 185 before Comm. on Armed Serv., 93d Congr., 1st Sess., 17-18 Oct. 1973

(GPO-23-617) Avail: Armed Serv. Investigating Subcomm.

A Congressional investigation was conducted to determine the status of the petroleum resources at the Elk Hills Naval Reserve in California. The area is government owned property and is one of four such government owned oil fields. The statutes protecting the areas are discussed. The manner in which the resources of the oil field are obtained and processed are reported. The overall energy system and the contributions which can be expected from oil reserves are analyzed by selected witnesses.

P.N.F.

N74-30383# Committee on Armed Services (U. S. House).
NAVAL PETROLEUM RESERVES

Washington GPO 13 Nov. 1973 14 p refs Rept. under authority of H. Res. 185 presented to Comm. on Armed Serv., 93d Congr., 1st Sess., 13 Nov. 1973

(GPO-24-028) Avail: SOD HC \$0.25

N74-30384# Federal Power Commission, Washington, D.C.
GUIDELINES FOR ENERGY CONSERVATION FOR IMMEDIATE IMPLEMENTATION; SMALL BUSINESS AND LIGHT INDUSTRIES

Feb. 1974 25 p

(FPC/OCE/1) Avail: NTIS HC \$4.25

Short term measures to improve the efficiency of fuel utilization by small business concerns and light industry are recommended for particular use during the energy crisis of the Winter of 1974. A course of action is considered that implements the following: (1) control of plant space heating; (2) maintenance and adjustment of combustion equipment; (3) adoption of effective process controls; and (4) modification and upgrading of existing equipment. Detailed guidelines are presented which contain information on the specific item to be improved or modified, how energy conservation for that item is attained, how long it will take to implement the measure, and the estimated energy savings involved. A list of professional resources is included to aid management in finding qualified assistance for initiating their own effective energy conservation program. A.A.D.

N74-30386# Committee on Finance (U. S. Senate).

ENERGY WINDFALL PROFITS

Washington GPO 1974 131 p Hearings on Section 110 of S. 2589 before Comm. on Finance, 93d Congr., 2d Sess., 22-23 Jan. 1974

(GPO-28-102) Avail: Comm. on Finance

Testimony relevant to Congressional considerations of a proposal to tax excess or windfall profits in the energy sector is presented. The problems of administration of such a bill, including development of regulations, rulings, and litigation guidelines, are discussed. Corporate management procedures with respect to compliance with the proposed bill are also considered. A definition of income subject to windfall profits tax is submitted.

and general debate includes a discussion of Internal Revenue Service precedents, the probable impact on gasoline and fuel allocations, and the world oil supplies issue. The possibility that a profits tax would discourage domestic energy production is also discussed. A.A.D.

N74-30389# Princeton Univ., N.J. Center for Environmental Studies.

ENERGY CONSERVATION IN HOUSING Progress Report, 1 Jul. 1972 - 30 Jun. 1973

John Fox, Harrison Fraker, Jr., Richard Grot, David Harrie, Elizabeth Schorske, and Robert Socolow Dec. 1973 60 p refs

(Grant NSF GI-34994)

(Rept-6) Avail: NTIS HC \$6.00

A research project was conducted to determine the normal use of energy in private homes. The data describing the consumption of energy have generally been derived from the detailed study of the performance of a dwelling in hypothetical or controlled situations are based on the requirements of some average household living in some standard unit. The activities described in the report are: (1) a statistical analysis of monthly gas consumption in four hundred town houses where gas is used exclusively for heating, (2) a program to develop instrumentation to determine the factors which determine energy utilization in a residence, (3) a close and systematic surveillance of the construction of townhouses and apartments, and (4) a program of interviews with more than thirty individuals who played a role in determining the construction of the townhouses. Suggestions for more efficient energy utilization are proposed. Author

N74-30393# Oak Ridge National Lab., Tenn.

INVENTORY OF CURRENT ENERGY RESEARCH AND DEVELOPMENT

G. M. Caton, J. M. Chilton, J. K. Huffstetler, B. W. Kline, D. C. Michelson, M. P. Guthrie, and G. U. Ulrikson Dec. 1973 632 p refs

(Contract W-7405-eng-26)

(ORNL-EIS-73-63-Vol-1) Avail: NTIS HC \$33.75

An overview is presented of the research and development being done on most aspects of energy sources, electric power, energy uses and health and ecological effects. The inventory consists of data on: (1) 4907 research projects related to energy problems; (2) indices that include information on research facilities, sponsoring agencies, principal investigators, locations where research performed, and permuted title index of research projects; and (3) funding summary tables. A description of the questionnaire package sent to research investigators and organizations is given. Projects on energy sources and projects on electric power are described. NSA

N74-30394# Oak Ridge National Lab., Tenn.

INVENTORY OF CURRENT ENERGY RESEARCH AND DEVELOPMENT

G. M. Caton, J. M. Chilton, J. K. Huffstetler, B. W. Kline, D. C. Michelson, M. P. Guthrie, and G. U. Ulrikson Dec. 1973 574 p refs

(Contract W-7405-eng-26)

(ORNL-EIS-73-63-Vol-2) Avail: NTIS HC \$30.75

Projects on electric power, projects on energy uses and energy (general), and projects on health and ecological effects are described. Author (NSA)

N74-30395# Oak Ridge National Lab., Tenn.

INVENTORY OF CURRENT ENERGY RESEARCH AND DEVELOPMENT. 3. INDICES

G. M. Caton, J. M. Chilton, J. K. Huffstetler, B. W. Kline, D. C. Michelson, M. P. Guthrie, and G. U. Ulrikson Dec. 1973 405 p

(Contract W-7405-eng-26)

(ORNL-EIS-73-63-Vol-3) Avail: NTIS HC \$22.25

This volume, Vol. 3 contains the indices to Vols. 1 and 2, namely: Research Facility Index; Sponsor Index; Investigator Index; Location Index; and Permuted Title Index. NSA

N74-30396# Oak Ridge National Lab., Tenn.

NSF-RANN ENERGY ABSTRACTS. A MONTHLY ABSTRACT JOURNAL OF ENERGY RESEARCH

M. P. Guthrie, ed. Dec. 1973 96 p refs

(Contract W-7405-eng-26)

(ORNL-EIS-73-52-Vol-1-12) Avail: NTIS HC \$7.00

The bibliography covers research on energy sources, electric power (generation, supply and demand, transmission, environmental effects, and use), and energy (production, consumption, supply and demand, and policy). The 56 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

N74-30402# Massachusetts Inst. of Tech., Cambridge. Energy Lab.

TESTIMONY BEFORE THE SUBCOMMITTEE ON ENERGY OF THE COMMITTEE ON SCIENCE AND ASTRONAUTICS, HOUSE OF REPRESENTATIVES

David C. White 23 Jul. 1973 8 p

(Grant NSF G1-32874)

(PB-227885/1; NSF-RA/N-73-048) Avail: NTIS HC \$4.00

CSCL 10A

Recommendations were made that House Bills H.R. 8348 and H.R. 9133 be modified and amplified to include the following general operational features (1) specific ties to mission-oriented agencies such as the proposed ERDA with line item funding for long term core programs of research and special funding for facility development; (2) special authority to involve industry in R and D programs through both joint funding and cooperative programs to assure rapid reduction of research to practice and effective transfer to the industrial sector; (3) the establishment of a limited number of major research laboratories to supplement the National Laboratories with a clear mission for each; and (4) high level government and industry overview committees that will maintain funding and enhance a strong independent management of the research facility. GRA

N74-30407# Army War Coll., Carlisle Barracks, Pa.
THE ENERGY CRISIS: REVISION IN US POLICY TO PRESERVE NATIONAL SECURITY Student Essay

John W. Duffett 22 Oct. 1973 32 p refs

(AD-778886) Avail: NTIS CSCL 05/4

World energy resources are reviewed with emphasis on the energy crisis in the U.S. Domestic and international constraints on the resolution of the energy crisis are analyzed. A revision of the priorities in national security and foreign policy are discussed in terms of our energy requirements between now and 1985. Coal, oil, gas, hydroelectric, nuclear, oil shale, wind, tide, and geothermal are appraised as sources of energy. The conclusion of the essay is that U.S. domestic and foreign policy must be re-evaluated because of the increasing demand for energy. (Modified author abstract) GRA

N74-30444# RAND Corp., Santa Monica, Calif.

SOME COMMENTS ON CONSERVATION IN THE USE OF ENERGY

Deane N. Morris Apr. 1974 26 p Presented at the 39th GAMA Ann. Meeting, San Diego, Calif.

(P-5231) Avail: NTIS HC \$4.50

Energy supply and demand in California are discussed. Suggestions are made concerning the efficient utilization of energy resources. Tabulated data are included. EJO

N74-30445*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

TRANSPORT DYNAMICS OF A HIGH-POWER-DENSITY MATRIX-TYPE HYDROGEN-OXYGEN FUEL CELL

Paul R. Prokopius and Norman H. Hagedorn Washington Aug. 1974 19 p refs

(NASA-TN-D-7757, E-7876) Avail: NTIS HC \$3.00 CSCL 10A

Experimental transport dynamics tests were made on a space power fuel cell of current design. Various operating transients were introduced and transport-related response data were recorded with fluidic humidity sensing instruments. Also, sampled data techniques were developed for measuring the cathode-side electrolyte concentration during transient operation. Author

N74-30446# National Bureau of Standards, Boulder, Colo. Cryogenics Div.

CRYOGENIC H₂ AND NATIONAL ENERGY NEEDS

J. Hord 10 Aug. 1973 24 p refs Presented at the Cryogenic Eng. Conf., Atlanta, 8-10 Aug. 1973

(Paper-N-1) Avail: NTIS HC \$4.25

National and world energy shortages are briefly summarized to demonstrate the relevance of synthetic fuels in satisfying future energy markets. A perspective of national energy needs, as they relate to cryogenic hydrogen fuel, is given. Hydrogen and alternate synthetic fuels are briefly reviewed and potential applications for cryogenic hydrogen are described. Technical research and development efforts, required to satisfy specific current and future national needs, are identified. The mechanism for implementation of synthetic fuels and the indistinct timetable for transition to these fuels are discussed. Author

N74-30447# National Bureau of Standards, Boulder, Colo. Cryogenics Div.

SUPERCONDUCTING ELECTRICAL GENERATORS FOR CENTRAL POWER STATION USE

T. M. Flynn, R. L. Powell, D. B. Chelton, and B. W. Birmingham 10 Aug. 1973 16 p Presented at the 1973 Cryogenic Eng. Conf., Atlanta, 8-10 Aug. 1973

(Paper-M4) Avail: NTIS HC \$4.00 CSCL 10B

Superconductivity applied to electrical generator machine design was investigated in an effort to find a more efficient means of electrical energy production. The specific needs of the commercial, manufacturer, and user sectors in relation to development of the technology were documented. The results of the following three preliminary studies are reported (1) a market appraisal and economic analysis to assess commercial potential and economic impact, including the beneficial effect on import/export balance of trade; (2) applications of superconducting machinery to determine future machinery needs of the electric power industry; and (3) technical problem identification to determine the critical components, materials, and systems, and suggest an appropriate research and development program. Actual experimental construction was precluded because of a lack of funds. Author

N74-30448*# National Aeronautics and Space Administration, Pasadena Office, Calif.

HIGH VOLTAGE, HIGH CURRENT SCHOTTKY BARRIER SOLAR CELL Patent Application

Richard J. Stirn, inventor (to NASA) (JPL) Filed 5 Aug. 1974 15 p

(Contract NAS7-100)
(NASA-Case-NPO-13482-1; US-Patent-Appl-SN-495021) Avail:
NTIS HC \$4.00 CSCL 10A

A Schottky barrier solar cell is described which consists of a layer of wide band gap semiconductor material on which a very thin film of semi-transparent metal is deposited to form the barrier. The layer of the wide band gap semiconductor material is on top of a layer of narrower band gap semiconductor material, to which one of the cell's contacts may be attached directly, or through a substrate. The cell's other contact is a grid structure which is deposited on the thin metal film. NASA

N74-30450# Stanford Univ., Calif.
EFFECT OF CARBON DIOXIDE ON ELECTRODE VOLTAGE FALL ON MHD GENERATOR PERFORMANCE Interim Report

Gary Arnold DuBro Oct. 1973 90 p refs
(Contracts F44620-73-C-0045; F33615-72-C-1088; AF Proj. 6813; AF Proj. 9752)
(AD-779698; SU-IPR-565; AFOSR-74-0776TR) Avail: NTIS CSCL 10/2

A series of experiments were performed to investigate the effect of carbon dioxide concentration on electrode voltage fall in a simulated MHD generator with an argo-carbon dioxide-potassium plasma. It was observed that increases in carbon dioxide addition resulted in very significant increases in electrode voltage drops. The electrode fall increased with the increase of carbon dioxide concentration, the increase of applied current, and the decrease in electrode temperature. Further, the voltage drops were larger at the cathode than at the anode. Experimental electrical conductivities were also reported. Electric fields were applied with a resulting maximum transverse current density of 0.500 amps/cm squared; molecular additions of up to 5% were injected into the stream. A theoretical model for the electron number density and electric potential was postulated and the results were compared with experimental electrode voltage drops. (Modified author abstract) GRA

N74-30451# Wyoming Univ., Laramie. Water Resources Research Inst.

COAL-ENERGY DEVELOPMENT IN THE NORTHERN GREAT PLAINS

Jack R. Davidson Oct. 1973 137 p Prepared in cooperation with North Dakota State Univ. and Montana State Univ., Bozeman Sponsored by the Office of Water Resources Research (PB-231560/4; QWRR-B-024-WYO(1); W74-07056) Avail: NTIS HC \$4.75 CSCL 13B

The growth demand for clean energy has focused attention on western coals, particularly the extensive lignite and sub-bituminous deposits in the Northern Great Plains. The Fort Union Powder River Coal beds, which underlie a large part of northern Wyoming, southeastern Montana and western North Dakota offer the greatest potential for development, because of the vast quantities of coal which can be strip mined. The U.S. Government has undertaken to assess coal/energy development problems through the Northern Great Plains Resources Program (NGPRP). The Water Resource Research Institutes of the three-state area, together with the Office of Water Resources Research, undertook the following tasks; to determine the study needs, to inventory current research efforts and to assess their potential contribution, to establish the priorities for study as seen by the decision makers in the three states, and to assess the capacity of the region's scientists to carry out the needed studies. Eight categories for study were identified; trace elements; atmospheric effects; surface resources (including reclamation); coal resources and mining techniques; water (including water quality); economic and social issues; institutional and legal issues; and technology development. GRA

N74-30509# Bureau of Mines, Pittsburgh, Pa. Energy Research Center.

EVALUATION OF A NOVEL ELECTROPHORETIC SEPARATION

TION METHOD TO REMOVE PYRITIC SULFUR FROM COAL

K. J. Miller and A. F. Baker 1974 17 p ref Sponsored by EPA
(BM-RI-7960) Avail: NTIS HC \$4.00

Electrophoretic mobility measurements of coal and pyrite particles in distilled water revealed a difference between the migration speeds of the two materials toward the anode in a dc electric field. This information led to the development of a laboratory electrophoresis column for separating fine pyrite from coal by utilizing the electrokinetic and the specific gravity differences between coal and pyrite. The study demonstrated on a laboratory scale that pyrite and other impurities can be separated from fine coal by electrophoresis using a stage separation technique. Author

N74-30690*# Nevada Univ., Reno. Mackay School of Mines.

THE GREAT BASIN INVESTIGATION Monthly Progress Report, Jul. 1974

Jack G. Quade, Principal Investigator Jul. 1974 2 p EREP (Contract NAS9-13274)
(E74-10701; NASA-CR-139321) Avail: NTIS HC \$4.00 CSCL 08E

N74-30693*# Eason Oil Co., Oklahoma City, Okla.

AN EVALUATION OF THE SUITABILITY OF ERTS DATA FOR THE PURPOSES OF PETROLEUM EXPLORATION Final Report, Jan. 1973 - Jan. 1974

Robert J. Collins, Principal Investigator, Frederic P. McCown, Leo P. Stonis, Gerald J. Petzel, and John R. Everett Jun. 1974 157 p refs Original contains color illustrations. Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21735)
(E74-10704; NASA-CR-139433) Avail: NTIS HC \$11.00 CSCL 08G

The author has identified the following significant results. ERTS-1 data give exploration geologists a new perspective for looking at the earth. The data are excellent for interpreting regional lithologic and structural relationships and quickly directing attention to areas of greatest exploration interest. Information derived from ERTS data useful for petroleum exploration include: linear features, general lithologic distribution, identification of various anomalous features, some details of structures controlling hydrocarbon accumulation, overall structural relationships, and the regional context of the exploration province. Many anomalies (particularly geomorphic anomalies) correlate with known features of petroleum exploration interest. Linears interpreted from the imagery that were checked in the field correlate with fractures. Bands 5 and 7 and color composite imagery acquired during the periods of maximum and minimum vegetation vigor are best for geologic interpretation. Preliminary analysis indicates that use of ERTS imagery can substantially reduce the cost of petroleum exploration in relatively unexplored areas.

N74-30762*# Eason Oil Co., Oklahoma City, Okla.

AN EVALUATION OF THE SUITABILITY OF ERTS DATA FOR THE PURPOSES OF PETROLEUM EXPLORATION

Robert J. Collins, F. P. McCown, L. P. Stonis, Gerald Petzel, and John R. Everett In NASA. Goddard Space Flight Center 3d ERTS-1 Symp., Vol. 1, Sect. A 1974 p 809-821 Prepared in cooperation with Earth Satellite Corp., Washington, D. C.

(Paper-G17) CSCL 08G

This experiment was designed to determine the types and amounts of information valuable to petroleum exploration extractable from ERTS data and the cost of obtaining the information using traditional or conventional means. It was desired that an evaluation of this new petroleum exploration tool be made in a geologically well known area in order to assess its usefulness in an unknown area. The Anadarko Basin lies in western

or new exploration provinces. For the first time, small and medium size oil companies can rapidly and effectively analyze exploration provinces as a whole. Author

Oklahoma and the panhandle of Texas. It was chosen as a test site because there is a great deal of published information available on the surface and subsurface geology of the area, and there are many known structures that act as traps for hydrocarbons. This basin is similar to several other large epicontinental sedimentary basins. It was found that ERTS imagery is an excellent tool for reconnaissance exploration of large sedimentary basins

N74-30764* Earth Satellite Corp., Washington, D.C.
RELATIONSHIP OF ROOF FALLS IN UNDERGROUND COAL MINES TO FRACTURES MAPPED ON ERTS-1 IMAGERY
 Charles E. Wier (Indiana Geological Survey), Frank J. Wobber, Orville R. Russell, Roger V. Amato, and Thomas V. Leshendok
In NASA. Goddard Space Flight Center 3d ERTS-1 Symp., Vol. 1, Sect. A 1974 p 825-843 refs

(Paper-G19) CSCL 081

ERTS imagery is of unique value for mapping of certain fractures that are not identifiable on aircraft imagery. Because color infrared and ERTS imagery complement each other both sources of data were used to map fractures in western Indiana and eastern Illinois. In the Kings Station Mine, Gibson County, Indiana, most roof falls reported had occurred in areas where mapped fractures were closely spaced and intersecting. Using this information as a basis for extrapolation, roof fall hazard maps were prepared for other mine sites. Various coal resources programs related to energy and environment also were conducted. Author

N74-30882# Bureau of Mines, Laramie, Wyo.
METHODS FOR REFINING CRUDE SHALE OIL PRODUCED BY IN SITU RETORTING

Clyde M. Frost and Philip L. Cottingham Jan. 1974 27 p refs
 (PB-229217/5, BM-RI-7844) Avail. NTIS HC \$3.25 CSCL 081

Crude shale oil produced during in situ combustion retorting experiments by the Bureau of Mines at Rock Spring, Wyoming, was refined by three different processing schemes. The crude oil was fractionated to raw naphtha and 400 F plus residuum in the first experiment. The 400 F plus residuum was hydrogenated over cobalt molybdate catalyst at 815 F and 1,100 psig. An aliquot blend of the raw naphtha and 160 F to 400 F hydrogenated naphtha was hydrogenitrified and then catalytically reformed. The 400 F plus hydrogenated oil was catalytically cracked. The total crude was hydrogenated over nickel-tungsten catalyst at 800 F and 1,500 psig in the second scheme. The third scheme was similar to the second except that prior to the hydrogenation step, the total crude was hydrostabilized over cobalt molybdate at 500 F and 500 psig. (Modified author abstract) GRA

N74-31026# Bureau of Mines, Bartlesville, Okla. Energy Research Center.

WASTE LUBRICATING OIL RESEARCH: SOME INNOVATIVE APPROACHES TO RECLAIMING USED CRANK-CASE OIL

M. L. Whisman, J. W. Goetzinger, and F. O. Cotton 1974 23 p refs
 (BM-RI-7925) Avail. NTIS HC \$4.25

The processes tested for reclaiming used lubricating oil including percolation through both chemically treated clay and ion-exchange resins, distillation through batch and continuous wiped-wall vacuum apparatus, treatment with solvent extraction systems, and chemical removal of impurities with chelating agents. The criteria of evaluation for each treatment was oil recovery and reduction of acidic and metallic components. Both vacuum distillation and solvent treatment ranked high in their abilities to remove acidic and metallic components of the used oil with

good oil recoveries. A combination of the two techniques gave the best overall results in terms of quality evaluations made by established bench tests. Author

N74-31104 Joint Publications Research Service, Arlington, Va.
HYDROLOGIC SERVICING OF GEOLOGICAL EXPLORATION ON THE SEA SHELF

A. Ye. Smoldyrev, S. Ye. Saks, and I. Sh. Gezin *In its Meteorol. and Hydrol.*, No. 5, 1974 (JPRS-62559) 24 Jul. 1974 p 98-105 refs Transl. into ENGLISH from *Meteorol. i Gidrol.* (Moscow), no. 5, 1974 p 69-73

The peculiarities of the geological exploration operations on the sea shelf are described. A study is made of the specific nature of hydrologic servicing of these operations. A number of problems are noted which are subject to solution on interaction of the marine geological and hydrometeorological services. Author

N74-31129# Environmental Protection Agency, Ann Arbor, Mich. Test and Evaluation Branch.

EVALUATION OF GM 1976 PROTOTYPE VEHICLE, A CATALYTIC EXHAUST MANIFOLD SYSTEM

Henry L. Gompf Jun. 1972 10 p
 (PB-218686/4, APTD-1409) Avail. NTIS HC \$3.00 CSCL 13B

A test sequence was conducted on a General Motors prototype using a catalytic exhaust manifold system concept. Due to the consistent success displayed by this system in meeting the required 1976 emission level in the General Motors laboratory, an evaluation program was initiated. Beyond necessary engine modifications, a vehicle was equipped with four major emission controls: (1) A quick heat intake manifold, EFE, to assist in cold start fuel evaporation; (2) a Grace noble metal catalyst for oxidation of hydrocarbon and carbon monoxide; (3) a Gulf noble metal catalyst for reduction of oxides of nitrogen; and (4) an air pump and associated valving to supply air for exhaust port oxidation and oxidizing air to the Grace catalyst bed. The GM prototype system was tested three times from a cold start using the 1975 Federal emission test procedure. It appears that this prototype system is an excellent candidate for extended mileage evaluation. GRA

N74-31144# Los Alamos Scientific Lab., N.Mex.

DATA SHEETS FOR PPO RADIOISOTOPIC FUEL

T. K. Keenan, R. A. Kent, R. N. R. Mulford, and M. W. Shupe Dec. 1973 12 p refs
 (Contract W-7405-eng-36)

(LA-5160-MS(Rev-1)) Avail. NTIS HC \$4.00

The thermal energy of PPO (pure plutonium oxide) fuel results from the radioactive decay of Pu-238 and this energy is converted into usable electric power for space probe or other applications. The basic fuel module associated with the current MHW heat source is a PPO sphere 1.465 + or - 0.015 in. in dia and containing 100 + or - 2 thermal watts. The spheres are individually encapsulated and then assembled into geometric arrays to form the working heat source. Certain properties of PuO₂ with emphasis on behavior at the proposed operational conditions being discussed are listed. Author (NSA)

N74-31147# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.

QUESTION ABOUT THE FEASIBILITY OF AN ALTERNATING NUCLEAR ENGINE

G. Cristea 1973 16 p refs
 (IFA-FR-115-1973) Avail. AEC Depository Libraries HC \$3.00

The possibility is discussed of the direct transformation of nuclear energy into mechanical energy through the agency of an alternating heat engine. Author (NSA)

N74-31233# General Electric Co., Philadelphia, Pa. Space Sciences Lab.

LARGE ENTHALPY EXTRACTION EXPERIMENTS IN A NON-EQUILIBRIUM MAGNETOHYDRODYNAMIC GENERATOR

E. Tate, C. Marston, and B. Zauderer 29 Jul. 1974 13 p refs (Doc-74SD226) Avail: NTIS HC \$4.00

Experiments measuring the performance of a magnetohydrodynamic (MHD) generator are reported. The test gas used was cesium seed neon heated to a temperature of 3520 K in a shock tube. The power output was 1.82 megawatts, with a 19.3% enthalpy extraction. The MHD channel had an area ratio of six to one with seventy-one pairs of electrodes. Theoretical calculations show that if thermionically emitting electrodes were used, 30% enthalpy extraction could be obtained. M.C.F.

N74-31240# Japan Atomic Energy Research Inst., Tokyo. **ANALYSIS OF THE RELAXATION PHENOMENA IN NONEQUILIBRIUM MHD GENERATOR BY FOUR-TERMINAL NETWORK THEORY**

H. Shirakata Mar. 1973 40 p refs In JAPANESE (JAERI-M-5207) Avail: AEC Depository Libraries

By extending the method for two-dimensional analysis of the electrical characteristics of a nonequilibrium MHD generator using four-terminal network theory, the relaxation phenomena in a multielectrode generator was studied. It is possible by this technique to examine the relaxation phenomena in the multielectrode generator as a whole, which usually defies the conventional methods. Numerical calculations were made on the Faraday generator which has 32 electrode pairs and preionizers. The variations in electron density, electron temperature, and output current along the generator channel are evaluated, taking into consideration the effects of wall leakage current and electrothermal instability. Author (NSA)

N74-31257# Atomic Energy Commission, Oak Ridge, Tenn. Technical Information Center.

PROBLEMS ON DEVELOPMENT OF SUPERCONDUCTING POWER TRANSMISSION LINES

N. T. Bendik and E. L. Blinkov, ed. 1973 36 p refs Transl. into ENGLISH from Probl. Sozdaniya Sverkhprovodyashchikh Liniy (Moscow), 1973 36 p (AEC-tr-7509) Avail: NTIS HC \$4.00

The problems in the development of superconducting power transmission lines and their solutions are presented. The following specific topics are considered: (1) analysis of electromagnetic, thermophysical, and hydrodynamic processes that take place in power transmission lines; (2) cryogenic high-voltage insulation, basic requirements on insulation constructions, the types of cryogenic insulation, the advantages of coolant and vacuum as the basic insulation, and the scientific research program on high-voltage insulation; (3) properties of superconducting ac cable (SCC) lines that are largely determined by their transmitting capacity; (4) features of heat exchange and hydrodynamics of SCC; (5) character of pulsation modes and conditions under which they occur; and (6) developing superconducting cables, the problems of measuring the parameters of SCC, automation of measurements, and control, regulation, and safety. NSA

N74-31389 British Library Lending Div., Boston Spa (England). **THE ENERGY POLICY OF THE GERMAN FEDERAL GOVERNMENT**

10 Dec. 1973 49 p Transl. into ENGLISH from the report of the Office of the Federal Min. for Trade and Ind. of the FRG, Bonn, 26 Sep. 1973

(BLL-OA-Trans-886-(6196 3)) Avail. British Library Lending Div., Boston Spa, Engl.: 5 BLL photocopy coupons

The energy supply and demand for Germany are discussed for the present and the future. The changes from a buyers' market with the production surpluses in the sixties to a sellers' market is described, and results show an upward trend in prices. Policies in the various fields of energy supply require intensified international cooperation for the security of long term supply. Energy research of natural gas, brown and hard coal is also discussed. M.C.F.

N74-31390 British Library Lending Div., Boston Spa (England). **THE PROBLEMS OF EFFICIENT UTILIZATION OF NATURAL RESOURCES**

V. Prokudin [1974] 5 p refs Transl. into ENGLISH from Econ. Gazeta (USSR), no. 44, 1973

(BLL-M-23272-(5828 4F)) Avail. British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Problems of environmental protection are briefly discussed. An integrated program is presented for the development of a general and comprehensive program of cooperation in the field of environment protection and the efficient utilization of natural resources. M.C.F.

N74-31394# Committee on Appropriations (U. S. House). **SPECIAL ENERGY RESEARCH AND DEVELOPMENT APPROPRIATIONS BILL FOR 1975. PART 1: DEPARTMENT OF THE INTERIOR**

Washington GPO 1974 977 p refs Hearings before Subcomm. of the Comm. on Appropriations, 93d Congr., 2d Sess., 11 Feb. 1974, 4 Mar. 1974, 5 Mar. 1974

(GPO-29-514) Avail. Subcomm. on the Dept. of the Interior and related agencies

An overview of energy programs within the Department of Interior was presented in a Congressional hearing called to hear testimony on the Trans-Alaska Pipeline, development of the Outer Continental Shelf, remote sensing of mineral resources, and research in the efficient extraction, conversion, and use of geothermal energy, oil shale, coal, and natural gas. Short term considerations, intermediate tasks, and long term strategy are discussed for the Federal Energy Office, Geological Survey, Office of Coal Research, and the Bureau of Mines. Budget figures, specific programs, management structure, and contracts are described for each organization, and rationales are given for each of their various contributions towards a unified national program in energy research and development. Fuel allocation, foreign trade, market considerations, oil and gas programs, and energy conservation and analysis are discussed in light of current and expected per capita energy demand in the U.S. strip mining, mine health and safety, and mine waste management are also considered along with debate concerning possible adjustment of the Federal Energy Budget. A.A.D.

N74-31403# Army War Coll., Carlisle Barracks, Pa. **THE ENERGY CRISIS ISSUES AND ALTERNATIVES Student Essay**

George C. Kuekes 20 Oct 1973 22 p refs (AD-779366) Avail: NTIS CSCL 05/3

The status of domestic reserves has been reviewed and the adequacy of these reserves and future energy requirements noted. Other energy sources as supplements to the five primary energy sources have been indicated. Alternatives for a solution to the energy crisis have been indicated with the recommended alternative providing for the establishment of a single Federal agency to coordinate the total energy program. Typical policies that should be developed, are indicated and include conservation and research and development. (Modified author abstract) GRA

N74-31409# Mitre Corp., McLean, Va. **SYMPOSIUM ON ENERGY, RESOURCES AND THE ENVIRONMENT. VOLUME 1: INTRODUCTORY AND CONTEXT SESSIONS**

Nov. 1972 280 p refs Symp held at Kyoto, Japan, 9-12 Jul. 1972 4 Vol.
(PB-219953/7; MITRE-72-190-Vol-1) Avail. NTIS HC \$6.75;
HC also available from NTIS \$34.00/set of 4 reports as
PB-219952-SET CSCL 13B

The report provides a transcript of the proceedings of the first two sessions of the Symposium on Energy, Resources, and the Environment sponsored by the MITRE Corporation, Washington, D.C., the Institute of Energy Economics, Tokyo, Japan, and the Nomura Research Institute of Technology and Economics, Tokyo, Japan on July 9th, 10th, 11th and 12th, 1972. Topics discussed include: Alternative world futures, Review of MITRE study; Long-range prospects for mankind; International economic implications of the nuclear fuel cycle, Japanese energy perspective, U.S. short and medium term issues; Pacific basin development and future; International context. GRA

N74-31410# Mitre Corp., McLean, Va.
SYMPOSIUM ON ENERGY, RESOURCES AND THE ENVIRONMENT. VOLUME 2: PANEL SESSIONS ON ENERGY AND RESOURCE ISSUES

Nov. 1972 502 p refs Symp. held at Kyoto, Japan, 9-12 Jul. 1972 4 Vol.
(PB-219954/5; MITRE-72-190-Vol-2) Avail. NTIS HC \$12.50;
HC also available from NTIS \$34.00/set of 4 reports as
PB-219952-SET CSCL 13B

The report provides a transcript of the proceedings of two of the four workshop sessions held on July 11th at the Symposium on Energy, Resources, and the Environment held on July 9th, 10th, 11th, and 12th, 1972. The session on Energy Issues featured presentations on The Development of Fusion in Japan and its Prospects, The Multi-Utilization of Nuclear Energy - A Techno-Economical Evaluation of a Process for Large Steel Making, The Present Status and Future Prospects of Energy Utilization in the Iron Industry, Magneto-Hydrodynamic (MHD) Power Generation Status and Prospects for Electric Utility Application, Large Scale Utilization of Solar Energy, and Geothermal Energy. The session devoted to Resource Issues featured presentations on Resource Development as a Function of Japanese Economic Growth, Australian Energy Resources, Indonesian Energy Resources, U.S. Transportation: Some Energy and Environmental Considerations, Urban Transportation, and Uranium Enrichment With a Sea-Thermal Power Plant. GRA

N74-31411# Mitre Corp., McLean, Va.
SYMPOSIUM ON ENERGY, RESOURCES AND THE ENVIRONMENT. VOLUME 3: PANEL SESSIONS ON ENVIRONMENTAL, ECONOMICAL AND INSTITUTIONAL ISSUES

Nov. 1972 462 p refs Symp. held at Kyoto, Japan, 9-12 Jul. 1972 4 Vol.
(PB-219955/2; MITRE-72-190-Vol-3) Avail. NTIS HC \$10.60;
HC also available from NTIS \$34.00/set of 4 reports as
PB-219952-SET CSCL 13B

The report provides a transcript of the proceedings of two of the four workshop sessions held on July 11th at the Symposium on Energy, Resources, and the Environment held on July 9th, 10th, 11th, and 12th, 1972. The session on Environmental Issues featured presentations on Environmental Action Around the World, Climate Change and the Influence of Man's Activities on the Global Environment, Approaches to Canadian Environmental Problems, Assessment of the Industrial EcoSystem and Industrial Policy in Japan, Some Problems Arising out of the Low Sulfur Fuel Supply System in Japan, Coal: The Black Magic, and Environmentally Acceptable Fuels by Today's Technology (With Emphasis on Gasification). The session on Institutional and Economic Issues included Some Comments on U.S. Energy Institutions, Technology Assessment of Mass Energy Consumption, An Idea and Concept of Japan's Policy on Natural Resources Development, Indonesian Institutional and Economic Issues, and The State of Our Mineral Resources. GRA

N74-31412# Mitre Corp., McLean, Va.
SYMPOSIUM ON ENERGY, RESOURCES AND THE ENVIRONMENT. VOLUME 4: RECAPITULATION OF ENERGY, RESOURCE, ENVIRONMENTAL, ECONOMIC AND INSTITUTIONAL ISSUES

Nov. 1972 223 p refs Symp. held at Kyoto, Japan, 9-12 Jul. 1972 4 Vol.
(PB-219956/0; MITRE-72-190-Vol-4) Avail. NTIS HC \$6.75;
HC also available from NTIS \$34.00/set of 4 reports as
PB-219952-SET CSCL 13B

The report provides a transcript of the proceedings of the fourth day of the Symposium on Energy, Resources, and the Environment sponsored by The MITRE Corporation, Washington, D.C., the Institute of Energy Economics, Tokyo, Japan, and the Nomura Research Institute of Technology and Economics, Tokyo, Japan. The session was devoted to reports by the four Workshop Chairmen summarizing the issues discussed during the Energy Issues, Environmental Issues, Resource Issues, and Institutional and Economic Issues sessions. GRA

N74-31526*# National Aeronautics and Space Administration
Lewis Research Center, Cleveland, Ohio.

ADVANCED RANKINE AND BRAYTON CYCLE POWER SYSTEMS: MATERIALS NEEDS AND OPPORTUNITIES

S. J. Grisaffe and D. C. Guentert. 1974 27 p refs Presented at the Mater. for Power Systems Meeting, Seven Springs, Penn., 17-19 Jun. 1974; sponsored by the American Society for Metals

(NASA-TM-X-71583; E-8035) Avail. NTIS HC \$3.25 CSCL 10A

Conceptual advanced potassium Rankine and closed Brayton power conversion cycles offer the potential for improved efficiency over steam systems through higher operating temperatures. However, for utility service of at least 100,000 hours, materials technology advances will be needed for such high temperature systems. Improved alloys and surface protection must be developed and demonstrated to resist coal combustion gases as well as potassium corrosion or helium surface degradation at high temperatures. Extensions in fabrication technology are necessary to produce large components of high temperature alloys. Long time property data must be obtained under environments of interest to assure high component reliability. Author

N74-31527*# National Aeronautics and Space Administration
Lewis Research Center, Cleveland, Ohio.

PRELIMINARY DESIGN OF A 100 kW TURBINE GENERATOR

Richard L. Puthoff and Paul J. Sirocky. 1974 22 p refs Presented at Intern. Solar Energy Soc., Ft. Collins, Colo., 21-23 Aug. 1974

(NASA-TM-X-71585; E-8037) Avail. NTIS HC \$3.00 CSCL 10A

The National Science Foundation and the Lewis Research Center have engaged jointly in a Wind Energy Program which includes the design and erection of a 100 kW wind turbine generator. The machine consists primarily of a rotor turbine, transmission, shaft, alternator, and tower. The rotor, measuring 125 feet in diameter and consisting of two variable pitch blades operates at 40 rpm and generates 100 kW of electrical power at 18 mph wind velocity. The entire assembly is placed on top of a tower 100 feet above ground level. Author

N74-31529# Mitre Corp., McLean, Va.
RECOMMENDATIONS TO RANN/NSF: SOLAR ENERGY R AND T PROGRAM

Richard S. Greeley, comp. Feb. 1974 84 p
(M74-21) Avail. NTIS HC \$7.25

A systems analysis of solar energy programs was conducted and a summary of the results is provided. Briefly, various solar energy applications and techniques are expected to become economically competitive with conventionally fueled systems between 1985 and 2000 and could provide significant quantities

of energy to the U. S. early in the 21st Century. The problems associated with each of seven solar energy applications and techniques are identified and details of proof-of-concept experiments in each area are outlined. Recommended methods for the dissemination and utilization of research results are listed.

Author

N74-31530* Naval Ammunition Depot, Crane, Ind. Weapons Quality Engineering Center.

EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS. INITIAL EVALUATION TESTS OF GENERAL ELECTRIC COMPANY STANDARD AND TEFLONATED NEGATIVE ELECTRODE 20.0 AMPERE-HOUR, NICKEL-CADMIUM SPACECRAFT CELLS WITH AUXILIARY ELECTRODES

1 Jul. 1974 28 p

(NASA Order S-23404-G)

(NASA-CR-139654; WQEC/C-74-337) Avail: NTIS HC \$4.50 CSCL 10A

The standard plate cells exhibited higher average end-of-charge (EOC) voltages than the cells with teflonated negative plates; they also delivered a higher capacity output in ampere hours following these charges. All the cells reached a pressure of 20 psia before reaching the voltage limit of 1.550 volts during the pressure versus capacity test. The average ampere hours in and voltages at this pressure were 33.6 and 1.505 volts respectively for the teflonated negative plate cells and 35.5 and 1.523 volts for the standard plate cells. All cells exhibited pressure decay in the range of 1 to 7 psia during the last 30 minutes of the 1-hour open circuit stand. Average capacity out for the teflonated and standard negative plate cells was 29.4 and 29.9 ampere hours respectively.

Author

N74-31531* Techtran Corp., Glen Burnie, Md.

ARE WIND-DRIVEN POWER PLANTS POSSIBLE?

P. Juchem Washington NASA Aug. 1974 10 p Transl. into ENGLISH from Koelnische Rundschau (West Ger.), no. 96a, 26 Apr. 1953

(Contract NASw-2485)

(NASA-TT-F-15860) Avail: NTIS HC \$4.00 CSCL 10A

A great deal has been written about the project to exploit wind energy to produce electrical energy. The controversy over the tremendous wind wheels has not died down, and, in the age of an evergrowing demand for energy, it has again become a subject of discussion. The following is a contribution to this subject and reflects the personal opinion of the author about the project.

Author

N74-31532* Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

THE DEVELOPMENT OF A SOLAR POWERED RESIDENTIAL HEATING AND COOLING SYSTEM Final Report

Mark J. O'Neill, Paul O. McCormick, and William R. Kruse Jul. 1974 95 p refs

(Contract NAS8-25986)

(NASA-CR-120400; LMSC-HREC-TR-D390138) Avail: NTIS HC \$7.75 CSCL 10A

A solar energy collector design is disclosed that would be efficient for both energy transfer and fluid flow, based upon extensive parametric analyses. Thermal design requirements are generated for the energy storage systems which utilizes sensible heat storage in water. Properly size system components (including the collector and storage) and a practical, efficient total system configuration are determined by means of computer simulation of system performance.

Author

N74-31534* Techtran Corp., Glen Burnie, Md.

WIND POWER USAGE IN EUROPE?

A. T. H. Gross Washington NASA Aug. 1974 19 p refs Transl. into ENGLISH from Ergeb. der Jahrestagung der Studienges. Windkraft eV Stuttgart, DK 621.311.24 003.1, no. 4 p 1-6

(Contract NASw-2485)

(NASA-TT-F-15855) Avail: NTIS HC \$4.00 CSCL 10A

The development of wind power technology has lead to basic discoveries which will make standardized large-scale production possible. Its economical use is regarded as a possible extra source of electrical energy for already existing systems, since there is an abundance of wind in the plains stretches of Central Europe. Equipment cost for system-sized, self regulating wind power machines which now produce a respectable 100 to 300 kilowatts, are estimated at about 600 to 700 marks per kilowatt in large-scale production. In those areas which still have no electricity, underdeveloped countries for instance, an individual wind machine could well compete with the diesel engine.

Author

N74-31535* Scientific Translation Service, Santa Barbara, Calif. **UTILIZATION OF WIND ENERGY IN DENMARK**

Washington NASA Sep. 1974 16 p ref Transl. into ENGLISH from Tech. Mod. (France), v. 35, no. 13-14, 1-15 Jul. 1943 p 106-109

(Contract NASw-2483)

(NASA-TT-F-15868) Avail: NTIS HC \$4.00 CSCL 10A

Use of wind energy in Denmark during World Wars 1 and 2 is reviewed. It presents statistical data on other energy sources and compares costs of all types of energy. Some technical discussion of the Lykkegaard 5.5 m diameter mills and F.L.S. 17.5 m diameter mills is given.

Author

N74-31536* Scientific Translation Service, Santa Barbara, Calif. **TERRESTRIAL APPLICATIONS OF THE PHOTOVOLTAIC SOLAR GENERATORS**

Washington NASA Sep. 1974 83 p Transl. into ENGLISH of "Les Applications Terrestres des Generateurs Solaires Photovoltaïques", Centre National d'Etude Spatiales, Paris, report, 1974 p 1-78

(Contract NASw-2483)

(NASA-TT-F-15906) Avail: NTIS HC \$7.25 CSCL 10A

The future prospects of solar generators are discussed. An analysis is made of the present state of the application of photovoltaic energy. The future prospects in France and other countries are discussed, followed by three supplements covering hydrogen storage of electric power produced by solar cells and the climatology of solar radiation.

Author

N74-31537* California Univ., Livermore. Lawrence Livermore Lab.

SHALLOW SOLAR POND ENERGY CONVERSION SYSTEM: AN ANALYSIS OF A CONCEPTUAL 10-MW_e PLANT

A. F. Clark, J. A. Day, W. C. Dickinson, and L. F. Wouters 25 Jan. 1974 30 p refs

(Contract W-7405-eng-48)

(UCRL-51533) Avail: NTIS HC \$4.00

A shallow solar pond system appears to be the most cost effective way to produce large scale electric power from solar energy. Water is used both for heat collection and heat storage. Inexpensive layers of weatherable transparent plastic over the water suppress heat loss to the environment. The hot water is stored in an insulated reservoir at night and during bad weather. The stored hot water heats a thermodynamic fluid, such as Freon 11, which drives a turbine and an electric generator. The estimated busbar cost of electricity (in 1973 dollars) for a shallow solar pond system, which could come on line in as short a time as 5 to 7 years, is 27 mills/kWh. It is projected that this cost could be reduced by almost half with the development of improved and cheaper plastics and more efficient turbines.

Author (NSA)

N74-31539* Naval Research Lab., Washington, D.C.

ENERGY FROM THE OCEAN: AN APPRAISAL

Owen M. Griffin May 1974 47 p refs

(NRL Proj. F02-24; RR1310341)

(AD-779877; NRL-MR-2803) Avail: NTIS CSCL 10/1

The oceans and their environment have long been envisioned

as renewable sources of energy. It is the purpose of this report to assess the feasibility of drawing on the sea for power and to determine the extent to which the oceans are likely to serve future energy needs. A review is made of proposed U.S. funding levels for the research and development of renewable energy sources during the years 1975 - 1979, and a study is made of the technical and environmental acceptability status of tidal, wind, and sea thermal power generation systems. The estimated costs of these environmental power sources are compared with the prevailing power costs for nuclear and coal plants. On the basis of these comparisons, recommendations are made for a program of research and development, culminating in the construction of prototype plants, for wind and sea thermal power plants. Tidal power generation is found to be technically feasible but economically uninviting at present. Author (GRA)

N74-31542# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.

SOLAR THERMAL ELECTRIC POWER SYSTEMS Annual Progress Report, 1 May - 31 Dec. 1973

Jan. 1974 288 p refs Prepared in cooperation with Westinghouse Elec. Corp., Boulder, Colo. (Grant NSF GI-37815) (PB-231115/7; NSF-RA/N-74-001; NSF/RANN/SE/GI-37815/PR/73/4) Avail: NTIS HC \$6.75 CSCL 10A

The objective is to develop design parameters for solar thermal electric power systems that can provide lowest cost electric power. Parametric performance and cost models are being developed for subsystems such as the concentrator, flat plate collector, absorber heat transfer, heat transport, heat storage, heat engine, and cooling tower. Cost optimization methods are being developed, which can be used to select cost effective subsystem units, subsystem groups and to optimize the entire system. Power systems of 3 to 100 MW capacity that can be utilized in electrical networks are being considered. GRA

N74-31544# Mitre Corp., McLean, Va.

SOLAR ENERGY PROOF OF CONCEPT EXPERIMENTS Final Report

Dec. 1973 106 p (Contract NSF C-831) (PB-231143/9; MTR-6537; NSF-RA/N-73-111C) Avail: NTIS HC \$4.50 CSCL 10A

Critical experiments are described which are intended to prove the technical feasibility and socio-economic desirability of specific applications or techniques for the widespread use of solar energy. These experiments fall within the following areas: heating and cooling of buildings, process heat, 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. (Modified author abstract) GRA

N74-31590# Bureau of Mines, Bartlesville, Okla. Energy Research Center.

COMPOUND-TYPE SEPARATION AND CHARACTERIZATION STUDIES FOR A 370 TO 530 C DISTILLATE OF RECLUSE, WYOMING, CRUDE OIL

D. E. Hirsch, J. E. Dooley, J. W. Vogh, and C. J. Thompson 1974 29 p refs (BM-RI-7945) Avail: NTIS HC \$4.50

A systematic procedure was developed for separation, characterization, and semiquantitative analysis of high boiling (350 to 550 C) distillates of crude oils. Isothermal and molecular distillation were used to prepare the 370 to 530 C distillate of Recluse, Wyo., crude oil. The distillate was separated into fractions by chemical treatment, silica-alumina gel adsorption,

and gel permeation chromatography (GPC). The fractions were analyzed by use of GPC correlations and mass and nuclear magnetic resonance (NMR) spectrometry. The increased knowledge of petroleum composition obtained from the data will contribute to improved petroleum processing and utilization and energy conservation. Author

N75-31606# Bureau of Mines, Laramie, Wyo. Energy Research Center.

SECOND-ORDER EFFECTS IN THE KINETICS OF OIL SHALE PYROLYSIS

Donald W. Fausett, John H. George (Wyo. Univ., Laramie), and Harry C. Carpenter Mar. 1974 26 p refs (PB-231279/1; BM-RI-7889) Avail: NTIS HC \$3.25 CSCL 07D

The report presents a system of thermal decompositions providing an adequate description of the mechanism of oil shale pyrolysis. Specific rate constants for systems of thermal decompositions studied are estimated via a least squares procedure. The estimates thus obtained provide a mathematical method of the corresponding thermal decomposition system. A model which generates a good fit to published Bureau of Mines experimental data, in comparison with other models studied, is based on a thermal decomposition system consisting of two first order reactions and three second order reactions. Values computed for the specific rate constants corresponding to this system are shown to exhibit a temperature dependence which is in good agreement with the Arrhenius equation. GRA

N74-31610# Tennessee Valley Authority, Chattanooga. Div. of Environmental Planning.

FULL-SCALE DESULFURIZATION OF STACK GAS BY DRY LIMESTONE INJECTION. VOLUME 3: APPENDICES I THROUGH L Final Report

F. E. Gartrell Aug. 1973 343 p refs Sponsored by EPA (PB-230385/7; EPA-650/2-73-019C) Avail: NTIS HC \$20.75 CSCL 13B

The report gives results of a test program of dry limestone injection, demonstrated on a 150-Mw pulverized-coal-fired boiler at TVA's Shawnee Plant. The program included: equipment shakedown, dust distribution studies, process optimization, and long-term injection trials. The program is discussed in context with previous investigations and EPA-sponsored support activities. Appendices contain test program detail results and results of EPA support projects. Because of low SO₂ removal efficiencies and the potential for major reliability problems, it does not appear that dry limestone injection will play an important role in controlling SO₂ emissions from power plants. GRA

N74-31895# Bureau of Mines, Bartlesville, Okla. Energy Research Center.

FRACTURING OIL SHALE WITH EXPLOSIVES FOR IN SITU OIL RECOVERY

J. S. Miller, C. J. Walker, and J. L. Eakin Mar. 1974 110 p refs (PB-231283/3; BM-RI-7874) Avail: NTIS HC \$4.50 CSCL 08I

This report presents results of Bureau of Mines preliminary research and the field application of explosive fracturing techniques to prepare oil shale for in situ recovery of shale oil. Small-scale surface tests were conducted to determine the feasibility of using a nitroglycerin-base explosive for creating rock fractures. Surface and near-surface tests with liquid explosives showed that explosions in sheetlike layers simulating underground fractures would propagate effectively. Explosive fracturing tests were performed in oil shale formations on seven sites. The research on oil shale formations demonstrated that nitroglycerin displaced in a natural or hydraulically induced fracture would detonate and the explosion would propagate through the explosive filled fracture. Fourteen methods used to evaluate the extent of

fragmentation in the explosively fractured oil shale are discussed. (Modified author abstract) GRA

N74-31896# Bureau of Mines, Dallas, Tex. Mineral Supply Field Office.

ASSESSMENT OF U.S. PETROLEUM SUPPLY WITH VARYING DRILLING EFFORTS

T. M. Garland, M. Carrales, Jr., and J. S. Conway Mar. 1974 42 p refs

(PB-231153/8; BM-IC-8634) Avail: NTIS MF \$1.45, SOD HC \$0.75 as 128 27 8634 CSCL 081

This report presents a Bureau of Mines assessment of crude oil and associated gas production and reserves that would result from different drilling efforts in the lower 48 states during the 1972-85 period. The drilling effort was based upon five growth rate assumptions from the 1971 level. Additions to crude oil reserves were computed for nine cases resulting from the use of three equations for findings per foot drilled and three constant revision factors. The results presented vividly illustrate that the United States will not become self-sufficient in crude oil production by 1985 and also illustrate the lead time required to reverse the decline in oil production. Discussion is limited to three of the nine cases to provide high, intermediate, and low results. More emphasis is on the intermediate case because it is indicative of the most probable trends. The methodology and statistical data are included in the appendices. Author (GRA)

N74-31897# Bureau of Mines, Bartlesville, Okla. Energy Research Center.

USE OF CENTRIFUGAL MEASUREMENTS OF WETTABILITY TO PREDICT OIL RECOVERY

P. B. Lorenz, E. C. Donaldson, and R. D. Thomas Feb. 1974 31 p refs

(PB-231103/3; BM-RI-7873) Avail: NTIS HC \$3.25 CSCL 081

Wettability measurements and laboratory water-flood tests were compared on synthetic and natural crude oils, treated and untreated outcrop and oilfield sandstone cores, synthetic brines with and without caustic, detergent, or phosphate additives, equilibrated and unequilibrated systems, and at 77 and 150 F. Wettability was evaluated by the Bureau of Mines method. Waterflood data were fitted by empirical curves. Results showed that wettability measurements at 77 F were useful predictors of recovery. (Modified author abstract) GRA

N74-32194# Army Foreign Science and Technology Center, Charlottesville, Va.

THERMODYNAMICS OF LIQUID METAL MHD GENERATORS

D. D. Kalafati and V. B. Kozlov 9 Feb. 1974 167 p refs Transl. into ENGLISH of the mono. Termodinamika Zhidkometal Uicheskih MGD-Preobrazovatelei, Moscow, 1972 192 p (AD-781021; FSTC-HT-23-1306-73) Avail: NTIS CSCL 10/2

The book is devoted to the thermodynamics of the magnetohydrodynamic method of conversion of thermal energy into electrical, using liquid metal working fluids. The prospects for use of liquid metal MHD converters in transportation and stationary power engineering, based on nuclear sources, are set forth. Possible thermodynamic cycles, the fields of their use and the basic features of the heat circuits are discussed. A thermodynamic analysis of possible liquid metal MHD converter cycles is carried out, methods of increasing their efficiency are pointed out and analytical solutions are obtained for a number of optimization problems. A section of the book is devoted to prospects for use of the liquid metal MHD converter built-on units to steam turbine installations in a binary energy cycle for stationary atomic electric power stations. (Modified author abstract) GRA

N74-32370# Dyna-Therm Corp., Cockeysville, Md.
DEVELOPMENT OF ELECTRICAL FEEDBACK CONTROLLED

HEAT PIPES AND THE ADVANCED THERMAL CONTROL FLIGHT EXPERIMENT Technical Summary Report

Walter B. Bienert May 1974 151 p refs

(Contract NAS2-6227)

(NASA-CR-114751; DTM-74-2) Avail: NTIS HC \$10.75 CSCL 20M

The development and characteristics of electrical feedback controlled heat pipes (FCHP) are discussed. An analytical model was produced to describe the performance of the FCHP under steady state and transient conditions. An advanced thermal control flight experiment was designed to demonstrate the performance of the thermal control component in a space environment. The thermal control equipment was evaluated on the ATS-F satellite to provide performance data for the components and to act as a thermal control system which can be used to provide temperature stability of spacecraft components in future applications. Author

N74-32381# Westinghouse Research Labs., Pittsburgh, Pa.
EVALUATION OF THE FLUIDIZED-BED COMBUSTION PROCESS. VOLUME 1: PRESSURIZED-BED COMBUSTION PROCESS DEVELOPMENT AND EVALUATION Final Report, Jul. 1971 - May 1973

D. L. Kearns, D. H. Archer, J. R. Hamm, R. A. Newby, and E. P. O'Neill Dec. 1973 365 p refs

(Contract EPA-68-02-0217)

(PB-231162/9; EPA-650/2-73-048A) Avail: NTIS HC \$8.00 CSCL 13B

The report presents results of a process evaluation of the pressurized fluidized-bed combustion (FBC) system for power generation; preliminary plans and a cost estimate for a 30-MW pressurized FBC boiler development plant; identification of a project team and program to demonstrate FB oil gasification/desulfurization for power generation on a 50-MW plant; and evaluation of pressurized oil gasification for combined-cycle power generation. It identifies no problems which preclude the development of pressurized FBC combined-cycle power plants and FB oil gasification power plants which can generate electrical energy within environmental goals at lower energy costs than competitive systems. Work reported here, a continuation of earlier FBC process evaluation efforts, is aimed at the development and demonstration of these fuel processing systems. GRA

N74-32382# Westinghouse Research Labs., Pittsburgh, Pa.
EVALUATION OF THE FLUIDIZED-BED COMBUSTION PROCESS. VOLUME 2: FLUIDIZED-BED BOILER COMBINED CYCLE POWER PLANT DEVELOPMENT. VOLUME 1: APPENDICES Final Report

D. L. Kearns, D. H. Archer, J. R. Hamm, R. A. Newby, and E. P. O'Neill Dec. 1973 245 p refs

(Contract EPA-68-02-217)

(PB-231163/7; EPA-650/2-73-048A-D) Avail: NTIS HC \$6.00 CSCL 13B

Contents cover the following: (1) economic sensitivity; (2) sulfur removal systems; (3) plant operation and control; and (4) alternative fluid bed boiler concepts. GRA

N74-32383 National Petroleum Council, Washington, D.C.
EMERGENCY PREPAREDNESS FOR INTERRUPTION OF PETROLEUM IMPORTS INTO THE UNITED STATES Interim Report

Jul. 1973 60 p refs

Copyright. Avail. Issuing Activity

A study and analysis of possible emergency supplements to or alternatives for imported oil, natural gas liquids, and petroleum products in the event of an interruption of these imports. The areas of the study which are significant include evaluations of savings through petroleum use curtailment which might be realized through voluntary and mandatory measures, estimates of emergency oil production volumes, and evaluations of the feasibility and cost of providing emergency standby petroleum supplies by storage or by restriction of domestic production.

The various conditions to be met by the energy crisis and the policies to be followed are analyzed. Author

N74-32384 National Petroleum Council, Washington, D.C.
EMERGENCY PREPAREDNESS FOR INTERRUPTION OF PETROLEUM IMPORTS INTO THE UNITED STATES. A SUPPLEMENTAL INTERIM REPORT OF THE NATIONAL PETROLEUM COUNCIL

15 Nov. 1973 63 p
 Copyright. Avail: Issuing Activity

A study was conducted to assist government and industry in efforts to alleviate the effect of energy interruption and to cope with the current energy crisis. A history of the factors leading to the energy crisis is provided as background data. Tables of data are provided to show the demand and availability of various energy sources. It is stated that the U.S. must develop an energy self-sufficiency which will not allow the Nation to be vulnerable to an imports interruption. Domestic energy resources are more than adequate to meet this goal, but a national program must be initiated to develop them. Only through a coherent and cohesive National Energy Policy can the U.S. avoid a repetition of the inconvenience and hardship caused by the fuel embargo.

Author

N74-32385 National Petroleum Council, Washington, D.C.
EMERGENCY PREPAREDNESS FOR INTERRUPTION OF PETROLEUM IMPORTS INTO THE UNITED STATES. SUPPLEMENTAL PAPERS TO INTERIM REPORT OF 15 NOVEMBER 1973

21 Dec. 1973 141 p refs
 Copyright. Avail: Issuing Activity

A study was conducted to analyze the impact of the energy shortages and to determine steps to be taken to alleviate the effects on the U.S. economy. The subjects considered include the following: (1) crude oil supply and transportation, (2) emergency oil and gas production, (3) fuel convertibility and alternate energy sources, and (4) energy use curtailment. Tables of data are provided to show resource availability and future production capabilities for selected energy sources. Author

N74-32387# Patent Office, Washington, D.C.
TECHNOLOGY ASSESSMENT AND FORECAST, THIRD REPORT, JUNE 1974

Jun. 1974 181 p refs
 Avail: NTIS HC \$12.25

Profiles of activity within selected, active technological areas, both in the U.S. and in foreign countries, is presented for the purpose of providing an assessment overview and forecast of current technology. Energy technology is discussed with a focus on the broad topic of obtaining liquid hydrocarbons or gaseous hydrocarbons from solid carbonaceous material. The principal processes described are those involving coal gasification, and the obtaining of oil from shale. An overview of technological activity, for all countries combined, for the U.S. alone, for all foreign countries combined, and for certain selected countries, is presented according to quantitative contribution and amount of effort in 258 broad categories of technology, as measured by patents. Similar profiles are provided for six states. Specific reports are included for the categories of optics and photography, electronics, stock materials, coating, bonding, and molding, and chemical compositions and processes. A.A.D.

N74-32388# Commerce Dept., Washington, D.C.
TECHNOLOGY ASSESSMENT AND FORECAST: EARLY WARNING REPORT OF THE OFFICE OF TECHNOLOGY ASSESSMENT AND FORECAST, DECEMBER 1973

Dec. 1973 282 p
 Avail: NTIS HC \$17.25

Information designed to assist business, government, and the academic community in decision making situations is presented according to overall and foreign activity in active technological areas. Reports on specific areas include the following categories: (1) optics; (2) photography; (3) electronics; (4) stock materials;

(5) metallurgy and metalworking; (6) coating, bonding, and molding; (7) high polymer chemistry and chemical compositions; (8) textile manufacturing; (9) vehicles. A comprehensive state-of-the-art and forecast analysis is also given for emerging energy sources. Research activity in nuclear energy is described, and data is presented for ongoing development of natural energy resources, including solar energy, geothermal energy, and tide and wave energy. A.A.D.

N74-32391# Joint Economic Committee (U. S. Congress).

A REAPPRAISAL OF US ENERGY POLICY

William Proxmire, Henry S. Reuss, and Hubert H. Humphrey
 Washington GPO 8 Mar 1974 50 p refs Rept. of the Subcomm. on Consumer Economics, Subcomm. on Intern. Economics, and Subcomm. on Priorities and Economy in Govt., 93d Congr., 2d Sess., 8 Mar. 1974

(GPO-29-215) Avail: SOD HC \$0.60

Brief summaries of twenty recommendations are reported to Congress in preface to a reappraisal of U.S. energy policy, which includes an assessment of the current fuel situation and the effects of policies designed to curb the shortages. Price controls and gasoline rationing are discussed with consideration of mandatory allocation of a more diverse range of oil products. Measures to curb consumption over the long run are also discussed in terms of transportation savings, lowered heating requirements, and reduced consumer demand for gas and electricity. Several alternatives are presented for stimulating domestic oil production, and the international oil situation is discussed in terms of its effects on the separate interests of producers and consumers. A.A.D.

N74-32405*# National Aeronautics and Space Administration, Washington, D.C.

JAPAN AND THE ENERGY CRISIS

Yu. K. Sergeyev Sep. 1974 15 p refs Transl. into ENGLISH from Prob. Dalnego Vostoka (Moscow), no. 2, 1974 p 108-111

(NASA-TT-F-15924) Avail: NTIS HC \$4.00 CSCL 10A

The energy crisis in Japan is discussed in terms of market reliance on petroleum imports. Retrospective treatment is given the energy situation as it has existed in the economic milieu since the second World War. The requirements, possibilities, and difficulties of dependence on Middle East oil are identified, along with the economic consequences of rising prices of petroleum products. A.A.D.

N74-32432*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

A STUDY OF SUBSONIC TRANSPORT AIRCRAFT CONFIGURATIONS USING HYDROGEN (H2) AND METHANE (CH4) AS FUEL

Daniel B. Snow, Blake D. Avery, Lawrence A. Bodin, Paul Baldasare, and G. Fredrick Washburn 1 Aug. 1974 32 p
 (NASA-TM-X-71994) Avail: NTIS HC \$3.25 CSCL 01C

The acceptability of alternate fuels for future commercial transport aircraft are discussed. Using both liquid hydrogen and methane, several aircraft configurations are developed and energy consumption, aircraft weights, range and payload are determined and compared to a conventional Boeing 747-100 aircraft. The results show that liquid hydrogen can be used to reduce aircraft energy consumption and that methane offers no advantage over JP or hydrogen fuel. Author

N74-32468# Institute of Gas Technology, Chicago, Ill.
FEASIBILITY STUDY OF ALTERNATIVE FUELS FOR AUTOMOTIVE TRANSPORTATION Interim Report

J. B. Pangborn and J. C. Gillis 16 May 1974 28 p refs
 Presented at the 7th Alternative Automotive Power Systems Coordination Meeting, Ann Arbor, Mich., 16 May 1974
 (Contract EPA-68-01-211)

Avail: NTIS HC \$4.50 CSCL 10A

Selection criteria were developed and applied to a number

of alternative fuels. It is concluded that the most promising alternative fuels are synthetic gasoline and hydrocarbon distillates. Methanol is the next most attractive liquid fuel. Hydrogen is considered a speculative fuel which will become more attractive as fossil carbon resources are depleted. Author

N74-32469*# Kanner (Leo) Associates, Redwood City, Calif.
CONTRIBUTION TO THE CREATION OF BASIC DESIGN CONCEPTS FOR WIND POWER PLANTS Ph.D. Thesis
 Ulrich Huettner Washington NASA Jul. 1974 97 p Transl. into ENGLISH of Ph. D. Thesis from Technische Hochschule, Vienna, May 1942 93 p
 (Contract NASw-2481)
 (NASA-TT-F-15822) Avail: NTIS HC \$8.00 CSCL 10A

An estimate indicates that much more energy is available in the atmosphere than from the world's water-power resources. The most efficient dimensions of a power plant for tapping this energy are found to be a tower height of 35 meters and a rotor diameter of 40 meters, regardless of location. The concept of the rotor element, an annular part of the area covered by the rotor, is introduced for the derivation of relationships which are later applied to the entire rotor. Optimum blade planforms and section profiles are derived, and the best number of blades is found to be three. Author

N74-32470*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
TERRESTRIAL APPLICATIONS OF FEP-ENCAPSULATED SOLAR CELL MODULES

A. F. Forestieri and A. F. Ratajczak 1974 23 p Presented at the Intern. Conf. on Photovoltaic Power Generation, Hamburg. 25-27 Sep. 1974
 (NASA-TM-X-71608; E-8086) Avail: NTIS HC \$3.00 CSCL 10A

FEP-encapsulated solar cell modules and arrays have been designed and built expressly for terrestrial applications. System design including solar cell array mechanical design and the approach to system sizing is outlined. Such solar cell systems have been installed at six sites. Individual modules have undergone marine environment tests. Results from seven months of operation indicate that system is meeting its electrical design requirements. No mechanical degradation has been reported. The array on Mammoth Mountain, California has been damaged by rime ice but shows no loss in electrical output. Marine environment tests on single modules have shown that elements of the module must be completely sealed by the FEP. Based on the limited test data available, the FEP-encapsulated solar cell module appears well suited to terrestrial applications. Author

N74-32471*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

FLAT PLATE COLLECTOR PERFORMANCE DETERMINED EXPERIMENTALLY WITH A SOLAR SIMULATOR

Richard W. Vernon and Frederick F. Simon 1974 21 p refs Presented at the Intern. Solar Energy Soc. Meeting, Fort Collins, Colo., 19-23 Aug. 1974
 (NASA-TM-X-71602) Avail: NTIS HC \$3.00 CSCL 10A

The NASA is constructing a new office building at Langley Research Center that will utilize solar energy for heating and cooling. A collector technology program being conducted at Lewis will provide the basis for selecting collectors for use at Langley. The technology program includes testing collectors in an indoor facility under simulated solar radiation. Tests have been conducted on five collectors to date and performance data are presented herein. Author

N74-32472# Oak Ridge National Lab., Tenn.
ENERGY CONSERVATION AND THE ENVIRONMENT Progress Report, 31 Dec. 1973

Mar. 1974 76 p refs
 (Contract W-7405-eng-26; Grant NSF AF-398)
 (ORNL-NSF-EP-66) Avail: NTIS HC \$7.00

Emphasis was mainly placed on opportunities for energy conservation in the transportation and residential sectors.

Preliminary results for a highly disaggregated model of the TVA service area were obtained for the electricity demand growth. The research on policy alternatives in coal mining is discussed. The chapter on energy conservation analysis contains sections on energy uses for automobiles, bicycles, and aircraft; total energy requirements of air transport; residential energy conservation; and energy use for food. From the discussion of demand for electricity, information is included on effect of rate structure; applicability of the national electric demand models to the TVA service area; data base and preliminary results in TVA area demand study; and communication and implementation of findings. Evaluation of alternative reclamation techniques, an overview on the role of coal, and implementation activities are included.

NSA

N74-32473# Martin Marietta Labs., Baltimore, Md.
PROSPECTS OF PHOTOSYNTHETIC ENERGY PRODUCTION

B. Kok 1974 10 p Presented at 140th Meeting of the Am. Assoc. for the Advan. of Sci., San Francisco, 24 Feb. - 1 Mar. 1974

(Contracts AT(11-1)-3326; NSFC-705)
 (COO-3326-27; Conf-740213-4) Avail: NTIS HC \$4.00

The relevant aspects of photosynthesis are reviewed, the prospects for expanded exploitation of natural solar conversion systems are evaluated, and some avenues for needed research are suggested. The cheapest, largest, and most successful solar energy conversion system available is photosynthesis. Photosynthesis is not an efficient energy source. One approach examined was the search for increased yield of combustibles (e.g., woody plants) and another was the interference with photosynthetic processes so that combustible gases like hydrogen or methane were produced.

NSA

N74-32474# Brookhaven National Lab., Upton, N.Y. Accelerator Dept.

SOLAR POWERED STEAM SUPPLEMENT FOR THE BNL STEAM PLANT

J. G. Cottingham and G. K. Green 15 Mar. 1974 26 p refs Sponsored by AEC
 (BNL-18734) Avail: NTIS HC \$4.50

Solar energy converted to commercial steam can be distributed and used by existing equipment to heat and cool buildings. This forms a ready economical market for an otherwise expensive energy source. Component designs and system plans are outlined using an elevated boiler and reflectors that track the sun. Author (NSA)

N74-32475# Argonne National Lab., Ill.
DEVELOPMENT OF HIGH-SPECIFIC ENERGY BATTERIES FOR ELECTRIC VEHICLES Progress Report, Feb. - Jul. 1973

P. A. Nelson, E. C. Gay, R. K. Steunenberg, J. E. Battles, W. W. Schertz, D. R. Vissers, K. M. Myles, M. L. Kyle, D. S. Webster, and L. Burris Dec. 1973 47 p refs
 (Contract W-7405-109-eng-38)

(ANL-8039) Avail: NTIS HS \$5.45

A high specific energy lithium/sulfur battery having the performance characteristics required for powering pollution-free automobiles is described. The cells currently under development have negative electrodes of molten lithium and positive electrodes of sulfur separated by a molten lithium halide containing electrolyte. The operating temperature of the cells is about 400 C. Cells with positive electrodes consisting of sulfur arsenic carbon mixtures in graphite housings have achieved short time peak power densities and capacity densities that meet or exceed the goals for a single cell. A capacity density of 0.1 A-hr/sq cm has been sustained at a discharge current density of 0.1 A/sq cm for more than 500 hr and 100 cycles. Author (NSA)

N74-32476# Sandia Labs., Albuquerque, N.Mex. Criteria and Heat Transfer Div.
SOLAR COMMUNITY: ENERGY FOR RESIDENTIAL

HEATING, COOLING, AND ELECTRIC POWER

W. H. McCulloch, D. O. Lee, and W. P. Schimmel, Jr. Feb. 1974 18 p refs Presented at 140th Meeting of the Am. Assoc. for the Advan. of Sci., San Francisco, 25-27 Feb. 1974 (Contract AT(29-1)-789)

(SLA-74-91; Conf-740213-3) Avail: NTIS HC \$3.00

A series of systems studies on the potential uses of solar energy were conducted for the solar total energy community. This is a residential community which could significantly reduce its fossil fuel energy consumption by using the sun as the source for most of the community's energy needs. A system computer program was used to examine several candidate systems and to optimize the operation of interrelated components which provide space heating, air conditioning, water heating, and electricity for residences and light commercial buildings. An experimental program has been initiated to investigate various technological areas relative to the concept. The study shows that the solar community is technologically feasible and that the projected costs warrant the further investigation of solar energy as an alternative residential energy source. Author (NSA)

N74-32477# Sandia Labs., Albuquerque, N.Mex.
SOLAR TOTAL-ENERGY COMMUNITY PROJECT

G. E. Brandvold Mar. 1974 9 p

(Contract AT(29-1)-789)

(SLA-74-124) Avail: NTIS HC \$4.00

The concept of a solar total energy community entails collecting solar energy at a central area, converting part of it to electricity, and distributing the rest of it to homes and/or businesses for space heating or cooling. A concept for such uses of solar energy, its departure from other solar-energy approaches, and the development program being conducted to further explore its feasibility are described. Author (NSA)

N74-32478# Sandia Labs., Albuquerque, N.Mex.
EXPERIMENTAL RESISTIVITY ELECTRODE EMPLACEMENT FOR THE HAWAII GEOTHERMAL PROJECT

G. E. Brandvold Apr. 1974 8 p refs

(Contract AT(29-1)-789)

(SLA-74-194) Avail: NTIS HC \$4.00

Problems of geothermal resource research are considered. Field trials of an experimental terradynamics electrode for resistivity surveys have been carried out, and the design of an instrumented magma penetrometer was begun. Author (NSA)

N74-32484 Royal Aircraft Establishment, Farnborough (England).
 Engineering Physics Dept.

SOME COMMENTS OF THE ELECTRICAL PERFORMANCE OF GENERATORS OPERATING WITH RECTIFIED OUTPUT

P. A. Shaw In *its Current Develop. Status of Variable Speed Constant Freq. (VSCF) Cycloconverter Elec. Supply Systems for Aircraft*, Dec. 1973 p 95-120

Development of variable speed constant frequency electrical systems for aircraft are discussed. Technical problems and their effect on machine design were examined. ESRO

N74-32488# Mitre Corp., McLean, Va.
SYSTEMS ANALYSIS OF SOLAR ENERGY PROGRAMS. APPENDIX: RESEARCH TASKS Final Report

Dec. 1973 150 p refs

(Grant NSF C-831)

(PB-231145/4; MTR-6513-App; NSF-RA/N-73-111) Avail: NTIS HC \$4.75 CSCL 10A

A compendium is presented of proposed research tasks for each of the seven solar energy program sub-elements under the following five disciplines: (1) technical studies; (2) economic studies; (3) environmental studies; (4) sociological studies; and (5) institutional studies. Solar energy collection, conversion, storage, transmission and distribution, utilization, and systems integration subsystems are also matched with appropriate research tasks. Author (GRA)

N74-32489# Mitre Corp., McLean, Va.

SYSTEMS ANALYSIS OF SOLAR ENERGY PROGRAMS Final Report

Dec. 1973 325 p refs

(Grant NSF C-831)

(PB-231142/1; MTR-6513; NSF-RA/N-73-111A) Avail: NTIS HC \$7.25 CSCL 10A

This is one of a series of reports that cover a study of the NSF Five-Year Solar Energy Research Program. The approach used included the following: define general program structure, identify and describe current state-of-the-art, assess currently studied systems, identify problems formulate comprehensive set of research tasks, identify proof-of-concept experiments, and describe scenarios for production and implementation. Each of seven major applications of solar energy have been analyzed in terms of their costs and the benefits that are expected accrue from their implementation. The heating and cooling of buildings, wind energy systems, and the utilization of organic materials appear to be best capable of achieving commercial application within a few years. Process-heat systems, solar-thermal systems, photovoltaic systems, and ocean thermal gradient systems, appear to need continued Federal Government support beyond the initial NSF 5-year Program for solar energy systems. (Modified author abstract) GRA

N74-32490# Mitre Corp., McLean, Va.

SOLAR ENERGY RESEARCH PROGRAM ALTERNATIVES. PROPOSED RESEARCH TASKS, COSTS AND SCHEDULES FOR THE NATIONAL SCIENCE FOUNDATION FIVE-YEAR SOLAR ENERGY RESEARCH PROGRAM Final Report

Dec. 1973 149 p

(Contract NSFC-831)

(PB-231141/3; MTR-6516; NSF-RA/N-73-111B) Avail: NTIS HC \$4.75 CSCL 10A

Research Directorate Office of Systems Integration and Analysis. This document provides two alternative research plans, including task schedules and costs, for each of eight program elements: Heating and Cooling of Buildings, Process Heat, Thermal-Electric Energy Conversion, Photovoltaic Energy Conversion, Ocean Thermal Systems, Wind Energy Systems, Utilization of Organic Materials, and Common Applications. The two alternatives are (1) a set of research tasks considered to be the minimum necessary to bring about the widespread utilization of solar energy and (2) an accelerated plan to achieve more rapid utilization, with a higher degree of confidence and reduced technical risk. Author (GRA)

N74-32491# Mitre Corp., McLean, Va.

DISSEMINATION AND UTILIZATION OF SOLAR ENERGY RESEARCH RESULTS Final Report

Richard S. Greeley Dec. 1973 69 p refs

(Contract NSF C-831)

(PB-231144/7; MTR-6544; NSD-RA/N-73-111D) Avail: NTIS HC \$3.75 CSCL 10A

Thirty 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. (Modified author abstract) GRA

N74-32492# Illinois Univ., Urbana. Dept. of Civil Engineering.

RECLAMATION OF ENERGY FROM ORGANIC WASTE Final Report

John T. Pfeffer Mar. 1974 143 p refs

(Grant EPA-R-800766)

(PB-231176/9; EPA-670/2-74-016) Avail: NTIS HC \$4.75 CSCL 138

This study applied the anaerobic fermentation process to the production of methane from the organic fraction of urban

refuse. Shredded domestic refuse from which the inorganic fraction was separated was used as a substrate. Raw sewage sludge was added to the substrate in proportion to the rate at which it is produced by a population producing a given quantity of refuse. The quantity and quality of gas produced, the rate of gas production, the solids reduction, nutritional requirements, and operating problems were evaluated in a laboratory system operating at temperatures ranging from 35C to 60C. The results of the laboratory study together with published data on both capital and operating costs of refuse shredding, refuse separation, reactor volume, reactor mixing, reactor heating, and residue dewatering were used to analyze the economics of the process. (Modified author abstract) GRA

N74-32493# American Univ., Washington, D.C.
RESEARCH ON ELECTROCHEMICAL ENERGY CONVERSION SYSTEMS Interim Technical Report, Apr. - Oct. 1973

Alayne A. Adams, Robert T. Foley, and Richard M. Goodman
 Feb. 1974 43 p refs
 (Contract DAAK02-72-C-0084; DA Proj. 1T1-61102-A-34A)
 (AD-780952; ITR-4) Avail: NTIS CSCL 07/4

The research on electrochemical energy conversion systems has involved a search for electrolytes alternative to phosphoric acid for direct and indirect hydrocarbon-air fuel cells. It has concentrated on trifluoromethanesulfonic acid monohydrate and perfluorobutyric acid. Experiments in which hydrogen was electrooxidized showed that the enhanced performance of the sulfonic acid is not restricted to propane. Further, it is indicated that adsorption intermediates of the type seen in phosphoric acid and detrimental to the efficiency of the process are absent in this electrolyte. The electro oxidation of propane in perfluorobutyric acid proceeds at a lower rate than in CF₃SO₃H.H₂O. An apparatus and technique to measure the solubility of gases in electrolytes was installed. Preliminary measurements of the solubility of propane in CF₃SO₃H.H₂O are in the same range as those reported for H₃PO₄. (Modified author abstract) GRA

N74-32496# Dayton Univ. Research Inst., Ohio.
A METHOD TO PREDICT THE SERVICE LIFE OF INTERNAL FUEL CELL BAFFLE MATERIALS
 William E. Berner Jan 1974 49 p refs
 (Contract F33615-72-C-1282; AF Proj. 7381)
 (AD-781260; UDRI-TR-73-65; AFML-TR-73-278) Avail: NTIS CSCL 10/2

The reversion of elastomeric materials under conditions of elevated temperature and humidity has been a serious problem for the Armed Services. This report describes techniques to predict the life of two elastomeric fuel cell baffle materials under these environmental conditions. The techniques involves taking empirical reversion data at 24 specific test conditions and using it to confirm that the reaction rate is first order and to determine the reaction rate constant used to predict the reversion time. In a second program, a fuel tank sealant was evaluated for use as a possible adhesive to bond the fuel cell baffle material to the fuel cell. Through the usage of the reaction rates developed in this report it can be shown that the life of foam materials may be predicted through temperature and humidity data. With the two materials discussed, the life of a polyester matting material was approximately 3.3 times longer than the life of a polyester polyurethane foam. The results of the second program shows that the life of the adhesive was longer than the expected life of the foam materials. (Modified author abstract) GRA

N74-32584# Esso Research and Engineering Co., Linden, N.J.
A REGENERATIVE LIMESTONE PROCESS FOR FLUIDIZED-BED COAL COMBUSTION AND DESULFURIZATION Final Report

R. C. Hoke, M. S. Nutkis, L. A. Ruth, and H. Shaw Jan. 1974 110 p refs
 (Contract CPA-70-19)
 (PB-231374/0; GRUS-14GFGS-74; EPA-650/2-74-001) Avail: NTIS HC \$8.50 CSCL 07A

The report gives results of an experimental study of the pressurized combustion of coal in a fluidized bed of limestone and regeneration of sulfated limestone. The study is part of a program to develop fluidized-bed coal combustion as a means of desulfurizing flue gas in-situ and generating clean power at low cost. The process, including regeneration of spent limestone by reduction to lime, produces a gas stream containing a sufficient concentration of SO₂ to be fed to a by-product sulfur recovery unit. Initial SO₂ removal rates were about 85%. The regeneration step was studied at pressures up to 10 atm and temperatures up to 2100F. High conversion of sulfated material to lime was achieved by injecting air into the bed, by forming adjacent reducing and oxidizing zones, and by minimizing formation of undesired CaS. GRA

N74-32682# Brookhaven National Lab., Upton, N.Y.
REVIEW OF BROOKHAVEN NATIONAL LABORATORY SUPERCONDUCTING POWER TRANSMISSION PROGRAM

J. E. Jensen 11 Oct. 1973 12 p Sponsored by AEC
 (BNL-18346) Avail: NTIS HC \$3.00

Research is being conducted to develop a superconducting ac cable system leading to the construction of a 1/2 mile model cable of 200 MVA capacity and a cable of large capacity for tests at a utility testing site. It is a coaxial cable of flexible design using Nb₃Sn superconductor and a tape wound dielectric, helium impregnated, of a material yet to be determined. The research development is reported on the dielectric materials, cryogenic enclosure, refrigeration, and superconducting materials. NSA

N74-32683# Los Alamos Scientific Lab., N.Mex.
USAEC-DAT DC SUPERCONDUCTING POWER TRANSMISSION LINE PROJECT AT LASL Progress Report, 1 Jul. - 30 Sep. 1973

W. E. Keller, comp. and R. D. Taylor, comp. Nov. 1973 28 p refs
 (Contract W-7405-eng-36)
 (LA-5468-PR) Avail: NTIS HC \$4.00

The principal findings of two study contracts on feasibility and costs involved in building a commercial SPTL are summarized. Experimental critical current results for Nb₃Sn tapes in several geometries and numerical calculations of the magnetic field profile assuming various models of the current distribution are presented. Continued progress in the areas of fabrication, superconducting materials, and test bed operation is reported. Author (NSA)

N74-32684# Los Alamos Scientific Lab., N.Mex.
DEVELOPMENT PROJECT FOR A dc SUPERCONDUCTING POWER TRANSMISSION LINE

T. E. McDonald 1973 8 p refs Presented at Underground Transmission and Distribution Conf., Dallas, Apr. 1974 Sponsored by AEC
 (LA-UR-73-1500; Conf-740410-1) Avail: NTIS HC \$4.00

A dc superconducting power transmission project that is in progress at the Los Alamos Scientific Laboratory is described. The project is directed toward the development of a system that would primarily be used for long distance high capacity transmission. A discussion of the advantages of a dc superconducting transmission line is given and preliminary cost estimates of a conceptual design are presented. Author (NSA)

N74-32728# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
THE NASA LANGLEY BUILDING SOLAR PROJECT AND THE SUPPORTING LEWIS SOLAR TECHNOLOGY PROGRAM

Robert G. Ragsdale and David Namkoong 1974 34 p refs
 Presented at the Intern. Solar Energy Soc. Meeting, Fort Collins, Colo., 19-23 Aug. 1974
 (NASA-TM-X-71600; E-8075) Avail: NTIS HC \$3.25 CSCL 14B

The use of solar energy to heat and cool a new office building that is now under construction is reported. Planned for completion in December 1975, the 53,000 square foot, single story building will utilize 15,000 square feet of various types of solar collectors in a test bed to provide nearly all of the heating demand and over half of the air conditioning demand. Drawing on its space-program-developed skills and resources in heat transfer, materials, and systems studies, NASA-Lewis will provide technology support for the Langley building project. A solar energy technology program underway at Lewis includes solar collector testing in an indoor solar simulator facility and in an outdoor test facility, property measurements of solar panel coatings, and operation of a laboratory-scale solar model system test facility. Based on results obtained in this program, NASA-Lewis will select and procure the solar collectors for the Langley test bed. Author

N74-32785* National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
AN ANALYSIS OF FRACTURE TRACE PATTERNS IN AREAS OF FLAT-LYING SEDIMENTARY ROCKS FOR THE DETECTION OF BURIED GEOLOGIC STRUCTURE
 Melvin H. Podwysocki Jun. 1974 85 p refs Submitted for publication
 (NASA-TM-X-70742; X-923-74-200) Avail: NTIS HC \$7.25 CSCL 08G

Two study areas in a cratonic platform underlain by flat-lying sedimentary rocks were analyzed to determine if a quantitative relationship exists between fracture trace patterns and their frequency distributions and subsurface structural closures which might contain petroleum. Fracture trace lengths and frequency (number of fracture traces per unit area) were analyzed by trend surface analysis and length frequency distributions also were compared to a standard Gaussian distribution. Composite rose diagrams of fracture traces were analyzed using a multivariate analysis method which grouped or clustered the rose diagrams and their respective areas on the basis of the behavior of the rays of the rose diagram. Analysis indicates that the lengths of fracture traces are log-normally distributed according to the mapping technique used. Fracture trace frequency appeared higher on the flanks of active structures and lower around passive reef structures. Fracture trace log-mean lengths were shorter over several types of structures, perhaps due to increased fracturing and subsequent erosion. Analysis of rose diagrams using a multivariate technique indicated lithology as the primary control for the lower grouping levels. Groupings at higher levels indicated that areas overlying active structures may be isolated from their neighbors by this technique while passive structures showed no differences which could be isolated. Author

N74-32861* Naval Research Lab., Washington, D.C.
ARTIFICIAL SEA SLICKS: THEIR PRACTICAL APPLICATIONS AND ROLE IN FUNDAMENTAL RESEARCH Interim Report
 William R. Barger and William D. Garrett 4 Jun. 1974 17 p refs
 (NRL Proj. G02-03; NRL Proj. G02-07)
 (AD-780784; NRL-7751) Avail: NTIS CSCL 08C

Artificial sea slicks are man-made, monomolecular, organic films adsorbed at the air-sea interface. They are formed from spontaneously spreading, water-insoluble polar liquids. Techniques for generating artificial sea slicks from surface vessels and from the air have been devised. Research into the chemical modification of air-sea interactions has led to several practical applications for artificial sea slicks. The ability of organic surface films to damp capillary waves renders the area covered by the film highly visible and sensible under most environmental conditions. The attenuation of both capillary and high-frequency gravity waves by artificial sea slicks has been examined under open-ocean conditions. The wave-damping property has been used as a basis for the development of seamarkers that generate highly visible, persistent ripple-damped zones on the sea surface. Large artificial slicks have been used as a tool to elucidate the

mechanisms of wind-wave interactions and air-sea exchange processes. The most widely used application of film-forming organic chemicals is for the control and containment of oil spills, and increasing the efficiency of oil retrieval operations. (Modified author abstract) GRA

N74-33092* Environmental Protection Agency, Research Triangle Park, N.C. Emission Standards and Engineering Div.
FLUE GAS DESULFURIZATION: ANSWERS TO BASIC QUESTIONS
 Oct. 1973 18 p
 (PB-231005/0; EPA-450/9-73-001) Avail: NTIS HC \$4.00 CSCL 13B

The purpose of this publication is to provide a better understanding of flue gas desulfurization. It provides brief answers to questions concerning its applicability, cost, effectiveness, and operation. GRA

N74-33139* Brookhaven National Lab., Upton, N.Y. Dept. of Applied Science
CONTROLLED THERMONUCLEAR RESEARCH. SURVEY OF APPLICATIONS OF FUSION POWER AND TECHNOLOGY TO THE CHEMICAL AND MATERIALS PROCESSING INDUSTRIES Bimonthly Report, Jan. - Feb. 1974
 M. Steinberg, J. Powell, and M. Beller 1974 6 p
 (BNL-18745; BMR-4) Avail: NTIS HC \$4.00

Current efforts are directed toward processes and markets which can utilize the energy forms from fusion reactors. A list is given that outlines various products and processes which are energy-intensive. The thermal reactions may utilize energy directly or indirectly. Directly indicates that the process gas is introduced into the blanket to obtain the required energy. Indirectly indicates that the process gas is heated by heat exchange with blanket coolant gas. The heat exchange may be accomplished by regenerative pebble-bed heaters, in which alternate beds are heated by reactor coolant gas (e.g., helium). By appropriate valving, the hot bed then gives up its stored heat to the process gas while the other bed is heated. NSA

N74-33149* Los Alamos Scientific Lab., N.Mex.
CRYOGENICS SAFETY IN A HYDROGEN FUEL SOCIETY
 R. Reider, F. J. Edeskuty, and K. D. Williamson, Jr. [1974] 20 p refs Presented at 5th Intern. Cryogenic Eng. Conf., Kyoto, 7-10 May 1974
 (Contract W-7405-eng-36)
 (LA-UR-74-340; Conf-740509-1) Avail: NTIS HC \$3.00

An inevitable world-wide shortage of fossil fuel and concern for environmental pollution have aroused interest in hydrogen as a synthetic clean fuel. To make liquid hydrogen a universally attractive fuel requires only an extension of existing technology. The fundamentals of cryogenic safety with specific attention to hydrogen are reviewed with respect to material properties, control of ignition sources, management of leaks, inerting and ventilating, analysis of spills, cold injury, air condensation and oxygen enrichment, pressure relief and thermal stresses. Problems of standards and regulations, safety training, development of operating procedures, and emergency plans must be addressed thoroughly before the common use of liquid hydrogen will receive public acceptance. The nature and consequences of hydrogen accidents are analyzed. Author (NSA)

N74-33176* Air Force Systems Command, Wright Patterson AFB, Ohio. Foreign Technology Div.
THE USE OF PLASMA ACCELERATORS IN SPACE RESEARCH
 I. M. Podgornii 17 Jun. 1974 16 p refs Transl into ENGLISH from Plazmennyye Uskor. (USSR), 1973 p 41-47
 (AD-781662; FTD-HT-23-1045-74) Avail: NTIS CSCL 20/9

The creation of an artificial solar wind by using a coaxial electrodynamic plasma accelerator with pulsed gas admission is discussed. The required parameters of capacitor battery capacitance, voltage at the electrodes, and amplitude and time

characteristics of the pulse fed to the hydrogen accelerator were determined experimentally. The experiments made it possible to reproduce the form of the earth magnetosphere including the geomagnetic tail, the collisionless shock wave, and a number of other phenomena. The areas of application of the electrodynamic accelerator are defined. Author

N74-33210# Bureau of Mines, Bartlesville, Okla. Energy Research Center.

ANALYSIS OF AVIATION GAS TURBINE FUELS Final Report

R. W. Hurn Dec. 1973 13 p refs

(Contract DOT-AS-20058)

(AD-774673; FAA-RD-73-189) Avail: NTIS HC \$3.00

Experimental work was done to determine for aviation turbine fuels the trace components that could be source material of atmospheric pollutant. Data were obtained on both U. S. and European area fuels. Other analytical data were obtained for turbine exhaust gases and, concurrently, on the fuels used in producing the exhaust. The objective in the engine exhaust study was to correlate, if possible, the presence of fuel trace components and the appearance of such components in the aircraft emissions. Results of the study suggest that trace elements of fuels can be controlled at levels such that the fuel is not significant as a source of those elements as aircraft emissions. Author

N74-33213# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

EVALUATION OF THE EFFECTIVENESS OF ANTI-MIST FUEL ADDITIVES IN PREVENTION OF AIRCRAFT FUEL TANK ULLAGE FIRES AND EXPLOSIONS Technical Report, 1 Dec. 1972 - 15 Feb. 1973

Gregory W. Gandee and Robert G. Clodfelter Jan. 1974 22 p refs

(AF Proj. 3048)

(AD-781378; AFAPL-TR-73-111) Avail: NTIS CSCL 21/4

A series of vertical gunfire tests was conducted at Wright-Patterson AFB in order to assess the effectiveness of fuel additives in reduction of the fire and explosion hazards that can be associated with kerosene (JP8) fuel under gunfire conditions. This program considered commercial additives which have been developed for the fire-safe fuel efforts of the FAA, the Army, and the British Government. The additives were intended to prevent fuel mist or spray during a crash situation. This effort considered the effectiveness of these additives at a concentration of approximately 0.3% wt. in the prevention of explosions of fuel mist or spray as a 50 calibre armor piercing incendiary ordnance round passes through the liquid-vapor interface. Results indicated that additives could be effective. Two of the four materials reduced average pulse pressure rise to less than 10 psi as compared to 40 psi rise with neat JP-8. Additives were not effective when evaluated in JP-4 fuel. Author (GRA)

N74-33245# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

PRELIMINARY STUDY OF THE CATALYTIC COMBUSTOR CONCEPT AS APPLIED TO AIRCRAFT GAS TURBINES Final Report, Jan. 1972 - Feb. 1974

William S. Blazowski and Gerald E. Bresowar May 1974 65 p refs

(AF Proj. 3048)

(AD-781762; AFAPL-TR-74-32) Avail: NTIS CSCL 21/2

The investigation was intended to study the feasibility of using solid catalytic beds in the reaction zone of aircraft gas turbine combustors. Since the catalytic combustor operates at low-equivalence ratios throughout (there is no near-stoichiometric operation as in most conventional combustors), oxide of nitrogen emissions were forecast to be extremely low. JP-4 fuel was used throughout the experimental test program. Flashback and preignition were observed and the fuel introduction system developed to partially overcome these problems is described. At all operating conditions tested, NOx concentration

was to be below 2 ppmV -- two orders of magnitude below that expected from a conventional combustor operated under similar inlet and exhaust conditions. No reduction in performance was noted over the 28 hours of test operation. (Modified author abstract) GRA

N74-33379* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SOLID MEDIUM THERMAL ENGINE Patent

James R. Jedlicka, LeRoy R. Guist, and Richard M. Beam, inventors (to NASA) Issued 20 Aug. 1974 25 p Filed 27 Feb. 1973 Supersedes N73-20931 (11 - 11, p 1347)

(NASA-Case-ARC-10461-1; US-Patent-3,830,060;

US-Patent-Appl-SN-336319; US-Patent-Class-60-527) Avail: US Patent Office CSCL 20M

A device is described which uses a single phase metallic working substance to convert thermal energy directly into mechanical energy. The device consists of a cylindrical metal tube which is free to rotate about its axis while being subjected to continuous bending moment stresses along the longitudinal axis of rotation. The stressing causes portions of the tube to be under compression while other parts are under tension which in turn causes the tube to rotate and provide mechanical energy. P.N.F.

N74-33408# Joint Committee on Defense Production (U. S. Congress).

ANNUAL REPORT OF THE ACTIVITIES OF THE JOINT COMMITTEE ON DEFENSE PRODUCTION WITH MATERIAL ON MOBILIZATION FROM DEPARTMENTS AND AGENCIES, PART 2

Washington GPO 7 Feb. 1974 631 p refs Twenty-third Annual Report of the activities of the Joint Comm. on Defense Production, 93d Congr., 1st Sess., 5 Feb. 1974

(S-93-683; GPO-23-827; AR-23) Avail: US Capitol, Senate Document Room

Strategic stockpiling objectives of materials for mobilization are reviewed and other stockpiling operations, including the acquisition of materials from abroad and the disposal of stockpile surpluses, are elaborated. G.G.

N74-33416* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ENERGY IMPACT OF SHORT-HAUL STOL SYSTEMS

Elwood C. Stewart Jul. 1974 20 p refs

(NASA-TM-X-62356) Avail: NTIS HC \$3.00 CSCL 05C

An analysis has been made to evaluate the impact on fuel requirements of a segregated short-haul system. A comparison has been made between two alternate scenarios: one with STOL, and the other without STOL. For the New York to Washington, D.C. city pair the results show: (1) the modal efficiency approach, while indicating the with STOL scenario requires more fuel than the without STOL scenario, is of questionable validity because it does not account for various effects which exist in realistic scenarios; (2) evaluation of fuel requirements based on more detailed modeling indicates that while a STOL scenario requires more fuel than without STOL when an idealized CTOL system is postulated, the STOL scenario requires less fuel than without STOL when the CTOL system has even moderate delays. These results are due to a combination of effects: the closer and more convenient locations of STOL ports to the traveler, congestion at the CTOL airports, and the impact of the through passenger traffic. Sensitivity of results to STOL aircraft block fuel and to CTOL congestion delays are considered. Author

N74-33418# Atomic Energy Commission, Washington, D.C. **FUEL TRANSPORTATION, DISTRIBUTION, AND STORAGE Subpanel report 3 used in preparing the AEC chairmans report to the President**

J. H. Seelinger 13 Nov 1973 163 p

(WASH-1281-3) Avail: NTIS HC \$11.25

Pipelines, ocean delivery systems, large nuclear underground fuel transportation, distribution, and storage (TDS), and hydrogen TDS were considered for research and development funding, but were abandoned for a more limited program designated the ship delivery system. Recommended funding was set at \$50 million over a five year fiscal period. The expected achievements of the ship delivery system are discussed and include the following: (1) detailed design of Arctic surface tankers suitable for transporting oil from certain regions of the Arctic to U. S. East Coast ports safely and economically; (2) detailed design and advanced components for Arctic submarine tankers for use where pipelines and surface tankers are not feasible; (3) detailed design of Arctic marine terminals, both surface and submerged, followed by feasibility demonstration; and (4) acceptance, commitment, and participation in these programs by commercial operators on the basis of established technology and economic desirability.

NSA

N74-33419# Atomic Energy Commission. Washington, D.C. **RESOURCE ASSESSMENT Subpanel report 1 used in preparing the AEC chairmans report to the President** T. H. McCulloh 13 Nov. 1973 147 p (WASH-1281-1) Avail: NTIS HC \$10.50

The United States will be primarily dependent for its energy needs upon oil and gas, coal, uranium and hydropower well into the next century. Domestic sources of these supplies will be taxed to the utmost during the 1973-85 period. Options involving different energy mixes, different levels of energy production, and varying environmental and socio-economic impacts may be permitted in the long term by technological progress. However, the necessary decisions regarding such options cannot now be made intelligently without a much better understanding of the domestic energy fuel resource base. Resolution of the energy crisis, which is basically a domestic fuel shortage, will depend primarily on increasing conventional fuel supplies. More effective means for the discovery, evaluation, and development of these supplies are needed. Since the cited fuels and hydropower will remain the prime domestic energy sources for many decades, it is essential to recognize that each is characterized by unique features of availability, usability, and environmental acceptability. They are only partly interchangeable as fuels and more complete interchangeability will require the restructuring of many industrial processes. Author (NSA)

N74-33420# California Univ., Livermore. Lawrence Livermore Lab.

ELEMENTS OF THE WORLD ENERGY CRISIS

G. C. Werth and E. Green 14 Jan. 1974 31 p refs Presented at Watchtower-74 Meeting, Moctez, Mexico, 18-20 Jan. 1974; Sponsored by Banco Nacional de Mexico (Contract W-7405-eng-48)

(UCID:16428) Avail: NTIS HC \$4.75

The chain of events leading to the world energy crisis is followed for each industrialized country and the effects that energy shortages are presenting and options that are available are identified. The Soviet Union has extensive oil and gas reserves and the U.S.A. has extensive fossil fuel reserves, but needs to develop technology for coal and shale. Western Europe has been dependent upon Middle East oil, but could develop their coal resources. Japan is dependent upon oil imports, and with the advanced prices of oil, the capital on that island needs to be used internally in improving living conditions. NSA

N74-33482# Duke Univ., Durham, N.C. Dept. of Electrical Engineering.

RESEARCH ON SPACECRAFT ELECTRICAL POWER CONVERSION Status Report, 1 Sep. 1973 - 28 Feb. 1974

Thomas G. Wilson 1 Mar. 1974 10 p refs

(Grant NGL-34-001-001)

(NASA-CR-140038; SR-26) Avail: NTIS HC \$4.00 CSCL 10A

The steady state characteristics and starting behavior of some widely used self-oscillating magnetically coupled square wave inverters were studied and the development of LC-tuned square wave inverters is reported. An analysis on high amplitude voltage spikes which occur in dc-to-square-wave parallel converters shows the importance of various circuit parameters for inverter design and for the suppression of spikes. A computerized simulation of an inductor energy storage dc-to-dc converter with closed loop regulators and of a preregulating current step-up converter are detailed. Work continued on the computer aided design of two-winding energy storage dc-to-dc converters. G.G.

N74-33485# National Aeronautics and Space Administration, Washington, D.C.

NASA AND ENERGY

[1974] 16 p

(NASA-EP-121) Avail: NTIS MF \$1.45; SOD \$0.35 CSCL 10A

NASA technology contributions to create energy sources include direct solar heating and cooling systems, wind generation of electricity, solar thermal energy turbine drives, solar cells, and techniques for locating, producing, and collecting organic materials for conversion into fuel. G.G.

N74-33487# Federal Power Commission, Washington, D.C. **ENERGY CONSERVATION HANDBOOK FOR LIGHT INDUSTRIES AND COMMERCIAL BUILDINGS**

May 1974 18 p

Avail: NTIS MF \$1.45; SOD HC \$0.35

Suggested guidelines for surveying energy conservation opportunities in a given plant are reported. These pages were prepared with the help of consulting engineers who have wide experience assisting businessmen and plant operators to improve fuel utilization. The guidelines contain a checklist of places to look for energy conservation opportunities and suggest possible corrective measures to be applied. The survey is divided into two major sections: plant buildings and processes and equipment. Author

N74-33488# RAND Corp., Santa Monica, Calif.

SOME CHARACTERISTICS OF RADIOISOTOPE POWER SOURCES IN AN OCEAN ENVIRONMENT

R. C. Erdmann, E. C. Gritton, and M. J. Ozeroff Mar. 1974 31 p refs

(P-5056-1) Avail: NTIS HC \$4.75

The results of this study show that lightweight radioisotope heat sources can be considered for use undersea with little shielding necessary for electronics packages in close proximity to the heat source. Acceptable integrated electronic dose levels for gamma irradiation and neutron bombardment were obtained for extended mission times for the three isotopes considered. For Cm-244 and Co-60 it was found that the shield around the electronics package becomes important due to the strong back scattering effect of neutrons and gammas from the surrounding seawater. Author

N74-33489# RAND Corp., Santa Monica, Calif.

RESIDENTIAL WATER HEATING: FUEL CONSERVATION, ECONOMICS, AND PUBLIC POLICY

James J. Mutch May 1974 87 p refs

(Grant NSF GI-44)

(R-1498-NSF) Avail: NTIS HC \$7.50

Several alternatives that may reduce the amount of fossil fuel based energy needed to furnish residential hot water is presented. Thermal losses from the water heating system and the non-renewable energy requirements of the system are two alternatives considered. The economic cost of each measure to the consumer is examined as a function of the price of the fuel, allowing comparison of different fuel conservation approaches in terms of their life cycle costs. The potential of government policy

as a tool for implementation of economically beneficial fuel conservation alternatives is also discussed. M.C.F.

N74-33490# Houston Univ., Tex. Dept. of Physics.
SOLAR THERMAL POWER SYSTEM BASED ON OPTICAL TRANSMISSION

L. L. Vant-Hull and A. F. Hildebrandt [1974] 35 p refs
Sponsored in part by NSF
Avail: NTIS HC \$4.75

A baseline design, consisting of an array of heliostats that redirect beam radiation onto a receiver atop a 450 meter tower, was developed as part of a technical and economic feasibility study of a solar thermal electric power system based on optical transmission of direct solar energy to a central receiver. Reflector design was also considered, along with guidance, tracking, and control subsystems which include the sensors, electronics, motors, drive trains, and mounts required to support and orient the reflector assembly. A.A.D.

N74-33491# Houston Univ., Tex. Dept. of Physics.
A TOWER-TOP POINT FOCUS SOLAR ENERGY COLLECTOR

A. F. Hildebrandt and L. L. Vant-Hull 20 Mar. 1974 10 p refs
Presented at the Hydrogen Econ. Miami Energy Conf., Miami Beach, Fla., 18-20 Mar. 1974 Sponsored in part by ARPA

(Grant NSF G1-39456)

Avail: NTIS HC \$4.00

Temperatures over 1000 C appear possible with a large segmented Fresnel mirror consisting of independent hydraulically or electrically steered heliostats constructed of flat mirrors. A central receiver is elevated well above the mirror field on a tower of about 450 meters height, in order that the redirected solar radiation from a square mile radius be intercepted. A collector of such dimensions would produce heat at a peak rate of 500 MWT in the winter and 700 MWT in the summer. Author

N74-33492# General Electric Co., Santa Barbara, Calif. TEMPO Center for Advanced Studies.

HEAT-STORAGE WELLS FOR CONSERVING ENERGY AND REDUCING THERMAL POLLUTION

Charles F. Meyer and David K. Todd (Calif. Univ., Berkeley) Jun. 1973 6 p refs
Presented at the 8th Intersociety Energy Conversion Engineering Conf., Philadelphia, Aug. 1973 (P-635) Avail: NTIS HC \$4.00

Storing large amounts of useful heat in ground water appears feasible. Preliminary analysis shows that more than three-fourths of the stored heat can be recovered after 90 days; heat storage wells cost less than the cooling facilities they replace; and the necessary underground formations are widely available. For each unit of electricity generated today, two units of low temperature heat energy typically are wasted. Higher temperature heat (350 F) is usable for space heating, absorption air conditioning, water heating, and process heat. Heat at 350 F can be recovered from the exhaust gases of combustion gas turbines. Author

N74-33493# Atomic Energy Commission, Washington, D.C.
CONVERSION TECHNIQUES

R. E. English 13 Nov. 1973 355 p refs
(WASH-1281-6) Avail: NTIS HC \$20.75 CSCL 10A

The following eight objectives were established: (1) coal gasification: to develop processes for the production and use of clean low-BTU gas from coal in central power stations; (2) gas turbines: to increase the overall efficiency and reliability of power generation by developing high-temperature gas-turbine systems; (3) MHD: to increase the overall efficiency and reliability of power generation by developing MHD power systems; (4) potassium topping cycle: to increase the overall efficiency and reliability of power generation by developing potassium-vapor topping systems; (5) fuel cells: to develop efficient and economical

fuel cells for power generation; (6) use of waste heat and fuel to develop power systems for economical use of heat and fuel presently wasted; (7) advanced concepts: to evaluate, to investigate, and ultimately to develop advanced concepts for energy conversion; and (8) enabling technology: to evolve substantial improvement of various power systems or entirely new concepts for power generation. Author (NSA)

N74-33494# Atomic Energy Commission, Washington, D.C.
GEOTHERMAL ENERGY PROGRAM

13 Nov. 1973 192 p
(WASH-1281-8) Avail: NTIS HC \$12.75 CSCL 10A

Only one resource type is presently being used to produce power in the U.S.: dry steam generating 400 MWe at the Geysers near Santa Rosa, California. Six other types are potentially available for economic energy recovery. The program plan calls for a government budgetary obligation of \$40 million during FY-75 coupled with an industrial commitment of \$11.7 million. The five year budgetary obligations are estimated to be \$185 million for the government and \$60 million for industry. The complete five year plan plus the balance-to-complete funds is presented. Author (NSA)

N74-33495# Atomic Energy Commission, Washington, D.C.
ADVANCED METHODS OF OIL AND GAS PRODUCTION FROM FOSSIL FUELS Subpanel Report 7 used in Preparing the AEC Chairmans Report to the President

E. H. Fleming 13 Nov. 1973 138 p
(WASH-1281-7) Avail: NTIS HC \$9.50

Four subprograms and objectives for in situ coal gasification and recovery of oil and gas from tar sands and heavy oils are: (1) oil recovery from fluid injection, demonstrating optimum applications of existing and improved methods for some 60 billion barrels now technologically but not economically recoverable, and an additional 60 billion barrels not now technologically recoverable; (2) oil and gas from stimulating tight formations using nuclear explosives, large volume hydraulic fractures, and chemical explosives; (3) oil from oil shale by developing appropriate fracturing techniques and processing methods; and (4) oil and gas from advanced drilling technology. The predicted results of the contribution of each subprogram to production levels by 1985 and 1995 are presented, and the comparative roles of government and industry are briefly discussed. NSA

N74-33496# Atomic Energy Commission, Washington, D.C.
END-USE ENERGY CONSERVATION

J. H. Gibbons 27 Oct. 1973 226 p
(WASH-1281-12) Avail: NTIS HC \$14.50

Opportunities for effective conservation of energy in the end-use sectors are considered. Major increases in efficiency can be attained through improvement of end-use technologies, better materials resource management, substitution of time and materials for energy, and alteration of lifestyles. In developing the program, end-use was divided into three main sectors (transportation, buildings, and industry) in order to inventory the opportunities for saving energy and to define mechanisms for allocating R and D resources. For technical reasons two more research sectors were added (integrated utility systems, and cross-sectoral studies). Additional factors that must be considered in determining research priorities include growth rate, role of federal versus private resources, and the extent of research opportunities. The minimum program developed by the panel is estimated to ensure a 15% savings before 2000. (LMT) NSA

N74-33497# Atomic Energy Commission, Washington, D.C.
ENERGY SYSTEMS ANALYSIS

S. Gage 27 Oct. 1973 184 p
(WASH-1281-16) Avail: NTIS HC \$12.25 CSCL 10A

The establishment of those mechanisms in the Federal Government is considered that would provide for both ongoing planning and management functions based on comprehensive energy systems analyses and research programs to provide the fundamental knowledge and tools required for those analyses. Specifically, it is recommended that the energy system analysis be composed of the following five elements: (1) energy data base and system modeling; (2) technology assessment of emerging energy systems; (3) social technologies and energy systems; (4) systematic analysis of alternative energy futures; and (5) strategic management and evaluation of energy R and D programs.

Author (NSA)

N74-33498# California Univ., Livermore. Lawrence Livermore Lab.

GUIDE FOR CALCULATING COLLECTION EFFICIENCY FOR THE SHALLOW SOLAR POND (APPLICABLE FOR ANY HORIZONTAL FLAT PLATE SOLAR COLLECTOR)

W. C. Dickinson and R. D. Neifert 1 Feb. 1974 44 p refs (Contract W-7405-eng-48)

(UCID-16446) Avail: NTIS HC \$4.25

The collection efficiency of a solar collector system was calculated by a method of Hottel and Whillier and Liu and Jordan. The method calculates the hourly rate of energy collection and the long term on monthly average collection efficiency based upon monthly average daily solar insolation data and daytime temperatures obtained from Weather Bureau data. The method provides the most realistic values of collection efficiency that can be obtained for a given collector system in a given location. Not only is the monthly variation taken into account but also the statistical effect of bad weather. A computer program was written to calculate average hourly values of collected heat and average daily values of collection efficiency. NSA

N74-33499# Oak Ridge National Lab., Tenn.

NATURE OF DEMAND GROWTH AND IMPLICATIONS FOR ENERGY CONSERVATION

G. S. Gill 1974 11 p refs Presented at Conf. on Energy Conservation Res., Warrenton, Va., 18-20 Feb. 1974 Sponsored by AEC and NSF

(Conf-740214-1) Avail: NTIS HC \$3.00

The demand for electricity in the United States has been consistently growing at 7% per year for most of the post World War II years. If this trend were to persist, the demand for electricity in the year 2000 would be six times the 1970 level. This growth presents two major problems: the potential gaps between the supply of and demand for electricity and the growing stress on the quality of the environment. Research has accordingly been directed towards developing a methodology for an enhanced understanding of the nature of demand growth. Both constant and variable elasticity models provide useful information to the policy makers, public utilities, regulatory agencies, citizens groups, and scientific community for effectively dealing with the present and potential problems. Author (NSA)

N74-33500# California Univ., Livermore. Lawrence Livermore Lab.

SURFACE REQUIREMENTS FOR ELECTROSTATIC DIRECT ENERGY CONVERTERS

R. W. Moir, W. L. Barr, and G. H. Miley (Ill. Univ.) 17 Jan. 1974 18 p refs Presented at the Surface effects in controlled Thermonucl. Fusion Devices and Reactors Meeting, Argonne, Ill., 10-11 Jan. 1974 Sponsored by AEC

(UCRL-75323; Conf-740104-14) Avail: NTIS HC \$3.00 CSCL 10A

There are two major electrostatic direct energy converter concepts which are discussed from the point of view of the surfaces. One is the Venetian blind concept and the other is the periodic electrostatic focusing concept. They are both of the direct collector type. Fluxes of $D(+)$, $T(+)$, $He(+ +)$, electrons, and X rays are given. Design consideration due to thermionic

emission, secondary electron emission, and radiation cooling are discussed. A detailed discussion is devoted to breakdown physics, the voltages and electric field strengths that can be employed, and how surface deterioration may affect voltage holding due to $He(+ +)$ bombardment blistering. Author (NSA)

N74-33501# Naval Nuclear Power Unit, Fort Belvoir, Va.
OPERATING REPORT FOR RADIOISOTOPIC POWER GENERATORS OF THE US NAVY, VOLUME 7, NO. 2 Report for 1 Apr. - 31 Dec. 1973

31 Dec. 1973 85 p

(AD-781261) Avail: NTIS CSCL 18/14

The objective of the report is to serve as a vehicle for the accumulation and dissemination of information concerning the application and operation of radioisotopic power generators (RPGs) within the Navy. It will be noted that all RPGs presently listed are radioisotope thermoelectric generators (RTGs). Unless specifically identified as an engineering evaluation, items contained in this report are presented as an impartial collection of facts, observations and other information. The East Coast RPG Surveillance Facility (SURFAC) located at the Naval Nuclear Power Unit, Fort Belvoir, was placed operational on 1 June 1973. Three Sentinel 25-D's were placed operational on a tower operated by the Naval Coastal Systems Laboratory of the coast of Panama City, Florida. Three Sentinel 25-E's were recovered from the Amchitka Island, Alaska area and turned over to the U.S. Navy by the AEC. The AEC turned over the development SNAP-23A to the U.S. Navy. Eight Gulf one-watt RPG's were procured by the U.S. Navy. Author (GRA)

N74-33502# Stanford Research Inst., Menlo Park, Calif.
ASSESSMENT OF TOTAL ENERGY SYSTEMS FOR THE DEPARTMENT OF DEFENSE, VOLUME 2: APPENDICES Final Report

Richard L. Goen, Gordon Stout, L. O. Beaulaurier, Richard A. Schmidt, and John W. Ryan Nov. 1973 155 p refs

(Contract DACA23-73-C-0014)

(AD-781817; SRI-EGU-2513-Vol-2) Avail: NTIS CSCL 10/1

The purpose of the study is to assess the potential applicability of various types of total energy systems to military installations. The appendix volume of the final report contains (1) engineering performance characteristics and costs of fossil fuel system elements, (2) energy consumption data for military bases and derivation of the energy load profiles used in the study, (3) description of the fuel consumption model and summaries of the fuel consumption and total system costs for the various cases, (4) characteristics and costs of geothermal systems, and (5) description of solar energy systems. Author (GRA)

N74-33503# Stanford Research Inst., Menlo Park, Calif.
ASSESSMENT OF TOTAL ENERGY SYSTEMS FOR THE DEPARTMENT OF DEFENSE, VOLUME 1 Final Report

Richard L. Goen Nov. 1973 115 p refs

(Contract DACA23-73-C-0014, ARPA Order 2408)

(AD-781816; SRI-EGU-2513-Vol-1) Avail: NTIS CSCL 10/1

The purpose of the study is to assess the potential applicability of various types of total energy systems to military installations. The types of energy systems considered include diesel, gas turbine, steam turbine, geothermal, solar, nuclear, and solid wastes. Fuel savings are given for each type of system, and their costs are compared with the costs of conventional systems. The two most promising systems are (1) solar energy applied to heating and cooling, and (2) nuclear power. Author (GRA)

N74-33504# Atlantic Research Corp., Alexandria, Va.
A RATIONAL ENERGY POLICY

Coleman Raphael Apr. 1974 46 p refs

(PB-231913/5; ARC-P1-1) Avail: NTIS HC \$3.25 CSCL 10A

The overall energy problem is analyzed by defining the crisis, its causes, and the alternative solutions which are available. Conclusions drawn throughout the report are then brought together to form a rational and cohesive recommended program. GRA

N74-33505# Federal Power Commission, Washington, D.C. Bureau of Power.

STAFF REPORT ON WIND POWER

Sep. 1973 13 p

(PB-231955/6) Avail: NTIS HC \$3.00 CSCL 10B

The ten page pamphlet states that while there is a genuine interest on the part of all electric utilities today in economical and non-polluting sources of electric power, the practical potential for windpower devices is at present limited, and reasonable solutions for space requirements and land use problems have not yet been developed. GRA

N74-33506# Army Foreign Science and Technology Center, Charlottesville, Va.

MACROKINETIC PROCESSES IN POROUS MEDIA FUEL CELLS

Yu. A. Chizmadzhev, V. S. Martin, M. R. Tarasevich, and Yu. G. Chirkov 8 May 1974 589 p refs Transl. into ENGLISH from an unidentified RUSSIAN book Moscow, Nauka Press, 1971 364 p

(AD-781204; FSTC-HT-23-1566-73) Avail: NTIS CSCL 10/2

The book deals with macrokinetic processes in porous media, particularly in porous catalysts of fuel cells. It presents a detailed exposure of the theory of porous gas-diffusion electrodes and investigates capillary phenomena in porous media, hydrodynamic mixing and related processes. GRA

N74-33507# Army Foreign Science and Technology Center, Charlottesville, Va.

ISSUES IN HIGH-POWER CRYOGENIC TURBOGENERATOR DESIGNING

V. V. Dombrovskii, N. N. Anempodistova, and L. P. Aleksandrova 1 Apr. 1974 21 p refs Transl. into ENGLISH of the book "Vysokoispol. Turbo. i Gidrogen. s Neprosred. Okhlazhen." Leningrad, Nauka Press, 1971 p 3-17

(AD-781190; FSTC-HT-23-1691-73) Avail: NTIS CSCL 10/2

Problems in designing high-power electric machines with low-temperature cooling of windings made of superconducting and pure metals are discussed. The project for a 1600 Mw turbogenerator with superconducting rotor and stator winding made of beryllium and operating at 77K is used as the design illustration. GRA

N74-33508# General Electric Co., Philadelphia, Pa. Space Div.

ELECTRODE STUDIES AND RECENT RESULTS OF NON-EQUILIBRIUM MHD GENERATOR EXPERIMENTS

Bert Zauderer, Eric Tate, and Charles H. Marston May 1974 8 p refs

(Contract N00014-73-C-0039)

(AD-781744; Doc-74SD217; TR-21) Avail: NTIS CSCL 10/2

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 (GRA)

N74-33509# Army Foreign Science and Technology Center, Charlottesville, Va.

ON OPTIMIZING SUPPLY CONDITIONS FOR HIGH POWER PULSE INSTALLATIONS

K. V. Bulgakov and V. B. Freiman 10 Mar. 1974 8 p refs Transl. into ENGLISH from Izv. Elektrotekhn. Inst. (Leningrad), no. 86, 1970

(AD-781532; FSTC-HT-23-1013-73) Avail: NTIS CSCL 10/2

The problem of determining the economically optimal power supply configuration for a high power pulse generator is considered. Two basic designs are discussed; one employing a current regulated converter and a simpler design which uses no stage between the generator and the pulse shaper. The merits of each are theoretically evaluated in light of short term and long term economic considerations. GRA

N74-33510# Wayne State Univ., Detroit, Mich. Dept. of Chemistry.

PROPERTIES OF ENERGETIC IONS TRAPPED IN SOLIDS OF INTEREST AS FUTURE ENERGY SOURCES Final Report, 1 Oct. 1969 - 30 Sep. 1973

Larry Kevan Dec. 1973 31 p

(Grant AF-AFOSR-1852-70; AF Proj. 9750)

(AD-780613; AFOSR-74-0800TR) Avail: NTIS CSCL 07/5

This is a final report of research designed to extend the knowledge of production, storage and utilization of highly energetic chemical species. The research concentrated on the physical and chemical properties of radiation-produced ions trapped in solid matrices. The first definitive and comprehensive picture of trapped electron energy levels in glassy matrices extending over a broad range of polarity has been obtained from both experimental and theoretical studies. Mobility measurements of electrons in conduction states of glassy matrices have allowed the identification of the dominant electron scattering mechanisms. New methods involving electron-electron double resonance have been developed to study magnetic energy transfer between ions and radicals in disordered solids. The spatial correlation between cations and electrons produced by photoionization has been demonstrated to depend upon the photoionization energy. These studies lay the groundwork for characterizing the stability of ion trapping in disordered solids. Included are abstracts of 34 papers completed on this project. (Modified author abstract) GRA

N74-33511# American Cyanamid Co., Stamford, Conn. Chemical Research Div.

RESEARCH ON CADMIUM STANNATE SELECTIVE OPTICAL FILMS FOR SOLAR ENERGY APPLICATIONS

Quarterly Progress Report, 1 Jan. - 31 Mar. 1974

G. Haacke 31 Mar. 1974 43 p refs

(Grant NSF GI-39539)

(PB-232883/9; NSF-RA/N-74-031;

NSF-RANN/SE/GI-39539/PR/74-1; QPR-1) Avail: NTIS HC \$3.25 CSCL 10B

The development of transparent, electrically conductive cadmium stannate (Cd₂SnO₄) coatings and their incorporation into solar energy conversion devices are reported. The optical properties of Cd₂SnO₄ films will be determined and the use of these films evaluated as coatings for flat plate collectors covers. GRA

N74-33512# Stanford Univ., Calif. Dept. of Materials Science and Engineering.

APPLIED RESEARCH ON II-VI COMPOUND MATERIALS FOR HETEROJUNCTION SOLAR CELLS Interim Quarterly Progress Report, 1 Feb. - 21 Mar. 1974

Richard H. Bube, Alan L. Fahrnenbruch, Fredrik Buch, Kim Mitchell, and Valery Vasilchenko 15 Apr. 1974 25 p refs

(Grant NSF GI-38445)

(PB-232884/7; NSF-RA/N-74-030;

NSF-RANN/SE/GI-38445X/PR-74-1) Avail: NTIS HC \$3.00 CSCL 10B

Research aimed at developing large-area cells for terrestrial applications considered: (1) properties of high resistivity i-layers occurring near the junction interface between the CdS and the CdTe; (2) thermoelectric power measurements to investigate the electrical transport properties of CdTe films deposited by vapor transport; (3) The effect of thermally etching the CdS substrates on the epitaxy of CdTe films; and (4) H₂ anneals to convert high resistivity evaporated CdS films to low resistivity films. Films crystal cells with solar efficiencies of up to 5.2%, open circuit voltages up to 0.66 V in sunlight, and fill factors of 49% have been produced. GRA

N74-33513# Naval Postgraduate School, Monterey, Calif. Thesis

Fariborz Golshani Javadi Jun. 1974 83 p refs

(AD-782322) Avail: NTIS CSCL 10/1

A review of the world energy consumption is given and it is shown that there is a strong relationship between economic

growth and energy consumption. A comprehensive analytical model capable of evaluating the impact of energy related decisions is developed. The model is descriptive of exploration, extraction, storage, import, and processing of energy resources and takes into account the relationship between these aspects of energy production and the market prices of energy resources. GRA

N74-33514# Aerospace Corp., El Segundo, Calif. Civil Programs Div.

SOLAR THERMAL CONVERSION MISSION ANALYSIS. VOLUME 1: SUMMARY REPORT

15 Jan. 1974 230 p refs

(Contract NSF C-797)

(PB-232668/4; ATR-74(7417-05)-1-Vol-1;

NSF-RA/N-74-017-Vol-1) Avail: NTIS HC \$6.00 HC also available from NTIS \$18.00/set of 5 reports as PB-232667-SET CSCL 10B

Principal interim results of solar thermal conversion mission analysis are primarily methodological and intended to provide an analytical procedure that will consistently evaluate alternative solar thermal conversion concepts in a variety of realistic operating environments. Various sections summarize demand, insolation, margin, mission/system, economic, siting, and environmental methodologies and analyses developed under initial six month contract. More details are described in four additional volumes. Technical and economic results are preliminary and serve primarily to illustrate the potential capabilities of the methodology itself. (Modified author abstract) GRA

N74-33515# Aerospace Corp., El Segundo, Calif. Civil Programs Div.

SOLAR THERMAL CONVERSION MISSION ANALYSIS. VOLUME 2: DEMAND ANALYSIS

15 Jan. 1974 61 p refs

(Contract NSF C-797)

(PB-232669/2; ATR-74(7417-05)-1-Vol-2;

NSF-RA/N-74-017A-Vol-2) Avail: NTIS HC \$3.75 HC also available from NTIS \$18.00/set of 5 reports as PB-232667-SET CSCL 10B

A methodology is reported that is capable of characterizing future electric power demand data and to forecast Southern California hourly electric power demand for the years 1980-2000. Forecasts of demand data exhibiting cyclic variations consistent with observed behavior patterns are necessary inputs to the solar thermal conversion system simulation. Background information, technical reports and raw data were acquired from governmental agencies and utilities throughout the country and particularly Southern California. A demand model was postulated to include factors describing a growth trend, weather conditions, seasonal influences, and hourly cyclic variations. A correlation between demand and weather, or insolation factors was investigated.

GRA

N74-33516# Aerospace Corp., El Segundo, Calif. Civil Programs Div.

SOLAR THERMAL CONVERSION MISSION ANALYSIS. VOLUME 3: SOUTHERN CALIFORNIA ISOLATION CLIMATOLOGY

15 Jan. 1974 119 p refs

(Contract NSF C-797)

(PB-232670/0; ATR-74(7417-05)-1-Vol-3;

NSF-RA/N-74-017B-Vol-3) Avail: NTIS HC \$4.50 HC also available from NTIS \$18.00/set of 5 reports as PB-232667-SET CSCL 10B

An insolation data base consisting of hourly values of normal incidence (direct) insolation and total insolation for a two year period has been prepared in computer-compatible format for eight stations characterizing Southern California and for Albuquerque, New Mexico. The data base includes, in addition to the insolation data, solar position information and weather information. Statistical studies were performed on these data, including a comparison of insolation at various stations, a percentile frequency analysis of insolation values and a temperature insolation correlation analysis. A literature survey of the information available about

the distribution of sky brightness was made. The procedures used and the results of these various studies are discussed in detail. GRA

N74-33517# Aerospace Corp., El Segundo, Calif. Civil Programs Div.

SOLAR THERMAL CONVERSION MISSION ANALYSIS. VOLUME 4: MISSION/SYSTEM AND ECONOMIC ANALYSIS

15 Jan. 1974 158 p refs

(Contract NSF C-797)

(PB-232671/8; ATR-74(7417-05)-1-Vol-4;

NSF-RA/N-74-017C-Vol-4) Avail: NTIS HC \$5.00 HC also available from NTIS \$18.00/set of 5 reports as PB-232667-SET CSCL 10B

The mission/systems and economic analyses performed to examine the dynamic interaction of insolation, demand, and solar power systems are described. A methodology was developed, using the hourly demand projections and regional insolation data already obtained, to parametrically assess the performance characteristics of alternative solar thermal conversion missions and systems in realistic operating environments on a consistent basis. A comparative economic evaluation of these alternative power plant concepts with conventional power plants is possible once the technical performance of solar power plants have been parametrically determined for different modes of operation. GRA

N74-33518# Aerospace Corp., El Segundo, Calif. Civil Programs Div.

SOLAR THERMAL CONVERSION MISSION ANALYSIS. VOLUME 5: AREA DEFINITION AND SITING ANALYSIS

15 Jan. 1974 77 p refs

(Contract NSF C-797)

(PB-232672/6; ATR-74(7417-05)-1-Vol-5;

NSF-RA/N-74-017D-Vol-5) Avail: NTIS HC \$4.00 HC also available from NTIS \$18.00/set of 5 reports as PB-232667-SET CSCL 10B

The results are presented of an area definition and siting analysis which was conducted to define and characterize Southern California study region, and to identify the area within the region judged to be potentially suitable for siting solar power plants. Boundaries were chose to conform to state boundaries on the west, south, and east and with limits of the Southern California Edison Company service territory on the north. This region contains a wide variety of climatological and geological conditions and is served by three major electrical utilities - Southern California Edison Company, Los Angeles Department of Water and Power, and San Diego Gas and Electric Company. Between 5,000 and 15,000 square miles out of a total of 67,000 square miles were found to be potentially suitable for siting large, central-station solar power plants. GRA

N74-33519# British Steel Corp., Sheffield (England). Information Services.

FUEL ENERGY AND THE STEEL INDUSTRY: A BIBLIOGRAPHY

D. G. Brinn Apr. 1974 20 p refs

(PB-232236/0; SM/TN/1/35) Avail: NTIS HC \$4.00 CSCL 10A

The bibliography, which consists of 74 annotated references, has been organized under the following headings: (1) the overall energy situation; (2) the energy situation and the steel industry; (3) fuel and energy management in the steel industry; (4) reports of fuel and energy savings in steel industry; (5) the coal situation; (6) electricity supplies; (7) oil and gas; and (8) steelmaking and nuclear energy. GRA

N74-33520# Consolidation Coal Co., Library, Pa. Research Div.

PRODUCTION OF CLEAN FUEL GAS FROM BITUMINOUS COAL Final Report

G. Curran, J. Clancey, B. Pasek, and M. Pell Dec. 1973 241 p refs

(Contract EPA-EHSD-71-15)

(PB-232695/7; EPA-650/2-73-049) Avail: NTIS HC \$6.00 CSCI 07A

A process for the production of low-Btu gas from bituminous coals via fluid bed gasification is described. Coal processing consists of pretreatment, gasification, and final burnup. Hot fuel gas is desulfurized with half calcined dolomite and cleaned of particulates in high pressure drop cyclones. The sulfur acceptor is regenerated with steam and CO₂. A liquid phase Claus reactor is used to process the H₂S in the regenerator offgas into elemental sulfur. Experimental data are presented which demonstrated feasibility of the major process steps. The cost of the gas desulfurization process including sorbent regeneration and sulfur recovery is of the order of 20 cents/MM Btu of product gas.

(Modified author abstract) GRA

N74-33521# Dow Chemical Co., Walnut Creek, Calif.
RESEARCH AND DEVELOPMENT ON THE GLASS FIBER SODIUM-SULPHUR BATTERY *Semiannual Technical Report*

Charles A. Levine 1 May 1974 37 p
 (Contract DAHC15-73-C-0254)
 (AD-782059) Avail: NTIS CSCI 10/3

Development is proceeding on a high energy density sodium-sulfur secondary battery which uses the walls of fine hollow glass fibers as the electrolyte-separator. Use of thousands of these hollow glass fibers, bundled together in parallel and filled with sodium as the anolyte, results in a cell that has a very high energy per unit weight at a high power per unit weight. The authors are trying to make multi-fiber cells capable of at least 1000 cycles of charge-discharge, to build larger cells capable of long lifetimes, to scale up to a 5 ampere-hour cell, to continue development of a 40 ampere-hour cell, to determine operating parameters at different charge-discharge rates, and to determine construction details necessary for thermal cycling. GRA

N74-33522# Nebraska Univ., Lincoln. Water Resources Research Inst.

THE ROLE OF WATER IN THE ENERGY CRISIS

Oct. 1973 221 p refs Conf. held at Lincoln, Neb., 23-24 Oct. 1973 Sponsored by Dept. of Interior
 (PB-232404/4; W74-07961; QWRR-A-999-NEB(13)) Avail: NTIS HC \$5.75 CSCI 10A

Ways that the water resources community could help solve national and regional energy problems are presented. Topics discussed include energy-water relationship (economic, environmental, political-social, and technological), the role of water resources in the energy crisis, regional energy problems, and an assessment of research needs. GRA

N74-33525# Army Foreign Science and Technology Center, Charlottesville, Va.

ELECTRIC CIRCUIT CALCULATIONS FOR MULTISTAGE SOLAR THERMOELECTRIC GENERATORS

B. Arazmedov, Ch. Agabaev, Yu. N. Malevskii, B. M. Berdyev, and O. Annaev 1 Apr. 1974 9 p refs Transl. into ENGLISH from *Geliotekhnika* (USSR), no. 2, 1972 p 13-16
 (AD-782041; FSTC-HT-23-1591-73) Avail: NTIS CSCI 10/2

A method of calculating the electric circuit of a multistage solar thermoelectric generator is described for the case when all thermopile-stage functions are in appropriate working conditions and are series-connected into the external load circuit. GRA

N74-33526# Assistant Secretary of Defense (Installations and Logistics), Washington, D.C.

MANAGEMENT OF DEFENSE ENERGY RESOURCES: REPORT OF THE DEFENSE ENERGY TASK GROUP

15 Nov. 1973 210 p refs
 (AD-782268) Avail: NTIS CSCI 10/1

Energy-related problems facing the Department of Defense are investigated and 57 recommendations for strengthening the management of DOD energy resources are given. Topic areas covered include: World and U. S. energy outlook, Defense energy

requirements and budget impact; petroleum storage and distribution; fuels standardization; naval petroleum reserves; Defense energy conservation; energy-related R and D; and energy organization and management in DOD. GRA

N74-33834*# Servicio Geologico de Bolivia, La Paz.

BOLIVIAN PARTICIPATION IN THE INVESTIGATION AND ANALYSIS OF EARTH RESOURCES EXPERIMENT (EREP)

Carlos E. Brockmann, Principal Investigator Sep. 1973 4 p
 Sponsored by NASA EREP
 (E74-10767; NASA-CR-140015) Avail: NTIS HC \$4.00 CSCI 05B

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

N74-34037# United Aircraft Corp., East Hartford, Conn. Research Labs.

INVESTIGATION OF THE FEASIBILITY OF A MAGNETOHYDRODYNAMIC LASER *Final Report, 3 Jun. 1971 - 30 Apr. 1974*

Robert H. Bullis, Thomas L. Churchill, William L. Nighan, Peter O. Erlandsen, and Elliot R. Schulman 31 May 1974 92 p refs

(Contract N60921-71-C-0279)

(AD-781997; UARL-N921308-4) Avail: NTIS CSCI 20/5

The investigation is directed towards the evaluation of the feasibility of a magnetohydrodynamic laser concept (MHD-L) employing nonequilibrium electron kinetics to provide efficient energy transfer in a molecular laser system. To achieve this goal comprehensive modeling of the MHD plasma which has been based upon a detailed knowledge of electron and heavy particle kinetics has been developed. Experimental investigations conducted on small scale laminated and solid wall generator configurations have confirmed theoretical modeling predictions and indicate the potential attractiveness of the MHD-L concept for high power laser applications. Major emphasis in the report has been placed on the additional experimental information obtained from small scale generator tests as well as experimental results obtained in a generator configuration suitable for optical power extraction investigations. Author (GRA)

N74-34239# Naval Research Lab., Washington, D.C.

HYDROGEN AS A NAVY FUEL

H. W. Carhart, W. A. Affens, B. D. Boss, R. N. Hazlett, and S. Schuldiner 12 Jun. 1974 39 p refs
 (AD-781262; NRL-7754) Avail: NTIS CSCI 21/4

The report examines various factors relating to the possible use of hydrogen by the Navy as an alternate to conventional fuels. Properties, production, storage, hazards, handling, toxicity, and comparative costs of hydrogen in gaseous or liquid forms are discussed. GRA

N74-34240# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.

COMPREHENSIVE BIBLIOGRAPHY OF LITERATURE ON NONCRYOGENIC STORAGE AND RECOVERY OF HYDROGEN

P. A. Kuntz, W. W. Wimer, W. D. Weatherford, Jr., and R. D. Quillian Sep. 1973 104 p refs
 (Contract DAAK02-73-C-0221)

(AD-780928; AFLRL-30) Avail: NTIS CSCI 21/4

The chronological annotated bibliography has been compiled from the scientific literature for the noncryogenic storage of hydrogen for use as a fuel in a mobile vehicle. The bibliography covers a period of sixty-eight years (1905-1973) and is organized into two separate chronological bibliographies, each arising from different sources. These two primary sources are Chemical Abstracts and the Defense Documentation Center at Alexandria, Virginia. Topics covered include generation via decomposition and reaction of hydrides, metals, and other organic and inorganic

compounds, biochemical generation, and various other storage means. (Modified author abstract) G.R.A.

N74-34402* Dynatherm Corp., Cockeysville, Md.

HEAT PIPE DESIGN HANDBOOK, PART 2

E. A. Skrabek Aug. 1972 150 p refs

(Contract NAS9-11927)

(NASA-CR-134265; DTM72-3-Pt-2) Avail: NTIS HC \$10.50 CSDL 20M

The utilization of a digital computer code for heat pipe analysis and design (HPAD) is described which calculates the steady state hydrodynamic heat transport capability of a heat pipe with a particular wick configuration, the working fluid being a function of wick cross-sectional area. Heat load, orientation, operating temperature, and heat pipe geometry are specified. Both one 'g' and zero 'g' environments are considered, and, at the user's option, the code will also perform a weight analysis and will calculate heat pipe temperature drops. The central porous slab, circumferential porous wick, arterial wick, annular wick, and axial rectangular grooves are the wick configurations which HPAD has the capability of analyzing.

Author

N74-34415 National Aeronautical Establishment, Ottawa (Ontario). Low Speed Aerodynamics Lab.

WIND POWER AND THE VERTICAL AXIS WIND TURBINE DEVELOPED AT THE NATIONAL RESEARCH COUNCIL

R. S. Rangi, P. South, and R. J. Templin /in NRS Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab. 30 Jun. 1974 p 1-14 refs

A map with contours of the estimated wind power available in Canada was prepared which shows large areas with high power potential. A comparison of wind energy cost with alternate sources indicates that the capital cost of current wind machines has to be reduced considerably in order to make wind power competitive with existing sources. The design features, performance, and economics of a vertical-axis wind turbine are described, and the case is made that considerable capital cost savings are possible with the design.

Author

N74-34419# Committee on Science and Astronautics (U. S. House).

INTERNATIONAL SCIENCE AND TECHNOLOGY TRANSFER ACT OF 1974

Washington GPO 1974 174 p refs Hearings before Subcomm. on Intern. Cooperation in Sci. and Space of the Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., no. 37, 21-23 May 1974 (GPO-35-283) Avail: Subcomm. on Intern. Cooperation in Sci. and Space

Technology transfer legislation for international cooperation is considered with emphasis on telecommunication, solar energy conversion, and earth resources observation systems. G.G.

N74-34422# Committee on Labor and Public Welfare (U. S. Senate).

EFFECTS OF THE ENERGY CRISIS ON THE HEALTH CARE SYSTEM, 1973

Washington GPO 1974 119 p refs Hearings before the Subcomm. on Health of the Comm. on Labor and Public Welfare, 93d Congr., 1st Sess., 17 Dec. 1973 (GPO-28-057) Avail: Subcomm. on Health

A Congressional hearing was conducted to determine the effects of the oil shortage on the health care systems of the Nation. Testimony was submitted by representatives of the medical companies, drug manufacturers, hospital managers, and fuel producers. The shortages of drugs and medical supplies which are caused by the fuel shortage are identified. Several proposals for improving the situation are submitted.

Author

N74-34423# Committee on the Judiciary (U. S. Senate).
COMPETITION IN THE ENERGY INDUSTRY

Washington GPO 1974 408 p refs Hearings before Subcomm. on Antitrust and Monopoly of the Comm. on the Judiciary (Pursuant to S. Res. 56, Section 4, Gasoline and Fuel Oil), 93d Congr., 1st Sess., 8, 11 and 12 Jun., 11 and 27 Jul. 1973 (GPO-24-334) Avail: SOD HC \$3.00

A Congressional investigation was conducted to determine the situation within the petroleum industry and the competition which exists between various segments of the gasoline and fuel oil production facilities. Testimony was submitted by selected representatives of the industries involved to show the manner of operation and the impact of the oil crisis. Examples of legislation to control and promote improvements in the gasoline and fuel oil industries are provided. Projections concerning increasing energy requirements and possible areas of shortage are analyzed.

Author

N74-34428# Committee on Finance (U. S. Senate).

FISCAL POLICY AND THE ENERGY CRISIS, PART 1

Washington GPO 1973 583 p refs Hearings before the Subcomm. on Energy of Comm. on Finance, 93d Congr., 1st Sess., 27, 28 and 29 Nov. 1973

(GPO-25-047) Avail: SOD HC \$4.05

The formation of a financial base for a total energy policy whose scope includes both measures for reducing present energy consumption habits, and research support for the development of new sources of energy in order to relieve the U. S. of its almost complete dependence on fossil fuel, was the subject of a series of hearings before Congress. Both public and private sector measures are discussed, including the establishment of a national energy trust fund supported by a tax on energy consumption, the creation of incentives for the production of energy by private industry, and a variable import levy on foreign energy to protect and encourage domestic investment in energy technology.

A.A.D.

N74-34429# Committee on Finance (U. S. Senate).

FISCAL POLICY AND THE ENERGY CRISIS, PART 2, APPENDICES TO PART 1

Washington GPO 1973 338 p refs Hearings before Subcomm. on Energy of Comm. on Finance, 93d Congr., 1st Sess., 27, 28 and 29 Nov. 1973

(GPO-25-047) Avail: SOD HC \$2.40

Planning criteria relative to a national research, development, testing, and evaluation program directed to the enhanced recovery of crude oil and natural gas was submitted during discussions before Congress of fiscal policy and the energy crisis. A definition of the energy problem is provided which considers the implications of the crisis on the national economy and balance of payments, fiscal incentives on the supply side and fiscal disincentives on the demand side, as well as U. S. trade policy concerning importation and exportation of energy resources. Federal energy research and development funding is also outlined.

A.A.D.

N74-34430# Committee on Finance (U. S. Senate).

FISCAL POLICY AND THE ENERGY CRISIS, PART 3

Washington GPO 1974 440 p refs Hearings on S. 2806 before Subcomm. on Energy of Comm. on Finance, 93d Congr., 1st and 2d Sess., 27, 28 and 29 Nov 1973; 23, 24, 25, 28 and 29 Jan. 1974

(GPO-28-243) Avail: SOD HC \$3.15

The removal of price controls over the energy sector and the regulation of natural gas prices, as well as tax measures aimed at increasing energy supplies, decreasing residential energy consumption, and discouraging excess profits was the focus of a Congressional hearing whose purpose was to discuss fiscal policy in relation to the crisis. Energy reserves and the production of energy on nonpublic lands are discussed, along with proposed administration of a trust fund to support energy research and development.

A.A.D.

N74-34431# Committee on Finance (U. S. Senate).

FISCAL POLICY AND THE ENERGY CRISIS, PART 4

Washington GPO 1974 547 p refs Hearings on S. 2806

before Subcomm. on Energy of Comm. on Finance, 93d Congr., 1st and 2d Sess., 27, 28 and 29 Nov. 1973; 23, 24, 25, 28 and 29 Jan. 1974
(GPO-28-243) Avail: SOD HC \$4.45

Safety procedures are described which pertain to the use of nuclear materials for energy production, and information is presented regarding the development of coal gasification projects by the U. S. gas industry, for the purpose of informing Congress of ongoing energy research and development efforts to be considered in the formation of a total national energy policy based on fiscal responsibility. U. S. policy towards the Organization of Petroleum Exporting Countries cartel is reviewed, and both commercial and natural resources are considered in an effort to evaluate the chances for American energy-sufficiency before 1985. Data which illustrate oil company profitability are provided, and the impact of solar energy applications on the economics of energy supply and demand is discussed. The range of fiscal proposals aimed at the alleviation of the energy crisis are assessed both by commercial and governmental interests. A.A.D.

N74-34433# Atomic Energy Commission, Washington, D.C.
TRANSPORTATION SYSTEMS Subpanel Report 13 used in Preparing the AEC chairmans Report to the President
E. N. Petrick 27 Oct. 1973 314 p refs
(WASH-1281-13) Avail: NTIS HC \$18.75

The transportation energy research and development goals are identified as the development of the technology necessary to reduce transportation demand for crude oil and other fuels by improved efficiency, new designs with higher efficiencies, and utilization of alternative fuels. The reduction of transportation dependence on crude oil by 22% in the year 1985, 55% in the year 2000, and up to 100% after the year 2000, from the levels of consumption that would otherwise be experienced without the proposed program is called for. The transportation sector is grouped into the four subprograms of autos/trucks, air, rail/bus, and ships. The contribution of each to the overall goal is presented, along with a summary of the transportation energy research and development funding proposal.

Author (NSA)

N74-34439# Abcor, Inc., Cambridge, Mass. Walden Research Div.
DEVELOPMENT OF A METHODOLOGY TO ALLOCATE LIQUID FOSSIL FUEL CONSUMPTION BY COUNTY Final Report, Feb. 1973 - Mar. 1974

Josette C. Goldish, Franklin D. Trowt, John R. Ehrenfeld, Khoe M. Chng, and Richard Stockdale Mar. 1974 139 p refs
(Contract EPA-68-02-1067)
(PB-232209/7; EPA-450/3-74-021) Avail: NTIS HC \$10.00 CSDL 13B

Methods were developed for the routine determination of distillate and residual oil consumption by industrial, commercial, and residential consumers, as well as for gasoline and diesel fuel consumed by light and heavy duty motor vehicles. The resulting data are allocated to counties for input and storage in the National Emissions Data System (NEDS) area source format. In addition, seasonal fluctuations of fuel oil use by consumer category and geographic region, and references for determining sulfur content of fuel oils on a county basis, were analyzed. The report summarizes the methodologies that were developed and describes the computer processing techniques for reporting the data. GRA

N74-34442# Federal Energy Office, Washington, D.C. Office of Energy Analysis.
NATIONAL PETROLEUM SUPPLY AND DEMAND, 1974. POST-EMBARGO
26 Apr. 1974 56 p
(PB-232489/5; FEO-EATR-74-2) Avail: NTIS HC \$3.75 CSDL 21D

An analysis of the National petroleum supply and demand situation is presented. The assumptions underlying the estimation of petroleum product supply are discussed. The results of

implementing the forecasting model under two scenarios which take the lifted embargo into account and distinguish between two estimates of demand. Appendices present an outline of the simulation model itself and the data files which support the forecasts. Author (GRA)

N74-34448*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PROSPECTS FOR REDUCED ENERGY TRANSPORTS: A PRELIMINARY ANALYSIS

M. D. Ardema, M. Harper, C. L. Smith, M. H. Waters, and L. J. Williams Aug. 1974 30 p refs
(NASA-TM-X-62383) Avail: NTIS HC \$3.25 CSDL 01A

The recent energy crisis and subsequent substantial increase in fuel prices have provided increased incentive to reduce the fuel consumption of civil transport aircraft. At the present time many changes in operational procedures have been introduced to decrease fuel consumption of the existing fleet. In the future, however, it may become desirable or even necessary to introduce new fuel-conservative aircraft designs. This paper reports the results of a preliminary study of new near-term fuel conservative aircraft. A parametric study was made to determine the effects of cruise Mach number and fuel cost on the optimum configuration characteristics and on economic performance. For each design, the wing geometry was optimized to give maximum return on investment at a particular fuel cost. Based on the results of the parametric study, a nominal reduced energy configuration was selected. Compared with existing transport designs, the reduced energy design has a higher aspect ratio wing with lower sweep, and cruises at a lower Mach number. It has about 30% less fuel consumption on a seat-mile basis. Author

N74-34539*# Gould, Inc., Mendota Heights, Minn. Energy Research.
LONG LIFE, RECHARGEABLE NICKEL-ZINC BATTERY Final Report

E. Luksha Sep. 1974 90 p refs
(Contract NAS3-16809)
(NASA-CR-134658; Gould-742-031) Avail: NTIS HC \$7.50 CSDL 10C

A production version of the inorganic separator was evaluated for improving the life of the nickel-zinc system. Nickel-zinc cells (7-10 Ah capacities) of different electrode separator configurations were constructed and tested. The nickel-zinc cells using the inorganic separator encasing the zinc electrode, the nickel electrode, or both electrodes had shorter lives than cells using Visking and cellophane separation. Cells with the inorganic separation all fell below 70% of their theoretical capacity within 30 cycles, but the cells constructed with organic separation required 80 cycles. Failure of the cells using the ceramic separator was irreversible capacity degradation due to zinc loss through cracks developed in the inorganic separator. Zinc loss through the separator was minimized with the use of combinations of the inorganic separator with Visking and cellophane. Cells using the combined separation operated 130 duty cycles before degrading to 70% of their theoretical capacity. Author

N74-34540*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A BRIEF SUMMARY OF THE ATTEMPTS TO DEVELOP LARGE WIND-ELECTRIC GENERATING SYSTEMS IN THE US

Joseph M. Savino 1974 17 p refs Presented at Wind Energy Conf., Stockholm, 29-30 Aug. 1974; sponsored by Swedish Board for Tech. Develop.
(NASA-TM-X-71605; E-8088) Avail: NTIS HC \$3.00 CSDL 10A

Interest in developing large wind-electric generating systems in the United States was simulated primarily by one man, Palmer C. Putnam. He was responsible for the construction of the 1250 kilowatt Smith-Putnam wind-electric plant. The existence of this system prompted the U. S. Federal Power Commission to investigate the potential of using the winds as a source energy. Also, in 1933 prior to Putnam's effort, there was an abortive

attempt by J. D. Madaras to develop a wind system based on the Magnus effect. These three projects comprise the only serious efforts in America to develop large wind driven plants. In this paper the history of each project is briefly described. Also discussed are some of the reasons why wind energy was not seriously considered as a major source of energy for the U. S. Author

N74-34541*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

SOLAR ENERGY TO HEAT AND COOL A NEW NASA LANGLEY OFFICE BUILDING

W. L. Maag Sep. 1974 22 p refs
(NASA-TM-X-71615; E-8103) Avail: NTIS HC \$3.00 CSCL 10A

A solar heating and cooling system will be installed at a new NASA office building. The objective of this project is to establish a full-scale working test-bed facility to investigate solar energy for heating and cooling buildings. The energy collected will provide between 80 and 100 percent of the heating and cooling requirements during the cool months and between one-half and two-thirds of the cooling requirements in the summer. Thermal energy storage will be provided to bridge the gap between cloudy and clear days. Author

N74-34542*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

ENERGY AND ECONOMIC ANALYSIS OF TOTAL ENERGY SYSTEMS FOR RESIDENTIAL AND COMMERCIAL BUILDINGS

William L. Maag and Gary Bollenbacher Oct. 1974 19 p refs
(NASA-TM-X-71617; E-8099) Avail: NTIS HC \$3.00 CSCL 10A

Energy and economic analyses were performed for an on-site power-plant with waste heat recovery. The results show that for any specific application there is a characteristic power conversion efficiency that minimizes fuel consumption, and that efficiencies greater than this do not significantly improve fuel consumption. This type of powerplant appears to be a reasonably attractive investment if higher fuel costs continue. Author

N74-34543*# Committee on Science and Astronautics (U. S. House).

ENERGY FROM OIL SHALE: TECHNICAL, ENVIRONMENTAL, ECONOMIC, LEGISLATIVE, AND POLICY ASPECTS OF AN UNDEVELOPED ENERGY SOURCE

Washington GPO Nov. 1973 71 p refs Rept. Prepared for Subcomm. on Energy of Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., 30 Nov. 1973 Prepared by the Library of Congr., Sci. Policy Res. Div.

(GPO-25-572) Avail: Subcomm. on Energy

Current economic analyses indicate that the processing of oil shale is within or near the range of economic feasibility. Environmental acceptability remains to be tested on a large-scale basis. Advances in environmental control technologies, for example, revegetation and chemical processing of effluents, are said to reduce some of the harmful environmental impacts resulting from development of this resource. This paper discusses proposed legislation concerned with the development of oil shale which would establish a cooperative Government-industry corporation to construct models of an oil shale processing plant to demonstrate the economic feasibility and environmental acceptability of different technological methods, and, if deemed feasible, construct a commercial sized plant. Author

N74-34544*# Committee on Public Works (U. S. Senate).

THE FUEL SHORTAGE AND THE CLEAN AIR ACT

Washington GPO 1973 113 p Hearing on S. 2680 before Subcomm. on Air and Water Pollution of Comm. on Public Works, 93d Congr., 1st Sess., 12 Nov. 1973

(GPO-25-885) Avail: Subcomm. on Air and Water Pollution

Variances from clean air requirements are requested to deal with the fuel shortage for a limited duration. Changes in the clean air act implementation plans are intended to give affected

utilities and industries the necessary time to install available stack gas emission controls. G.G.

N74-34546*# Assistant Secretary of Defense (Installations and Logistics), Washington, D.C.

MANAGEMENT OF DEFENSE ENERGY RESOURCES. EXECUTIVE SUMMARY: REPORT OF THE DEFENSE ENERGY TASK GROUP

15 Nov. 1973 37 p refs
(AD-782267) Avail: NTIS CSCL 10/1

Energy-related problems facing the Department of Defense are summarized. Topic areas discussed are: World and U. S. energy outlook, Defense energy requirements and budget impact; petroleum storage and distribution; fuels standardization; naval petroleum reserves; Defense energy conservation; energy-related R and D; and energy organization and management in DoD. GRA

N74-34548*# Federal Power Commission, Washington, D.C. Office of the Chief Engineer.

STAFF REPORT: A TECHNICAL BASIS FOR ENERGY CONSERVATION

Apr. 1974 57 p refs
(PB-231924/2; FPC/OCE-2) Avail: NTIS HC \$3.75 CSCL 10A

A means for evaluating measures for coping with the nation's energy problems and for achieving fuel efficiency is presented. Correction of inefficiencies at the point of consumption of fuel and electric power offers opportunities for improving overall fuel efficiency. In the short run, improved fuel efficiency offers a means for dealing with fuel shortage without severe economic disruption. In the long run, with steeply rising fuel prices a virtual certainty, improved fuel efficiency is an essential part of maintaining a productive, competitive industry, able to supply the goods and services which society requires. GRA

N74-34549*# Southern Methodist Univ., Dallas, Tex.

DEVELOPMENT OF LOW-COST THIN-FILM POLYCRYSTALLINE SILICON SOLAR CELLS FOR TERRESTRIAL APPLICATIONS Quarterly Progress Report, 1 Jan. - 31 Mar. 1974

Ting I. Chu Apr. 1974 39 p refs Prepared in cooperation with Texas Instruments, Inc., Dallas

(Grant NSF GI-38981)

(PB-232895/3; NSF-RANN/SE/GI-38981/PR/74/1; NSF-RA/N-74-032; QPR-1) Avail: NTIS HC \$3.25 CSCL 10B

The deposition and characterization of polycrystalline silicon solar cells suitable for solar cell fabrication is described, along with the preparation and characterization of p-n junctions and Schottky barriers. The fabrication and evaluation of thin film solar cells with efficiencies and cost projections warranting further research and development support is also discussed. GRA

N74-34553*# Eagle-Picher Industries, Inc., Joplin, Mo. Couples Dept.

LEAD-ACID RESERVE BATTERY Final Report

L. R. Erisman Apr. 1974 38 p

(Contract DAAA21-73-C-0540)

(AD-782910) Avail: NTIS CSCL 10/3

The report discusses the development of a Lead Acid Reserve Battery identified as Eagle-Picher Battery number GAP-1500. The overall program was divided into two major parts, Battery Electrochemical Design (Part I) and Activation Mechanism Design Incorporation (Part II). The final battery configuration, is shown. GRA

N74-34662*# Purdue Univ., Lafayette, Ind. School of Engineering.

THERMOPHOTOVOLTAIC CELLS Final Report, Jun. 1972 - Dec. 1973

R. J. Schwartz, N. F. Gardner, Michael Lammert, and Philip

Munro Jun. 1974 79 p refs

(Contract DAAB07-72-C-0281; DA Proj. 1T0-61102-A-34A) (AD-782833; ECOM-72-0281-72-F) Avail: NTIS CSCL 09/1

In this report the fabrication, testing, and test results obtained on a germanium PIN Photovoltaic cell intended for use in a thermophotovoltaic energy conversion system are described. The cells were tested using a tungsten source with a spectral distribution approaching that of a 3220K black body. Conversion efficiencies as high as 11.72% were observed. The performance of these cells was measured at radiation intensities as high as 10 watts/sq. cm. and the performance of the cells was observed to be continuously improving as the radiation intensity increased. The open circuit voltage which was observed in these devices was lower than previously computed. The causes of the lower than expected open circuit voltage were determined to be the device thickness, which was larger than optimum for the radiation source, and the presence of a surface recombination which increased at high radiation intensity levels. Heat sink performance tests indicate that the device can be adequately heat sunk for operation at radiation intensities in excess of 10 watts/sq. cm. Recommendations for future work on these devices are also presented. Author (GRA)

N74-34674# Committee on Science and Astronautics (U. S. House).

RESEARCH ON GROUND PROPULSION SYSTEMS

Washington GPO 1974 603 p refs Hearings on H.R. 10392 before Subcomm. on Space Sci. and Applications of Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., No. 38, 11, 12, 13 and 18 Jun. 1974

(GPO-36-993) Avail: Subcomm. on Space Sci. and Appl.

A bill to amend the National Aeronautics and Space Act of 1958 to authorize and direct NASA to conduct research and develop ground propulsion systems which would serve to reduce the current level of energy consumption was considered in a Congressional hearing. The capital expenditures and health costs of air pollution are evaluated, and details of emission research findings for alternative motor vehicle power systems are provided, including full breakdowns for research direct expenditures. Industry conversion for production, service, and support of alternative low emission automotive power systems is also considered. AAD

N74-34791# Bureau of Mines, Morgantown, W.Va. Energy Research Center.

RELATIONSHIPS OF EARTH FRACTURE SYSTEMS TO PRODUCTIVITY OF A GAS STORAGE RESERVOIR

W. K. Overbey, Jr., W. K. Sawyer, and B. R. Henniger (Ashland College, Ohio) 1974 142 p refs

(BM-RI-7952) Avail: NTIS HC \$10.25

The Bureau of Mines conducted surface joint and stress measurements, airborne remote sensing imagery studies, compass-oriented borehole televiwer surveys, numerical simulation of fractured wells, and well productivity studies in a four-quadrangle study area of Ohio, to determine the effects of earth fracture systems on the deliverability of gas storage fields. The results of these studies indicate that much useful information about a gas storage reservoir can be obtained and put to practical use by studying: (1) oriented cores for fractures and directional permeability, (2) orientation of induced hydraulic fractures for alignment of well patterns, and (3) aerial photos and multispectral scanner imagery for general surface geology comparison and to determine if some development patterns can be generated by such results. Studies should be conducted in gently folded and strongly folded sedimentary formation areas to determine if the increased knowledge of earth fracture systems under these conditions might be beneficial in gasfield and gas storage reservoir development. Author

N74-34820# Technische Universitaet, Brunswick (West Germany). Inst fuer Geophysik und Meteorologie.

GEOSCIENTIFIC ASPECTS OF SUPPLYING ENERGY [GEOWISSENSCHAFTLICHE ASPEKTE ZUR ENERGIEVERSORGUNG]

Walter Kertz 1974 23 p refs In GERMAN Presented at 34th Jahresversammlung der Deut. Geophysik Ges., Berlin, 26 Mar. 1974. *Its GAMMA* 26, 18 S., 1974

Avail: NTIS HC \$4.25

Geoscientific aspects of energy sources consider future energy demands on nuclear fission, controlled nuclear fusion, solar energy, and geothermal energy. The danger of violating the entropy law through heating of the atmosphere by spend energy is discussed. Transl. by G.G.

N74-34834# Geological Survey, Menlo Park, Calif.

FLASHING FLOW IN HOT WATER GEOTHERMAL WELLS: COMPUTER PROGRAM

Manuel Nathenson May 1974 34 p refs

(PB-233123/9; USGS-GD-74-021) Avail: NTIS HC \$4.75 CSCL 08H

A PL/1 computer program for calculating the production characteristics of hot water geothermal wells which flash to steam-water mixtures in the cased portion of the hole is presented. The flashing flow is assumed to be isenthalpic and, for purposes of calculating pressure drop, a finely dispersed mixture of equal average velocity. The flow in the aquifer is treated using steady radial Darcy flow. The thermodynamic properties of saturated water and steam are obtained using interpolation and a stored set of steam tables. GRA

N74-35088# Southwest Research Inst., San Antonio, Tex.

A SURVEILLANCE STUDY OF SMOKE FROM HEAVY DUTY DIESEL POWERED VEHICLES; SOUTHWESTERN USA Final Report

John O. Stormont and Karl I. Springer Jan. 1974 290 p refs (Contract EPA-70-109)

(PB-232682/5; SwRI-AR-909; EPA-460/3-74-003) Avail: NTIS HC \$17.50 CSCL 13B

The effectiveness of the Federal diesel smoke regulations in controlling smoke emissions from a group of heavy-duty diesel engines engaged in routine automotive service was examined. Trucks and buses, powered by engines certified to meet 1970 smoke standards, were tested for smoke emissions at four-month intervals over a two-year period. Changes in smoke opacity observed during this test period were used to determine, to the extent possible, the effect of time, mileage, and type of service (or duty cycle) on opacity. Baseline brake specific emissions data of unburned hydrocarbons, carbon monoxide, and oxides of nitrogen were also obtained. GRA

N74-35146# Princeton Univ., N.J. Plasma Physics Lab.

A FUSION POWER PLANT

R. G. Mills, ed. Aug. 1974 588 p refs

(Contract AT(11-1) 3073; Grant NSF GP 579)

(MATT-1050) Avail: NTIS HC \$32.50

The technical features and advantages of electric power plants based on plasma fusion principles are discussed. The characteristics of plasmas and the problems of plasma control are analyzed. The operating cycle of a fusion power plant is explained. The subjects discussed include the following: (1) the diverter and vacuum system, (2) fuel injection, (3) magnetics, (4) choice of materials for the reactor, (5) heat transfer and energy conversion systems, (6) hazards, (7) environmental compatibility, and (8) maintenance, repair, and overhaul of the reactor.

N74-35148 Princeton Univ., N.J.

SUMMARY OF TECHNICAL FEATURES

R. G. Mills In *its* A Fusion Power Plant Aug. 1974 p 10-19

The electric plant described in this report produces 2030 MW of electric power for sale. The nuclear heat generated is 5305 MW. The overall net efficiency is 38%. The gross electric efficiency is 45.3%. The generators produce 2405 MW of electricity of which 375 is used within the plant, primarily for circulating the helium gas coolant. A chart of these characteristics, together with a

large number of other operating parameters, is presented for quick reference. A detailed drawing of the plant is presented. The primary fuels consumed within the reacting plasma are deuterium and tritium. Although an initial inventory of about 3 kg of tritium is required in order to begin operations, subsequent needs for tritium will be met by generating it from lithium in the lithium-beryllium-fluoride salt (flibe) present in the blanket. At full power, 1.1 kg of lithium will be consumed per day, but since the blanket contains over 160,000 kg of lithium, it may be several years before any lithium need be added to the blanket. This lithium need not be considered as a fuel but more as a maintenance and renewal expense in servicing the facility. The deuterium fuel requirements (0.35 kg per day) may be met by the purchase of heavy water. Daily consumption of D₂O will be about 1.76 kg which should cost less than eighty dollars.

Author

N74-35149 Princeton Univ., N.J.

ADVANTAGES OF FUSION POWER

P. Bonanos *In its A Fusion Power Plant* Aug. 1974 p 20-23 refs

The application of nuclear fuels for power production is discussed. The major advantage of fusion power is the essentially inexhaustible and cheap fuel supply. The total mass of fuel consumed in a 2000 MWe plant is small, less than 2 kg/day, and fuel costs are estimated to be less than 0.02 mill/kWh. Deuterium gas is presently extracted from water in commercial quantities at reasonable cost. For D-T reactors the tritium is not available naturally and must be bred within the plant. Lithium is naturally abundant. Total reserves are not accurately known because easily available surface sources such as western United States lake brines represent many centuries' use at current consumption rates.

Author

N74-35151 Princeton Univ., N.J.

THE OPERATING CYCLE

S. L. Gralnick *In its A Fusion Power Plant* Aug. 1974 p 40-74 refs

The operating cycle of the Princeton Reference Design Fusion Reactor is discussed. A design based on a long pulse tokamak - the pulse length is much longer than the residence time of the particles in the system is proposed. Consequently, fuel injection is provided, and a divertor is used to remove the reaction products (alpha particles) and unburnt fuel. In this manner, the plasma parameters are maintained constant during the extended pulse. The operating cycle of this design employs a 100 minute burning pulse and a current shutdown and reignition procedure that occupies less than 3 minutes. This provides a duty factor, defined as the ratio of the time during which power is produced to the total time of 97%. During the downtime the electrical load on the station is satisfied by withdrawing thermal energy from the molten salt (flibe) in the reactor blanket and storage areas, and consequently electrical power is delivered without interruption or load shedding. In this sense this design is a steady state power reactor.

Author

N74-35157 Westinghouse Electric Corp., Pittsburgh, Pa. **HEAT TRANSFER AND ENERGY CONVERSION SYSTEMS**

P. W. Davison and K. C. Sokolosky (New England Elec. System) *In Princeton Univ. A Fusion Power Plant* Aug. 1974 p 217-290 refs

The process of converting the energy produced in the plasma of a fusion reactor into electrical energy is discussed. Emphasis is placed on the reactor heat transfer systems. The physical characteristics of the reactor coolant system are tabulated. Heat transfer equations and mathematical models are provided to analyze the thermodynamic properties of the reactor. Methods and materials for protecting the components of the reactor from high temperature effects are explained.

Author

N74-35160 Princeton Univ., N.J.

FUEL HANDLING

E. F. Johnson *In its A Fusion Power Plant* Aug. 1974 p 362-410 refs

The fuel flows throughout the fusion power reactor and the processing sequences that are necessary to maintain a reactor feedstock of adequate purity while assuring on the one hand self-sufficiency in respect to the tritium fuel and on the other reasonable control of tritium losses to the environment are discussed. The principal fuel flows are shown as three major loops, namely, the primary fuel loop, the coolant helium loop, and the breeder salt loop. In the primary fuel loop the reactor feed materials, deuterium, tritium, and argon, are circulated continuously through the reactor along with small amounts of helium and protium ash. Both ash species are removed continuously in the course of condensing the primary fuel stream. In the breeder salt loop most of the tritium generated from the lithium in the salt is stripped out as tritium fluoride and recovered in cold traps. The small fraction of the tritium generation that is not stripped out permeates into the coolant helium, where it is recovered as water.

Author

N74-35199* Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div

SOLAR ARRAY TECHNOLOGY EVALUATION PROGRAM FOR SEPS (SOLAR ELECTRICAL PROPULSION STAGE) **Final Report**

1 Sep. 1974 253 p refs

(Contract NAS8-30315)

(NASA-CR-120483; LMSC-D384250) Avail NTIS HC \$15.75 CSCL 21C

An evaluation of the technology and the development of a preliminary design for a 25 kilowatt solar array system for solar electric propulsion are discussed. The solar array has a power to weight ratio of 65 watts per kilogram. The solar array system is composed of two wings. Each wing consists of a solar array blanket, a blanket launch storage container, an extension/retraction mast assembly, a blanket tensioning system, an array electrical harness, and hardware for supporting the system for launch and in the operating position. The technology evaluation was performed to assess the applicable solar array state-of-the-art and to define supporting research necessary to achieve technology readiness for meeting the solar electric propulsion system solar array design requirements.

Author

N74-35323* McDonnell-Douglas Astronautics Co., St. Louis, Mo.

DESIGN FABRICATION, TESTING, AND DELIVERY OF SHUTTLE HEAT PIPE LEADING EDGE TEST MODULES. VOLUME 1: EXECUTIVE SUMMARY Final Report

20 Apr. 1973 24 p refs

(Contract NAS8-28656)

(NASA-CR-124425; MDC-E0775-Vol-1) Avail NTIS HC \$4.25 CSCL 20M

The construction of two test modules is presented for a feasibility demonstration of a concept for reusable space shuttle wing leading edge surfaces. In this leading edge concept high temperature heat pipes were incorporated into the structure to cool the stagnation region, allowing the use of super-alloys in place of refractory metal, ablator protected, or carbon-carbon structures. The program included the analysis and design of the heat pipes, their integration into the test module structure, heat pipe development testing, construction of the test modules and a facility adapter, and formulation of recommended testing conditions. The results of the heat pipe and leading edge module thermal analyses indicate the test modules will meet the design goal: reducing the leading edge temperature at the stagnation line from 1315 C (2400 F) to less than 1010 C (1850 F). The development tests demonstrated that the module assembly could be brazed with active heat pipes, as was borne out by the subsequent successful brazing of both modules with active heat pipes loaded with sodium.

Author

N74-35333# Committee on Government Operations (U. S. Senate).

CURRENT ENERGY SHORTAGES OVERSIGHT SERIES (THE MAJOR OIL COMPANIES), PART 2

Washington GPO 1974 166 p ref Hearings pursuant to Section 4, S. Res. 46 before Subcomm. on Investigations of Comm. on Govt. Operations, 93d Congr., 2d Sess., 21 Jan. 1974

(GPO-28-575-PT-2) Avail: SOD HC \$1.50

The role of the domestic oil industry in dealing with the energy crisis was questioned in a Congressional hearing convened to gather information on the effects of oil import quotas, as well as to hear reliable data concerning charges that major oil companies have intended to eliminate price competition, and are hoarding production, to force both the adoption of new tax subsidies and the revocation of environmental laws. The positions of the major oil interests are represented both by direct testimony, and by response to a questionnaire designed to reflect projected and actual supply/demand balances and crude oil imports for the period 1971 through 1974 A.A.D.

N74-35334# Committee on Interior and Insular Affairs (U. S. Senate).

FUEL SHORTAGES, PART 3

Washington NASA 1974 104 p Hearing pursuant to S. Res. 45 a national fuels and energy policy study before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 25 May 1973

(GPO-23-158) Avail: Comm. on Interior and Insular Affairs

The impacts of the energy crisis on private commerce were assessed by congressmen, union officials, farmers, and small businessmen from the Midwest in a hearing before Congress which attempted to measure the real consequences of current trends in energy supply. A.A.D.

N74-35335# Committee on Interior and Insular Affairs (U. S. Senate).

ENERGY INFORMATION ACT, PART 3: APPENDIX

Washington GPO 1974 453 p refs Hearings on S. 2782 before Comm. on Interior and Insular Affairs, 93d Congr., 2d Sess., 15 Feb. 1974

(GPO-29-910) Avail: Comm. on Interior and Insular Affairs

Data were submitted to Congress which are relevant to a proposed bill for the establishment of a national energy information system, and for the authorization of the Department of the Interior to undertake an inventory of U.S. energy resources on public lands. The results of a national gas reserves study are provided, and a computerized decision making system designed to integrate social, economic, and environmental processes is proposed. A similar energy-based information classification system is also discussed. A.A.D.

N74-35336# Committee on Government Operations (U. S. Senate).

CURRENT ENERGY SHORTAGES OVERSIGHT SERIES (THE MAJOR OIL COMPANIES), PART 4

Washington GPO 1974 145 p Hearings pursuant to Section 4, S. Res. 46 before Subcomm. on Investigations of Comm. on Govt. Operations, 93d Congr., 2d Sess., 23 Jan. 1974

(GPO-28-575-PT-4) Avail: SOD HC \$1.40

Summaries of negotiations between major U.S. oil companies and Middle Eastern governments during the period from 1964 to 1974 were presented in a hearing before Congress which attempted to identify possible irregular procedures in foreign trade which may have contributed to the current energy crisis. The oil companies also submitted complete accounts of their inventories during the embargo period, and provided estimates of recoverable U.S. crude oil and natural gas reserves for 1973 and 1974. A.A.D.

N74-35337# Committee on Government Operations (U. S. Senate).

CURRENT ENERGY SHORTAGES OVERSIGHT SERIES (THE FEDERAL ENERGY OFFICE), PART 5

Washington GPO 1974 96 p Hearings pursuant to Section 4, S. Res. 46 before Subcomm. on Investigations of Comm. on

Govt. Operations, 93d Congr., 1st Sess., 25 Jan. 1974

(GPO-29-547) Avail: SOD HC \$1.00

The activities reported to Congress by the Federal Energy Office (FEO) include: (1) the formulation of a fivefold approach to energy policy; (2) the gathering of energy data from current information sources; (3) the development of computer based national energy information systems with comprehensive reporting systems; (4) public disclosure of up to date indicators of energy supply outlook and suggestions for conservation; and (5) the sponsorship of energy-related legislation. The interaction of the FEO with major oil companies, state agencies, and other Federal departments is discussed with specific examples. A.A.D.

N74-35341# Committee on Public Works (U. S. House).

TO INSURE THAT CERTAIN BUILDINGS FINANCED WITH FEDERAL FUNDS UTILIZE THE BEST PRACTICABLE TECHNOLOGY FOR THE CONSERVATION AND USE OF ENERGY

Washington GPO 1973 56 p Hearing on H.R. 11299 and H.R. 11565 before Subcomm. on Energy of Comm. on Public Works, 93d Congr., 1st Sess., 27 Nov. 1973

(GPO-26-489) Avail: Subcomm. on Energy

Hearings were held before the Energy Subcommittee of the Committee on Public Works on the conservation and use of energy in buildings financed with Federal funds. The bills, H.R. 11299 and H.R. 11565, also cover the technology necessary for conservation. E.H.W.

N74-35342# Committee on Public Works (U. S. House).

FUEL AVAILABILITY AND ALLOCATION IN THE UNITED STATES

Washington GPO 1974 176 p Hearing before Subcomm. on Energy of Comm. on Public Works, 93d Congr., 2d Sess., 4 Feb. 1974

(GPO-31-711) Avail: Subcomm. on Energy

A Congressional hearing was conducted to examine the impact of the gasoline shortage on gasoline stations and motorists in various parts of the country. Emphasis was placed on the New Jersey area as being typical of the problems experienced by the Eastern Seaboard states. The hearing consisted primarily of testimony provided by selected witnesses and investigating personnel. Specific examples of the inconveniences resulting from the fuel shortage are documented by written and photographic evidence. The need for more equitable distribution of fuel resources, especially gasoline, is stressed. Author

N74-35343# Committee on Interstate and Foreign Commerce (U. S. House).

SUMMARY OF MAJOR PROVISIONS OF STANDBY ENERGY EMERGENCY AUTHORITIES ACT (H. R. 13834)

Washington GPO Apr. 1974 6 p Prepared by the staff for the Comm. on Interstate and Foreign Commerce in connection with the Committee's consideration of H.R. 13834, 93d Congr., 2d Sess., Apr. 1974

(GPO-31-024; H-Print-22) Avail: Comm. on Interstate and Foreign Commerce

The differences between the standby energy emergency authorities act, and the conference agreement on the emergency act (S.2589) are summarized along with the major provisions of H.R. 13834. F.O.S.

N74-35344# Committee on Interior and Insular Affairs (U. S. House).

NATIONAL ENERGY RESEARCH

Washington GPO 1974 587 p refs Hearings on H.R. 6602 and related bills before Subcomm. on the Environment of Comm. on Interior and Insular Affairs, 93d Congr., 16 and 23 May 1973; 13 Jun. 1973; 10 Dec. 1973; 18 Dec. 1973; 31 Jan. 1974; 1 and 19 Feb. 1974

Avail: Subcomm. on the Environment

A Congressional hearing was conducted concerning National energy research problems. Bills were proposed to establish a National program for research, development, and demonstration

of fuels and energy technologies, and for the coordination and financial supplementation of Federal energy research and development. The provisions of the National Energy Research and Development Policy Act of 1973 are explained. The powers, functions, and controls exercised by various Federal agencies for improved use of fuel resources are explained. Author

N74-35345# Committee on Commerce (U. S. Senate).
RESOURCE CONSERVATION AND RECYCLING, PART 3
 Washington GPO 1974 185 p refs Hearings on S. 2753 before Special Subcomm. on Sci., Technol., and Commerce of Comm. on Commerce, 93d Congr., 2d Sess., 17-18 Jan. 1974 (GPO-29-572) Avail: Special Subcomm. on Sci., Technol., and Commerce

Projections of an impending increase in solid waste generation many times greater than population growth prompted a Congressional hearing whose purpose was to initiate a multiple set of economic and other incentives for improving solid waste disposal and recycling efforts. The utilization of waste energy is discussed, with particular reference to the CPU-400 solid waste disposal pilot plant which is expected to have the capability of consuming approximately 600 tons per day of municipal solid waste in order to produce 12,000 kilowatts of electric power per day. Other experimental units sponsored by utility companies which combine pyrolysis, gasification, and combustion processes to produce energy from solid waste are described. The information presented is primarily concerned with solving resource management problems in California. A.A.D.

N74-35346# Committee on Interstate and Foreign Commerce (U. S. House)

CIVIL AERONAUTICS BOARD, OVERSIGHT
 Washington GPO 1974 37 p Hearing before Subcomm. on Transportation and Aeron. of Comm. on Interstate and Foreign Comm., 93d Congr., 2d Sess., 7 Feb. 1974 (GPO-30-218) Avail: Subcomm. on Transportation and Aeron.

A Congressional investigation was conducted to investigate the problems confronting the commercial air lines and the assistance which may be provided by the Civil Aeronautics Board to assist in alleviating some of the problems. Testimony of selected witnesses during appearance before the investigating committee is presented. Subjects discussed include the legislation to protect air transportation consumers during labor-management disputes, the competition for traffic with foreign countries, and efforts to overcome the effects of the fuel shortage on airline operations. Author

N74-35347# Committee on Commerce (U. S. Senate).
ENERGY AND ENVIRONMENTAL OBJECTIVES, PART 1
 Washington GPO 1974 40 p refs Hearing before Subcomm. on Environment of Comm. on Commerce, 93d Congr., 2d Sess., 4 Feb. 1974 (GPO-30-912) Avail: Subcomm. on Environment

A hearing before Congress explored the potential compatibility of the energy shortage with environmental objectives, especially in terms of identifiable impacts of standards and regulations imposed by the Environmental Protection Agency intended to encourage public and private conservation measures. Topics discussed include solid waste energy utilization, electric power plant conversion from oil to coal, the retrieval and recycling of metals, paper, and glass, and continuing research in automotive emission control technology. A.A.D.

N74-35351# Committee on Public Works (U. S. Senate).
A LEGISLATIVE HISTORY OF THE CLEAN AIR AMENDMENTS OF 1970 TOGETHER WITH A SECTION-BY-SECTION INDEX, VOLUME 1

Washington GPO Jan. 1974 796 p refs Presented by the Library of Congr. to Comm. on Public Works, 93d Congr., 2d Sess., Jan. 1974 Prepared by the Library of Congr., Environ. Policy Div. (GPO-26-274) Avail: SOD HC \$5.30

The compilation provides ready access to significant documents and debates that led to Public Law 91-604, the Clean

Air Act Amendments of 1970. A complete reprint of the bill is included. A.A.D.

N74-35352# Committee on Public Works (U. S. Senate).
A LEGISLATIVE HISTORY OF THE CLEAN AIR AMENDMENTS OF 1970 TOGETHER WITH A SECTION-BY-SECTION INDEX, VOLUME 2

Washington GPO Jan. 1974 806 p refs Presented by the Library of Congr. to Comm. on Public Works, 93d Congr., 2d Sess., Jan. 1974 Prepared by the Library of Congr., Environ. Policy Div.

(GPO-26-274) Avail: SOD HC \$5.35

For abstract, see N74-35351.

N74-35353# Committee on Public Works (U. S. Senate).
TRANSPORTATION AND THE NEW ENERGY POLICIES, PART 1

Washington GPO 1974 214 p refs Hearing before Subcomm. on Transportation of Comm. on Public Works, 93d Congr., 1st Sess., 11 Dec. 1973

(GPO-27-160) Avail: Subcomm. on Transportation

Transportation problems caused by new energy policies are discussed before the Subcommittee on Transportation. The subcommittee examined the following issues: (1) the future of the highway construction program, as it will be implemented following the passage of the Federal Aid Highway Act of 1973, (2) the questions surrounding the President's proposals for different speed limits for cars, trucks, and buses, and the House passed bill, which sets a national speed limit of 55 mi/hr, (3) the capacity of mass transit to handle the increased load of passengers resulting from lower supplies of gasoline for highway use, (4) the priorities which should be established for fuel allocation among the various mode of transportation, (5) the difficulties anticipated in moving foodstuffs and other essential goods to market, and (6) other economic dislocations which may result from adjustments required in transportation policies. E.H.W.

N74-35355# Committee on Government Operations (U. S. Senate).

CURRENT ENERGY SHORTAGES OVERSIGHT SERIES (THE MAJOR OIL COMPANIES), PART 3

Washington GPO 1974 179 p Hearings pursuant to Section 4, S. Res. 46 before Subcomm. on Investigations of Comm. on Govt. Operations, 93d Congr., 2d Sess., 22 Jan. 1974

R(GPO-28-575-PT-3) Avail: Subcomm. on Investigations

Statistical data which reflect net sales, capital expenditures, and gross production of crude oil and natural gas liquids by the major oil companies were presented before a Congressional inquiry whose purpose was to determine whether profits and cash earnings were within a fair margin. Prospects for U.S. energy self-sufficiency through new sources of oil were also explored, and the impact of oil import interruptions on the GNP was assessed. A.A.D.

N74-35357# Committee on Appropriations (U. S. House).
DEPARTMENT OF TRANSPORTATION AND RELATED AGENCIES APPROPRIATIONS FOR 1975, PART 1: DEPARTMENT OF TRANSPORTATION NATIONAL TRANSPORTATION POLICY

Washington GPO 1974 355 p refs Hearings before a Subcomm. of the Comm. on Appropriations, 93d Congr., 2d Sess., 5 Mar. 1974

(GPO-31-433) Avail: Comm. on Appropriations

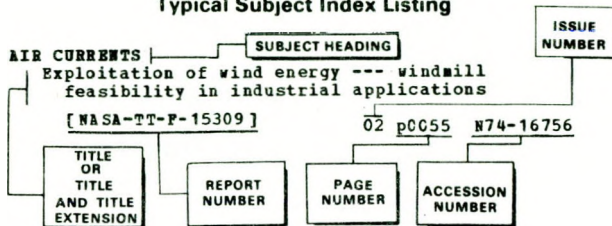
Goals for a unified national transportation policy, which focus on service standards and technology developments at a low per capita cost, are outlined in hearings before Congress aimed at determining equitable guidelines for federal funding of DOT and its related agencies. All phases of transportation are discussed, including railroads, inland barge carriers, buses, rapid transit systems, highways, and light aircraft. Federal obligations to subsidize certain aspects of the transportation sector are considered. The energy crisis and its influence on mass transit development is described, along with proposals for economic regulation of the industry. A.A.D.

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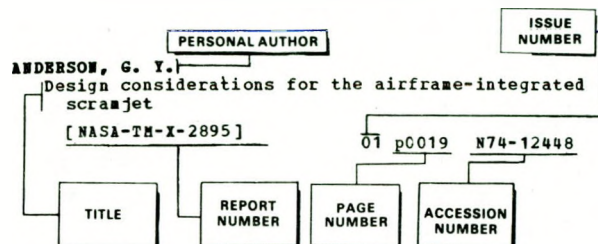
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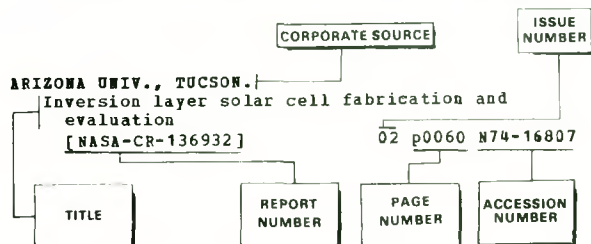
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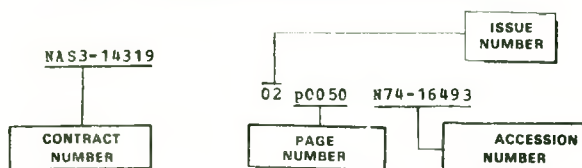
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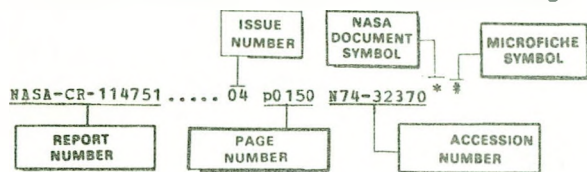
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UCRL-51533 04 p0148 N74-31537 #
UCRL-75323 04 p0159 N74-33500 #

UDRI-TR-73-65 04 p0154 N74-32496 #

UKY-TR70-73-CEED4 02 p0071 N74-18634 #
UKY-TR76-73-IMHR1 03 p0118 N74-28439 #

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US-PATENT-APPL-SN-336319 04 p0156 N74-33379* #
US-PATENT-APPL-SN-421702 01 p0025 N74-14496* #
US-PATENT-APPL-SN-440916 04 p0137 N74-29416* #
US-PATENT-APPL-SN-446567 02 p0074 N74-19584* #
US-PATENT-APPL-SN-455164 02 p0077 N74-19702* #
US-PATENT-APPL-SN-457295 02 p0077 N74-19701* #
US-PATENT-APPL-SN-458484 02 p0076 N74-19700* #
US-PATENT-APPL-SN-495021 04 p0143 N74-30488* #

US-PATENT-CLASS-29-572 01 p0027 N74-14784* #
US-PATENT-CLASS-29-588 01 p0027 N74-14784* #
US-PATENT-CLASS-60-527 04 p0156 N74-33379* #
US-PATENT-CLASS-136-89 01 p0027 N74-14784* #

US-PATENT-3,780,424 01 p0027 N74-14784* #
US-PATENT-3,830,060 04 p0156 N74-33379* #

USAMRDL-TR-73-32 02 p0061 N74-17764 #

USAPA-TR-74-2 03 p0104 N74-22622 #

USAMERDC-21583 03 p0121 N74-28553 #

USGS-CIRC-694 03 p0121 N74-28897 #

USGS-GD-74-021 04 p0166 N74-34834 #

U1-702700-F 02 p0082 N74-20948* #
U1-702700-2 01 p0013 N74-11148* #

WASH-1281 03 p0119 N74-28465 #
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WASH-1281-3 04 p0156 N74-33418 #
WASH-1281-6 04 p0158 N74-33493 #
WASH-1281-7 04 p0158 N74-33495 #
WASH-1281-8 04 p0158 N74-33494 #
WASH-1281-9 04 p0138 N74-29420 #
WASH-1281-12 04 p0158 N74-33496 #
WASH-1281-13 04 p0164 N74-34433 #
WASH-1281-16 04 p0158 N74-33497 #

WHOI-CONTRIB-3218 02 p0065 N74-18073 #
WHOI-CONTRIB-3218 03 p0102 N74-22091 #

WHOI-REF-73-75 03 p0102 N74-22091 #

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WQEC/C-74-337 04 p0148 N74-31530* #

W73-14368 01 p0025 N74-14105 #
W74-07056 04 p0144 N74-30451 #
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X-704-74-139 03 p0106 N74-25621* #
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