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ENERGY

A CONTINUING BIBLIOGRAPHY

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MAY 1974

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ENERGY

A Continuing Bibliography

With Indexes

Supplement 01

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 January 1, 1974 through March 31, 1974 in:

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

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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INTRODUCTION

This is the first issue of a new quarterly publication, *Energy: A Continuing Bibliography with Indexes* (NASA SP-7043). It lists 232 reports, journal articles, and other documents originally announced between January 1, 1974 and March 31, 1974 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. An earlier publication, *Energy: A Special Bibliography with Indexes* (NASA SP-7042) cited the documents announced in the same abstract journals from January 1968 through December 1973.

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

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

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

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All publications abstracted in this Section are available from the Technical Information Service, American Institute of Aeronautics and Astronautics, Inc., (AIAA), as follows: Paper copies are available at $5.00 per document up to a maximum of 20 pages. The charge for each additional page is 25 cents. Microfiche [1] are available at the rate of $1.00 per microfiche for documents identified by the # symbol following the accession number. A number of publications, because of their special characteristics, are available only for reference in the AIAA Technical Information Service Library. Minimum airmail postage to foreign countries is $1.00. Please refer to the accession number, e.g., A74-11072, when requesting publications.

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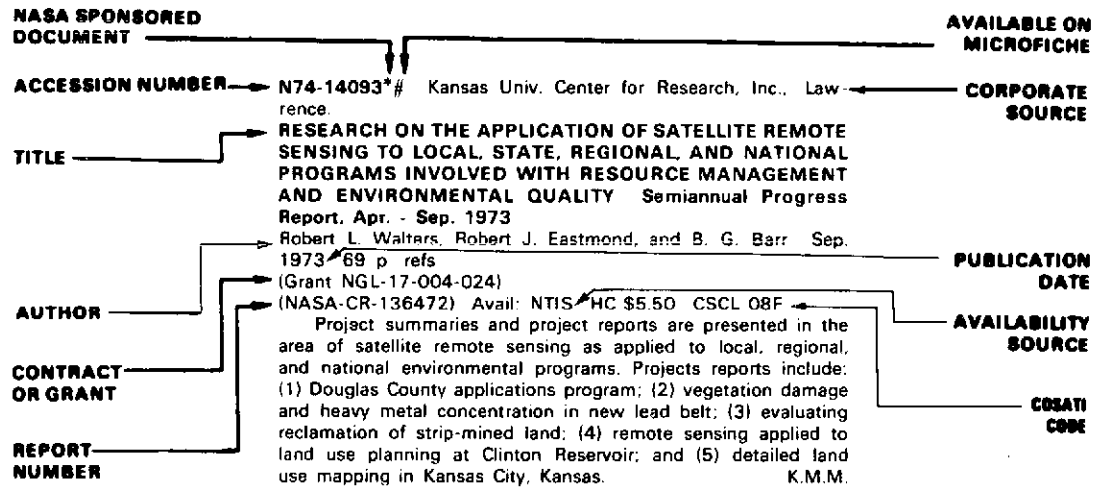

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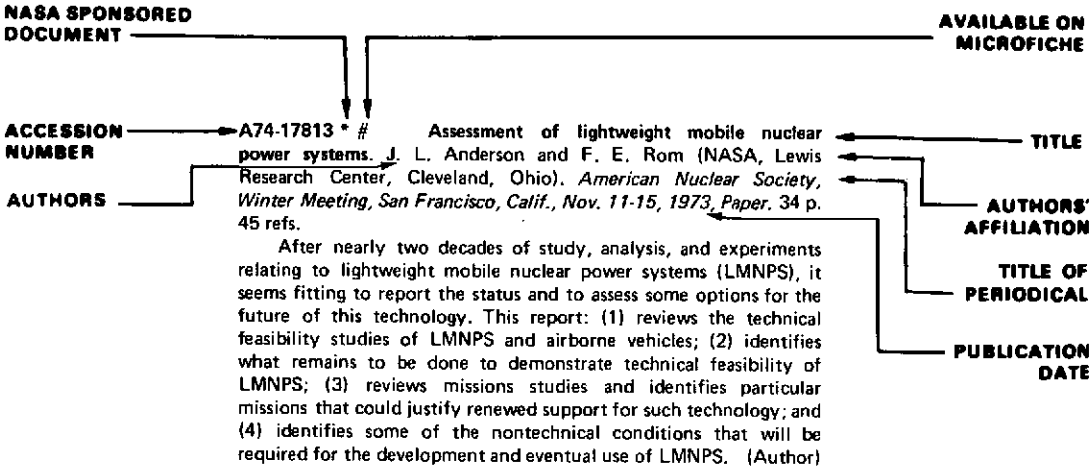

A Listing of Energy Bibliographies Contained In This Publication:

ENERGY

A Continuing Bibliography (Suppl. 01) MAY 1974

IAA ENTRIES

A74-10026 **Theoretical performance of cylindrical parabolic solar concentrators.** K.-E. Hassan and M. F. El-Refaie (Cairo, University, Cairo, Egypt). *Solar Energy*, vol. 15, Sept. 1973, p. 219-244.

A74-10144 **The technology and economics of commercial airplane design.** I. J. E. Steiner (Boeing Co., Commercial Airplane Group, Renton, Wash.). *Esso Air World*, vol. 25, no. 5, 1973, p. 119-124.

Discussion of the relation between technology and economics in commercial aviation. Past and present priority orders of aircraft market requirements in speed, range, frequency, quietness, passenger comfort and economics are compared. Direct operating cost trends, aerodynamic efficiency trends, thrust-to-weight growth, engine fuel efficiency trends, payload efficiency, airline revenues vs passenger yield, progress in takeoff noise reduction, return on investment, and approach noise are covered. Improved technology, two-man crew, reduced block time and maintenance cost, and communality/facilities compatibility are listed as elements of improved commercial aircraft design economics. V.Z.

A74-10463 # **Heating of a substance by an arc plasma (Plazmenno-dugovoi nagrev veshchestva).** A. V. Nikolaev. In: Plasma processes in metallurgy and in the technology of inorganic materials. Moscow, Izdatel'stvo Nauka, 1973, p. 20-32. 21 refs. In Russian.

The energetic characteristics of the heating process are analyzed for the heating of the vaporized and condensed phases of substances within and outside the electrical field of an arc discharge. It is shown that the heating of substances by an arc discharge plasma has a potential as a technique for practical electric-to-thermal energy conversion. It is also found that the power delivered to the substance can be controlled within large limits by varying the electrical parameters of the arc and the thermophysical properties of the plasma arc gas when this electric-to-thermal energy conversion process is used. An efficiency in excess of 80% is indicated for this energy conversion method. V.Z.

A74-10691 # **Physical behaviour of some biowaste gases in an ion engine.** A. R. Martin (City University, London, England). *American Institute of Aeronautics and Astronautics, Electric Propulsion Conference, 10th, Lake Tahoe, Nev., Oct. 31-Nov. 2, 1973, Paper 73-1113.* 7 p. 12 refs. Members, $1.50; nonmembers, $2.00. Research supported by the Science Research Council and Department of Trade and Industry.

The operation of a 100 mm diameter electron-bombardment ion engine using carbon dioxide, methane and nitrogen propellants was studied. The engine was of modern configurational design, but constructed to laboratory requirements rather than flight or engineering standards. The operation with nitrogen and methane was quite similar, and resulted in stable operation with reasonable efficiencies. Operation with carbon dioxide was anomalous, in that as utilization was increased a point occurred where the losses rose and the beam current fell. This was thought to be related to a change in the cathode work function as a result of oxygen poisioning. (Author)

A74-11020 # **Satellite solar power stations to meet future energy demands.** P. E. Glaser (Arthur D. Little, Inc., Cambridge, Mass.). *Industries Atomiques et Spatiales*, vol. 17, July-Aug. 1973, p. 77-95. 16 refs. In English and French.

A satellite solar power system (SSPS) can be designed to generate electrical power on earth at specific levels ranging from about 3000 to 15,000 megawatt. Over this range of power output the orbiting portion of the SSPS exhibits the best power-to-weight characteristics. Additional solar collector arrays and antennas could be added to establish an SSPS system at a desired orbital location. With the receiving antenna placed either on land or on platforms over water near major load centers and tied into a power transmission grid, power could be delivered to almost any desired geographic location. F.R.L.

A74-11219 # **Gas generators - A perspective.** W. H. Cutler (Lockheed Missiles and Space Co., Inc., Sunnyvale, Calif.). *American Institute of Aeronautics and Astronautics and Society of Automotive Engineers, Propulsion Conference, 9th, Las Vegas, Nev., Nov. 5-7, 1973, AIAA Paper 73-1168.* 7 p. Members, $1.50; nonmembers, $2.00.

The gas generator is usually thought of as a light weight, high power, short duration energy source, used mainly in aircraft and missiles. This premise is re-examined by viewing gas generators in the perspective of other energy sources with similar or overlapping characteristics and applications, to see where gas generators have a performance edge and where gaps exist which are opportunities for new gas generator applications. The alternative energy sources, which in addition to gas generators include gas turbines, reciprocating engines, compressed gas containers and hydraulic accumulators, flywheels, batteries, fuel cells, and solar photovoltaic cells, are first described in terms of their energy conversion process and the form in which their output energy is delivered. They are then compared on the basis of stored energy density and applicable power levels. Next, the factors involved in matching an energy source to its operating environment are enumerated. Finally, a number of new applications for gas generators are suggested which introduce new requirements in both technical and marketing areas. (Author)

A74-11257 # **Solid state hydrogen gas generator.** W. H. Barber, W. F. Beckert, and O. H. Dengel (U.S. Navy, Naval Ordnance Station, Indian Head, Md.). *American Institute of Aeronautics and*

Astronautics and Society of Automotive Engineers, Propulsion Conference, 9th, Las Vegas, Nev., Nov. 5-7, 1973, AIAA Paper 73-1232. 4 p. Members, $1.50; nonmembers, $2.00.

A family of light-weight solid state hydrogen gas generators has been developed for inflation of rocket deployed balloon structures. The generators utilize a reaction between metal hydrides and ammonium halides. The chemical reaction is thermally initiated. The generators tested so far are capable of inflating 1-15 cu. ft. structures at STP. The development of solid state hydrogen gas generators for inflation of 1,000-100,000 cu. ft. balloon structures appears feasible. (Author)

A74-11315 # **The case for hydrogen fueled transport aircraft.** G. D. Brewer (Lockheed-California Co., Burbank, Calif.). *American Institute of Aeronautics and Astronautics and Society of Automotive Engineers, Propulsion Conference, 9th, Las Vegas, Nev., Nov. 5-7, 1973, AIAA Paper 73-1323.* 13 p. 14 refs. Members, $1.50; nonmembers, $2.00.

Arguments in favor of the substitution of liquid hydrogen for oil to power commercial aircraft are presented. Shortage of petroleum in the United States and the need for import will lead to unacceptable dependence on foreign nations, will cost the U.S. heavily in terms of deficit balance of payments, and can become a continuous threat of interruption of oil supply that will endanger our independence in the fields of commerce, world trade, diplomacy, and even our national security. In addition, hydrogen offers potential advantages when used in aircraft. Examples of subsonic and supersonic commercial aircraft are examined to determine the advantages in performance, pollution, noise, and cost. Some problems associated with the use of liquid hydrogen as a fuel are discussed. V.P.

A74-12201 Spacecraft electrical power. E. Stofel (Hughes Aircraft Co., El Segundo, Calif.). In: EASCON '73; Electronics and Aerospace Systems Convention, Washington, D.C., September 17-19, 1973, Record. New York, Institute of Electrical and Electronics Engineers, Inc., 1973, p. 225-231. 13 refs.

Present developments in spacecraft power systems are placing strong emphasis on component weight reduction and efficiency improvements as a means of obtaining spacecraft with more power. The most striking of these are: (1) the improved efficiency of solar cells; (2) light-weight, large area solar arrays; (3) the possibility of light-weight nickel-hydrogen energy storage units; and (4) restructuring of power control electronics at higher operating voltages. These developments will tend to encourage further use of solar cell power systems for increasingly larger spacecraft, a trend that is already well established by the use of solar cells on almost all past and present spacecraft. Nuclear powered systems are advancing at a slower rate, with limited funding, and, therefore, apparently will remain relegated to special situations, such as missions to the outer planets or where physical compactness is a distinctive requirement. (Author)

A74-12242 * # **High voltage solar cell power generating system for regulated solar array development.** E. Levy, Jr. (Hughes Aircraft Co., Los Angeles, Calif.) and A. C. Hoffman (NASA, Lewis Research Center, Cleveland, Ohio). *American Institute of Aeronautics and Astronautics, Electric Propulsion Conference, 10th, Lake Tahoe, Nev., Oct. 31-Nov. 2, 1973, Paper 73-1105.* 13 p. Members, $1.50; nonmembers, $2.00. Contract No. NAS3-15826.

A laboratory solar power system regulated by on-panel switches has been delivered for operating high power (3 kw), high voltage (15,000 volt) loads (communication tubes, ion thrusters). The modular system consists of 26 solar arrays, each with an integral light source and cooling system. A typical array contains 2560 series-connected cells. Each light source consists of twenty 500 watt tungsten iodide lamps providing plus or minus 5 per cent uniformity at one solar constant. An array temperature of less than 40 C is achieved using an infrared filter, a water cooled plate, a vacuum hold-down system, and air flushing. (Author)

A74-12794 # **Actual state of French technical developments concerning sources of space power (Etat actuel des développements techniques français en matière de sources de puissance spatiales).** W. Palz and C. Martin (Centre National d'Etudes Spatiales, Paris, France). *International Astronautical Federation, International Astronautical Congress, 24th, Baku, Azerbaidzhan SSR, Oct. 7-13, 1973, Paper.* 17 p. 6 refs. In French.

French progress in study and research concerning solar generators for space applications is described. On the level of components continuing effort is being put forth to perfect silicon cells. The development of thin-film cadmium sulfide cells has reached the stage of practicality. In the years to come complete commercial production is expected. Rigid and flexible structures of solar panels have been developed in the 100 W to 10 kW range. Research and development work in this field is reviewed. F.R.L.

A74-12905 * # **Industrial use of aerospace technology.** J. E. Burnett (NASA, Lewis Research Center, Cleveland, Ohio). *International Astronautical Federation, International Astronautical Congress, 24th, Baku, Azerbaidzhan SSR, Oct. 7-13, 1973, Paper.* 5 p.

Using a few selected examples of the several hundred successful transfers of aerospace technology to applications outside the aerospace field, it is shown that aerospace-related new technology does have many valuable nonaerospace uses. The examples presented include technology transfers to the machine tool and petroleum industries as well as to the fields of electric utilities and computer-aided structure design. M.V.E.

A74-13234 * # **Satellite nuclear power station: An engineering analysis.** J. R. Williams, J. D. Clement (Georgia Institute of Technology, Atlanta, Ga.), R. J. Rosa, K. D. Kirby, and Y. Y. Yang. Research supported by NASA; Grant No. NGR-11-002-146. Atlanta, Ga., J.R. Williams, Georgia Institute of Technology, 1973. 143 p. 41 refs.

A nuclear-MHD power plant system which uses a compact non-breeder reactor to produce power in the multimegawatt range is analyzed. It is shown that, operated in synchronous orbit, the plant would transmit power safely to the ground by a microwave beam. Fuel reprocessing would take place in space, and no radioactive material would be returned to earth. Even the effect of a disastrous accident would have negligible effect on earth. A hydrogen moderated gas core reactor, or a colloid-core, or NERVA type reactor could also be used. The system is shown to approach closely the ideal of economical power without pollution. V.P.

A74-13293 # **Conversion of fuel nitrogen to NOx in a compact combustor.** H. R. Hazard (Battelle Columbus Laboratories, Columbus, Ohio). *American Society of Mechanical Engineers, Winter Annual Meeting, Detroit, Mich., Nov. 11-15, 1973, Paper 73-WA/GT-2.* 4 p. Members, $1.00; nonmembers, $3.00.

A low-nitrogen fuel, ASTM Jet A aviation kerosene, was doped with increasing amounts of pyridine as a means of increasing the content of chemically bound nitrogen; it was then burned at a rate of 50 lb/hr in a compact combustor incorporating staged air admission with a rich primary zone and water cooling of the walls. Each increase in fuel nitrogen content resulted in a significant increase in NOx in the combustion products, and it is estimated that as much as 90% of the fuel nitrogen was converted to NOx at very low nitrogen levels, decreasing to 55% conversion at higher levels. These results are consistent with data reported for large steam boilers and for small residential boilers. It appears that emission standards requiring very low levels of NOx emission will require use of fuels with very low nitrogen content. (Author)

A74-13448 **Thermoelectric generators (Les générateurs thermoélectriques).** R. Stoll (Thomson-CSF, Division Faisceaux Hertziens, Levallois-Perret, Hauts-de-Seine, France). *Entropie,* vol. 9,

July-Aug. 1973, p. 37-44. In French.

Consideration of the technology and characteristics of various types of thermoelectric flame generators, and review of the design of power plants employing such generators. A detailed description is given of the thermoelectric modules, the combustion chamber, and the heat exchangers employed in a thermoelectric flame generator, and various possible applications of these generators are noted, with particular emphasis placed on their use as power supplies for a radio beam relay station. It is concluded that currently used thermoelectric flame generators are well adapted to user needs, and are reliable and competitive with energy sources such as solar cells or high-capacity chemical batteries. A.B.K.

A74-13559 Effect of the sun, the moon and solar radiation pressure on a near-equatorial synchronous satellite. C.-H. Zee (Grumman Aerospace Corp., Bethpage, N.Y.). *Astronautica Acta*, vol. 18, Oct. 1973, p. 281-287. 9 refs. Research sponsored by the Grumman Aerospace Corp.

The effect of the sun, the moon and solar radiation pressure on a near-equatorial synchronous satellite is investigated by an extension of the previous work on the effect of the sun and the moon. In addition to the orbital plane movement mainly due to the sun and the moon, the solar radiation pressure results in the change of eccentricity as well as the rotation of the line of apsides. However, an integrated solution is presented to show the coupled effect of all orbital elements. (Author)

A74-13798 Performance and noise aspects of supersonic transport. J. Calmon and R. Hoch (SNECMA, Paris, France). In: INTER-NOISE 73; Proceedings of the International Conference on Noise Control Engineering, Copenhagen, Denmark, August 22-24, 1973. Lyngby, INTER-NOISE 73, Danmarks Tekniske Hojskole, 1973, p. 464-473. 5 refs.

The operating economics of a supersonic commercial aircraft are shown to be very sensitive to changes in power plant weight and propulsion efficiency and, therefore, necessarily compelled to be noisier than subsonic aircraft at the same technology level. It is expected that the noise level of supersonic commercial aircraft will be governed by the capability of varying optimal aerodynamic and propulsive configurations between takeoff and cruise. M.V.E.

A74-13943 Optimization of the power of Faraday MHD generators operating on nonequilibrium plasma. V. S. Vorob'ev and V. I. Krasnov (Akademiia Nauk SSSR, Nauchno-Issledovatel'skii Institut Vysokikh Temperatur, Moscow, USSR). *(Teplofizika Vysokikh Temperatur,* vol. 11, Jan.-Feb. 1973, p. 161-166.) *High Temperature,* vol. 11, no. 1, Sept. 1973, p. 134-138. 6 refs. Translation.

The electric output power of a Faraday-type MHD-generator using an inequilibrium turbulent plasma as the working medium is optimized under the assumption that the damping parameters of the gas at the channel inlet, the magnetic flux density, and the length and maximum cross section of the channel are known. Expressions relating the optimal local parameters are derived, and a system of equations describing the optimal flow is solved numerically. Calculations for a helium-cesium mixture are performed as an example. V.P.

A74-13944 Qualitative analysis of the efficiency of MHD energy conversion. V. Iu. Baranov, D. D. Maliuta, V. P. Panchenko, and F. R. Ulinich (Akademiia Nauk SSSR, Institut Atomnoi Energii, Moscow, USSR). *(Teplofizika Vysokikh Temperatur,* vol. 11, Jan.-Feb. 1973, p. 167-173.) *High Temperature,* vol. 11, no. 1, Sept. 1973, p. 139-144. Translation.

A method is proposed for solving the system of one-dimensional differential equations describing the gas flow in the channel of a Faraday-type MHD generator with ideally segmented electrodes. The convergence efficiency of the generator is determined as a function of the generator length and the load factor. The influence of the channel shape and the inlet Mach number on the conversion factor is examined, and the range of optimal parameters is determined. The energy conversion efficiency of a Faraday-type generator with solid electrodes is discussed. V.P.

A74-14043 Cryogenic Engineering Conference, University of Colorado, Boulder, Colo., August 9-11, 1972, Proceedings. Conference sponsored by the National Academy of Sciences, National Bureau of Standards, et al. Edited by K. D. Timmerhaus (Colorado, University, Boulder, Colo.; National Science Foundation, Engineering Div., Washington, D.C.). New York, Plenum Press (Advances in Cryogenic Engineering. Volume 18), 1973. 544 p. $30.

Recent developments in various aspects of low-temperature technology are reviewed in papers dealing with cryogenic processes, equipment, instrumentation, properties, and applications. General areas covered include liquefied natural gas technology, heat transfer measurements, insulation systems, cryogenic fluid mechanics, mechanical properties of structural materials used in cryogenic systems, determination of the thermodynamic properties of cryogenic fluids, thermal properties of nylons and greases, cryogenic instrumentation systems, refrigeration equipment, practical applications of superconductivity, and the preparation of atomic and metallic hydrogen. T.M.

A74-14046 # Development program for a liquid methane heat pipe. W. G. Foster and D. O. Murray (Lockheed Research Laboratories, Palo Alto, Calif.). In: Cryogenic Engineering Conference, Boulder, Colo., August 9-11, 1972, Proceedings. New York, Plenum Press, 1973, p. 96-102. 8 refs.

Description of a development program on the design of a heat pipe which would transfer 2 W of power over a length of 122 cm, with a total temperature drop of 2 K and a condenser temperature of 110 K. The heat pipe is intended for spacecraft applications, and the design requirements were satisfied by a simple wire-cloth wick, using methane as the working fluid. Thermal tests in a one-g field were conducted, and results agreed closely with the predicted performance. The radial temperature gradient was found to be smaller than anticipated for a methane heat pipe. No degradation in performance was found after the prototype was subjected to launch environment tests. T.M.

A74-14057 # Cryogenic instrumentation at and above liquid hydrogen temperature - Present and future. W. E. Keller (California, University, Los Alamos, N. Mex.). In: Cryogenic Engineering Conference, Boulder, Colo., August 9-11, 1972, Proceedings. New York, Plenum Press, 1973, p. 289-300. 18 refs. AEC-sponsored research.

Discussion of instrumentation problems associated with present and possible future large-scale cryogenic systems operating at or above liquid hydrogen temperatures - i.e., at temperatures above 13.8 K. Emphasis is placed on energy applications involving the use of liquid oxygen, liquid hydrogen, and liquefied natural gas as fuels and refrigerants. The types of processes and information which may be required in order to operate and regulate such large-scale cryogenic systems are outlined together with presently available and anticipated types of instrumentation required to meet operational demands. Attention is given to liquefaction and refrigeration systems, dewar insulation, liquid level sensors, measurement of state properties, and special storage methods. T.M.

A74-14112 The use of the Space Shuttle to support large space power generation systems. P. E. Glaser (Arthur D. Little, Inc., Cambridge, Mass.). In: Space Shuttle payloads; Proceedings of the Symposium, Washington, D.C., December 27, 28, 1972. Tarzana, Calif., American Astronautical Society, 1973, p. 167-191. 18 refs.

The feasibility of obtaining power from space by means of a satellite solar power station is reviewed. The requirements for a high-volume transportation system to low earth orbit followed by delivery of partially assembled components to geosynchronous orbit for final assembly and deployment are discussed. The steps required to develop the satellite solar power station are outlined with emphasis on supporting technology development and verification of technology readiness. The role of the Space Shuttle in spaceborne flight verification activities is projected and requirements for Space Shuttle payloads are indicated. (Author)

A74-14121 Use of Shuttle in establishing large space installations. K. A. Ehricke (North American Rockwell Corp., Space Div., Downey, Calif.). In: Space Shuttle payloads; Proceedings of the Symposium, Washington, D.C., December 27, 28, 1972. Tarzana, Calif., American Astronautical Society, 1973, p. 397-447. 23 refs.

Consideration of the feasibility of setting up an orbiting solar reflector and orbiting space power generation and distribution plants. A system called Lunetta, designed for practically useful night illumination of areas of the earth's surface by a reflector in equatorial geosynchronous orbit, is described. The socio-economic value of the Lunetta is stressed by citing the possibility of conducting agricultural activities with its aid at night. Problems connected with the choice of the size, location, and brightness of Lunetta are discussed, as well as problems of weight minimization and radiation-pressure compensation. The possibility of large-scale power generation in space, using nuclear, solar-thermal, and photovoltaic-reflector systems, is considered, as well as a power relay concept involving large antennas in geosynchronous orbit, reflecting and redirecting the energy flow of microwave beams. The ability of the Integrated Space Shuttle configuration selected by NASA and the Geospace Interorbital Transportation vehicle (incorporated in the Shuttle payload and then released in low orbit) to assist in the construction of large installations in geosynchronous orbit is evaluated. A.B.K.

A74-14133 Power conditioning system for FAA Air Route Traffic Control Centers. A. J. Froehlich, Jr. (FAA, Washington, D.C.) and A. Kusko (Alexander Kusko, Inc., Needham Heights, Mass.). In: Western Electronic Show and Convention, San Francisco, Calif., September 11-14, 1973, Proceedings. North Hollywood, Calif., Western Periodicals Co., 1973, p. 25/2-1 to 25/2-4.

The FAA is currently installing solid-state uninterruptible power source (UPS) equipment to supply electrical power at a high level of reliability in 20 U.S. air route traffic control centers. Each UPS consists of several parallel-connected 200-kVA rectifier-inverter modules which operate either from the commercial power line or from batteries and engine-generator sets upon failure of the commercial power. Performance and reliability requirements dictated by application in the air route traffic control centers are outlined together with plans developed for testing and maintenance of these power units. T.M.

A74-14248 Chemical storage of hydrogen in Ni/H2 cells. M. W. Earl and J. D. Dunlop (COMSAT Laboratories, Clarksburg, Md.). *COMSAT Technical Review*, vol. 3, Fall 1973, p. 437-441. 5 refs. Research sponsored by the International Telecommunications Satellite Organization.

It is shown that LaNi5 hydride can be used to reduce the operating pressure of a nickel/hydrogen cell without affecting its high cycle-life expectancy. Advantages of this concept are: safe operation at high hydrogen pressures, cell volume reduction of almost 50%, and simplification of cell pressure vessel design through prismatic-type cell construction; this eliminates electrolyte loss problems, provides an electrode stack design with improved shock and vibration characteristics, and simplifies battery packaging. V.P.

A74-14250 Vitreous oxide antireflection films in high-efficiency solar cells. A. G. Revesz (Communications Satellite Corp., Washington, D.C.). *COMSAT Technical Review*, vol. 3, Fall 1973, p. 449-452. 7 refs.

Lindmayer and Allison (1973) have shown that the short wavelength response and the fill factor of silicon solar cells can be significantly improved by using a major modification of the grid geometry in combination with a very shallow junction and a new antireflection film. The new cell, termed the violet cell, has a conversion efficiency of 13 to 14 percent. The theoretical considerations on which the antireflection film is based are outlined, and test data are examined. V.P.

A74-14327 Thermionic energy conversion. Volume 1 - Processes and devices. G. N. Hatsopoulos (Thermo Electron Corp.; MIT, Cambridge, Mass.) and E. P. Gyftopoulos (MIT, Cambridge, Mass.). Research sponsored by the U.S. Atomic Energy Commission. Cambridge, Mass., MIT Press, 1973. 276 p. 98 refs. $17.95.

A qualitative description of thermionic converters is given and basic phenomena in thermionic conversion are considered together with types of thermionic converters, the characteristics of typical thermionic converters, thermionic-converter systems, and aspects of thermionic conversion with other electrical power systems. Questions regarding the ideal performance of diode thermionic converters are examined, giving attention to thermionic emission, a simple diode thermionic converter, electron-motive diagrams through the inter-electrode space, output-current characteristics, energy-conversion efficiency, and optimum ideal performance. Vacuum thermionic converters are described along with vapor thermionic converters. G.R.

A74-14463 The second fifteen years in space; Proceedings of the Eleventh Goddard Memorial Symposium, Washington, D.C., March 8, 9, 1973. Symposium sponsored by the American Astronautical Society. Edited by S. Ferdman (Grumman Aerospace Corp., Bethpage, N.Y.). Tarzana, Calif., American Astronautical Society (Science and Technology Series. Volume 31), 1973. 196 p. $15.

The forthcoming fifteen years of U.S. efforts in space are examined in papers dealing with the impact of the space program on industrial, scientific, and social aspects of life in the U.S. Attention is given to anticipated developments in rocket engines, the possibility of harnessing solar energy as a source of electric power on earth by means of satellites, the use of computer control systems in manned and automated space vehicles, and the growth of the data communications technology. Exploration of the terrestrial planets is considered in a description of the Viking mission to Mars, and aspects of international cooperation in space are examined together with European space projects after 1980. T.M.

A74-14465 Solar power for our nation. T. J. Kelly and J. Mockovciak, Jr. (Grumman Aerospace Corp., Bethpage, N.Y.). In: The second fifteen years in space; Proceedings of the Eleventh Goddard Memorial Symposium, Washington, D.C., March 8, 9, 1973. Tarzana, Calif., American Astronautical Society, 1973, p. 39-54. 6 refs.

With increasing attention focusing on the energy problem, considerable interest has recently surfaced relative to the potential use of solar energy as a power source for our nation. This paper assesses the possibilities for near-term and longer-range applications of solar energy, including a large space-based Satellite Solar Power Station. Many applications are well beyond the research phase and could be accelerated to commercial readiness. Longer-range applications should be pursued with appropriate technology development programs to provide this nation with energy options in the future. If the nation wants to use solar energy as a major power source, it is technically possible to do so. Further, with appropriate incentives and government support, the public can have this clean and abundant energy source economically. (Author)

A74-14892 * Quantification of the luminescence intensity of natural materials. R. D. Watson, T. D. Hessin (U.S. Geological Survey, Denver, Colo.), and W. R. Hemphill (U.S. Geological Survey, Washington, D.C.). In: Management and utilization of remote sensing data; Proceedings of the Symposium, Sioux Falls, S. Dak., October 29-November 1, 1973. Falls Church, Va., American Society of Photogrammetry, 1973, p. 364-376. 7 refs. NASA-supported research. NASA Order L-58514.

Review of some of the results of an evaluation of the use of an airborne Fraunhofer line discriminator (FLD) for the detection of sun-stimulated luminescence emitted by rhodamine WT dye and some other materials. Rhodamine dye is reported to have been detected by airborne FDL in sea water in concentrations of less than 2 ppb. Experiments with a fluorescence spectrometer in the laboratory indicate that luminescence of some samples of crude and refined petroleum exceeds the luminescence intensity of rhodamine dye in concentrations of 10 ppm. M.V.E.

A74-16116 Regional and global energy transfer via passive power relay satellites. K. A. Ehricke (Rockwell International Corp., Space Div., Downey, Calif.). In: Technology today and tomorrow; Proceedings of the Tenth Space Congress, Cocoa Beach, Fla., April 11-13, 1973. Cape Canaveral, Fla., Canaveral Council of Technical Societies, 1973, p. 5-15 to 5-94. 23 refs.

The Power Relay Satellite (PRS) offers interesting possibilities as a feasible, shuttle-compatible method of transferring energy over continental or global distances. The basic principle of the PRS is that a microwave reflector is placed into geosynchronous orbit to redirect energy beamed from a power generation system (power source) to a receiver at a great distance from the power source. There the microwave energy is converted back to electricity for local distribution. Particulars of the transmitter antenna are given. The technology of converting electricity to microwave power was advanced greatly with the development of crossed-field devices. They operate on the principle of electron motion in a crossed electric and magnetic field. Microwave beam transmission is examined. Energy sources and primary electric power plants (PEPPs) in the United States are discussed. Attention is given to the shuttle compatibility of space relaying and its comparison with space power generation. F.R.L.

A74-16123 * Summary of the study of disposal of nuclear waste into space. F. E. Rom (NASA, Lewis Research Center, Power Applications and Systems Analysis Branch, Cleveland, Ohio). In: Technology today and tomorrow; Proceedings of the Tenth Space Congress, Cocoa Beach, Fla., April 11-13, 1973. Cape Canaveral, Fla., Canaveral Council of Technical Societies, 1973, p. 7-19 to 7-26. 7 refs.

NASA, at the request of the AEC, is conducting a preliminary study to determine the feasibility of disposing of nuclear waste material into space. The study has indicated that the Space Shuttle together with expendable and nonexpendable orbital stages such as the Space Tug or Centaur can safety dispose of waste material by ejecting it from the solar system. The safety problems associated with all phases of launching and operation (normal, emergency and accident) of such a system are being examined. From the preliminary study it appears that solutions can be found that should make the risks acceptable when compared to the benefits to be obtained from the disposal of the nuclear waste. (Author)

A74-16909 Evolution of studies in the field of gas lasers (Evolution des recherches dans le domaine des lasers à gaz). J. Robieux (Compagnie Générale d'Electricité, Marcoussis, Essonne, France). *(Société Française de Physique, Congrès, Vittel, France, May 28-June 2, 1973.) Journal de Physique*, vol. 34, Nov.-Dec. 1973, Supplement, p. C2-81 to C2-103. In French. Research supported by the Direction des Recherches et Moyens d'Essais, and Commissariat à l'Energie Atomique.

The progress of research in the field of gas lasers in the last five years is assessed, and a tentative prediction of what the evolution might be in the years to come is offered. The main objectives of work in this area are, first, obtaining the high laser energies in short time durations needed for the feasibility studies of laser induced nuclear fusion and second, investigating the physical principles that can be used to make laser sources capable of delivering high average powers. The physical phenomena that control the operation of presently existing laser devices are now sufficiently understood so that it is possible to predict that a new generation of lasers could be designed in the future, operating in the UV or possibly the X ray region of the spectrum. F.R.L.

A74-17195 # Recent developments in the field of thermionic power conversion and its possible effects on power supply systems in space and on earth (Neuere Entwicklungen auf dem Gebiet der thermionischen Energiewandlung und deren mögliche Auswirkungen auf Energieversorgungssysteme im Weltraum und auf der Erde). R. Henne (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Energiewandlung und elektrische Antriebe, Stuttgart, West Germany). *Österreichische Gesellschaft für Weltraumforschung und Flugkörpertechnik and Deutsche Gesellschaft für Luft- und Raumfahrt, Gemeinsame Jahrestagung, 6th, Innsbruck, Austria, Sept. 24-28, 1973, DGLR Paper 73-092.* 13 p. In German.

A74-17204 # Technological problems with large-area solar cell arrays (Technologische Probleme bei grossflächigen Solargeneratoren). N. Römisch (Gesellschaft für Weltraumforschung mbH, Porz-Wahn, West Germany). *Österreichische Gesellschaft für Weltraumforschung und Flugkörpertechnik and Deutsche Gesellschaft für Luft- und Raumfahrt, Gemeinsame Jahrestagung, 6th, Innsbruck, Austria, Sept. 24-28, 1973, DGLR Paper 73-107.* 26 p. 11 refs. In German.

Comparative study of two proposed solar cell array concepts with respect to their design, testing, launching, and operation. The two concepts considered are, respectively, a collapsible semirigid array and a flexible rollout array. A detailed study is made of launch vehicle constraints on weight and storage volume in the two concepts, the effects of reaction forces resulting from extension of the solar array on orbital and attitude control of the satellite are assessed, and an analysis is made of the heat-transfer and power-generating capabilities of the two concepts. A.B.K.

A74-17296 # Photosensitive elements for solar sensors (Eléments photo-sensibles pour senseurs solaires). Y. Salles (Radiotechnique-Compelec, Caen, France). *Industries Atomiques et Spatiales*, vol. 17, Sept.-Oct. 1973, p. 41-46. In French.

Spacecraft stability and attitude control is usually obtained through solar sensors with silicon transistors. Three types of solar cells are described: by focusing, by angle of attack, and digital, the latter being explained in detail. The selection of the silicon chip, the technology and the assembly of the transistors, and applications to the satellite Symphonie are discussed. N.D.

A74-17439 Characteristics of a nonequilibrium MHD generator. A. E. Buznikov, V. E. Vanin, and V. V. Kirillov (Akademiia Nauk SSSR, Nauchno-Issledovatel'skii Institut Vysokikh Temperatur, Moscow, USSR). *(Teplofizika Vysokikh Temperatur*, vol. 11, May-June 1973, p. 622-631.) *High Temperature*, vol. 11, no. 3, Jan. 1974, p. 554-561. 23 refs. Translation.

Results of experimental studies of a nonequilibrium MHD generator operating with a potassium-seeded argon plasma. Test measurements were performed at Hall numbers ranging from 1.5 to 25, electron temperatures of 1800 to 2800 K, electron-to-neutral particle temperature ratios of 1.1 to 1.8, and various values of relative wall temperature. It is shown that in addition to the influence of ionizational instability, the characteristics of a non-

equilibrium MHD generator are substantially affected by imperfections of electrical insulation in the channel and by inhomogeneities of nonequilibrium-plasma conductivity in layers near the electrodes. T.M.

A74-17654 **Present state of the art in conductive coating technology.** H. Köstlin (Deutsche Philips GmbH, Forschungslaboratorium, Aachen, West Germany) and A. Atzei (ESRO, Energy Conversion Div., Noordwijk, Netherlands). In: Photon and particle interactions with surfaces in space; Proceedings of the Sixth ESLAB Symposium, Noordwijk, Netherlands, September 26-29, 1972. Dordrecht, D. Reidel Publishing Co., 1973, p. 333-340; Discussion, p. 340, 341.

The existence of an electrically conductive coating ensures potential uniformity on the surface of a solar array. The development and preparation of this coating are described. The conductive layer consists of a very thin Sn doped In2O3 film which reduces the solar flux received at the cell's surface by only 1-2%; it does not affect the equilibrium temperature of the cells. Results of space qualification tests indicate that their properties remain unchanged under space environment condition. (Author)

A74-17813 * # **Assessment of lightweight mobile nuclear power systems.** J. L. Anderson and F. E. Rom (NASA, Lewis Research Center, Cleveland, Ohio). *American Nuclear Society, Winter Meeting, San Francisco, Calif., Nov. 11-15, 1973, Paper.* 34 p. 45 refs.

After nearly two decades of study, analysis, and experiments relating to lightweight mobile nuclear power systems (LMNPS), it seems fitting to report the status and to assess some options for the future of this technology. This report: (1) reviews the technical feasibility studies of LMNPS and airborne vehicles; (2) identifies what remains to be done to demonstrate technical feasibility of LMNPS; (3) reviews missions studies and identifies particular missions that could justify renewed support for such technology; and (4) identifies some of the nontechnical conditions that will be required for the development and eventual use of LMNPS. (Author)

A74-17905 # **The hydrogen fuel economy and aircraft propulsion.** A. L. Austin (California, University, Livermore, Calif.) and R. F. Sawyer (California, University, Berkeley, Calif.). *American Institute of Aeronautics and Astronautics and Society of Automotive Engineers, Propulsion Conference, 9th, Las Vegas, Nev., Nov. 5-7, 1973, AIAA Paper 73-1319.* 6 p. 20 refs. Members, $1.50; nonmembers, $2.00. Grant No. AF-AFOSR-72-2299.

Considerable interest has been directed toward the use of hydrogen as an ultimate replacement for fossil fuels. It is clean burning at comparable thermal efficiencies in piston and turbine engines, exists as a huge resource, and since the primary combustion product is water, the cycle from ecosphere to use and back to ecosphere is probably measured in years rather than millions of years as is the case with fossil fuels via the carbon cycle. The other fundamental advantage is that energy storage per unit weight is less than fossil fuels, and therefore hydrogen is an attractive fuel for aircraft. Large new sources of hydrogen at a low price are required before hydrogen can play an important role as an aircraft fuel. F.R.L.

A74-18180 **Aviation fuels and lubricants (Flugkraftstoffe und Flugschmierstoffe).** G. Spengler (München, Technische Universität; Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Flugtreib- und Schmierstoffe; Landesgewerbeanstalt, Bayern, Prüfamt für Brenn-, Kraft- und Schmierstoffe, Munich, West Germany), E. Jantzen, and J. Kern (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Flugtreib- und Schmierstoffe, Munich, West Germany). *VDI-Z*, vol. 115, no. 18, Dec. 1973, p. 1457-1459. 52 refs. In German.

It is pointed out that in the case of the fuel required for supersonic aircraft the lubricating properties of the fuel itself are insufficient. The needed lubricating characteristics of the fuel have, therefore, to be provided by suitable additives. Approaches for reducing the air pollution produced by aircraft are discussed together with developments regarding fuels for missiles operating at conventional and hypersonic velocities. The use of dry lubricating agents, such as molybdenum disulfide, is considered in connection with a discussion of aviation lubricants. G.R.

A74-18189 **Energy supply and energy transformers in satellites and spacecraft (Energieversorgung und Energiewandler in Satelliten und Raumfahrzeugen).** W. Peschka (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Energiewandlung und elektrische Antriebe, Stuttgart, West Germany). *VDI-Z*, vol. 115, no. 18, Dec. 1973, p. 1494, 1495. 18 refs. In German.

The energy sources considered include batteries, fuel cells, radioisotopes, and small reactors. Advances with regard to operational life are reported for sodium-sulfur and lithium batteries. Sodium batteries with water as electrolyte have also been developed. The status of solar cells is discussed together with mechanical-electrical transducers, thermoelectric transducers, and thermionic transducers. G.R.

A74-18797 * # **The jet engine design that can drastically reduce oxides of nitrogen.** A. Ferri and A. Agnone (New York University, Bronx, N.Y.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 12th, Washington, D.C., Jan. 30-Feb. 1, 1974, Paper 74-160.* 10 p. Members, $1.50; nonmembers, $2.00. Grant No. NGR-33-016-131.

The problem is analyzed for the case of hydrogen fuel, taking into account supersonic and hypersonic vehicles using scramjet engines. The combustion in scramjets occurs at very high velocity and in a short time. In scramjet combustor designs, two different criteria can be used to design the engine. The amount of NO formed in the diffusion flame depends substantially on the maximum temperature reached. Effects of changing the mode of combustion from a diffusion flame to a heat conduction flame are considered, giving attention to the amount of NO produced in an engine of a given design. G.R.

A74-18798 # **The refining of turbine fuels by modern hydrotreating.** R. L. Richardson and B. Peralta (Union Oil Company of California, Brea, Calif.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 12th, Washington, D.C., Jan. 30-Feb. 1, 1974, Paper 74-162.* 5 p. Members, $1.50; nonmembers, $2.00.

This paper reviews the present status of technology for removing sulfur compounds and hydrogenating aromatics in jet fuels, often designated as turbine fuels. The newer technique of catalytic hydrotreating will be emphasized because of its effectiveness in removing sulfur as well as nitrogen compounds, its flexibility in refinery applications, and its ability to upgrade other fuel characteristics, such as smoke point, aromatics content and thermal stability. (Author)

A74-18925 **Supersonic fuels from medium oils produced by the thermal cracking of crude oil residues (Überschallkraftstoffe aus Mittelölen der thermischen Krackung von Rohölrückständen).** R. Erlmeier (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Flugtreib- und Schmierstoffe, Munich, West Germany) and E. Meisenburg (Union Rheinische Braunkohlen Kraftstoff AG, Wesseling, West Germany). *Erdöl und Kohle Erdgas Petrochemie vereinigt mit Brennstoff-Chemie*, vol. 26, June 1973, p. 334-338. 10 refs. In German. (DFVLR-SONDDR-301)

The processing steps involved in obtaining the fuels are discussed, taking into account distillation, hydrogenation, and refining procedures. Attention is given to the effect of n-paraffins

and aromatic compounds on the fuel characteristics. The composition of the fuels was determined by analytical procedures which included thermodiffusion and NMR measurements. The properties of the fuels are compared with the requirements for fuels on a hydrocarbon basis which are to be used for velocities at Mach number 3. The investigation shows that the considered approach can provide suitable fuels for supersonic flight applications. G.R.

A74-18988 On the theory of alternating-current electrofluiddynamic converters. V. A. Kas'ianov and A. A. Mkhitarian (Kievskii Institut Inzhenerov Grazhdanskoi Aviatsii, Kiev, Ukrainian SSR). *(Gidromekhanika,* vol. 21, 1972, p. 65-69.) *Fluid Mechanics - Soviet Research,* vol. 2, Nov.-Dec. 1973, p. 157-162. Translation.

Linearized systems are considered. The solutions which are obtained are of interest from the point of view of qualitative analysis of the electrofluiddynamic (EFD) method of boundary layer control, when variable control voltage is used. The medium is assumed to be an incompressible colloid. The conversion section is a broad channel in which one-dimensional unsteady flow is produced between permeable flat electrodes. The solutions obtained are the first approximation for more complex problems in the field of EFD ac converters. F.R.L.

A74-19724 Gas-heated 'heat pipe' vacuum furnace (Gasbeheizter 'Wärmeröhren'-Vakuumofen). M. Stadelmann (Fotos Hutchins Photography, Inc., Belmont, Mass.). *Schweizerische Technische Zeitschrift,* vol. 71, Jan. 17, 1974, p. 40-43. 5 refs. In German.

The heat pipe is a very efficient device for the transportation of heat at high temperatures on a thermoionic basis. One of the applications of the heat pipe is connected with the development of a vacuum furnace which utilizes natural gas for heating. In the new device the heat pipe is used for the transfer of heat from a high-temperature burner to a vacuum chamber. The vacuum furnace provides temperatures up to 1037.5 C at a vacuum of 5 microtorr. G.R.

STAR ENTRIES

N74-10043*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REFAN PROGRAM. PHASE 1: SUMMARY REPORT
Eldon W. Sams and Donald L. Bresnahan Oct. 1973 70 p refs
(NASA-TM-X-71456; E-7749)

The Refan Program is aimed at a large reduction in aircraft approach and takeoff noise in the vicinity of airports caused by the JT3D-powered 707's and DC-8's and the JT8D-powered 727's, 737's and DC-9's. These aircraft represent a major part of the existing commercial fleet. The noise reductions can be achieved by engine and nacelle modifications in the form of aircraft retrofit kits. Engine turbomachinery noise is reduced by replacing the current two-stage fan with a larger single-stage fan and by nacelle acoustic treatment. Jet noise is reduced by the reduction on jet velocity caused by additional turbine work extraction to drive the larger bypass fan. The predicted net effect of these modifications on installed performance is large noise reductions on both approach and takeoff, increased takeoff thrust, decreased takeoff field length, and maintained or improved aircraft range depending on the amount of acoustic treatment included. The Refan Program is being conducted in two phases under contracts with one engine and two airframe companies. Results of the Phase I work are summarized in this report which describes the refan nacelle configurations studied, the airplane modifications required to install the nacelles, and the resulting airplane performance and noise reductions predicted for all five aircraft.
Author

N74-10074 Michigan Univ., Ann Arbor.
EXPERIMENTAL DETERMINATION OF DYNAMIC CHARACTERISTICS OF HYDROGEN OXYGEN FUEL CELL SYSTEMS Ph.D. Thesis
Bernard Ren Hao 1972 129 p

Dynamic characteristics of aqueous electrolyte hydrogen-oxygen fuel cells were investigated at various cell temperatures, electrolyte concentrations, electrode spacings, and types of electrodes. An electrical circuit was employed as a mathematical model in correlating the dynamic response of the test cell to the related system parameters. A RC electrical circuit which included an ideal voltage source was proposed as the mathematical model for the fuel cell systems, and the circuit components were determined experimentally. The ideal voltage source in the equivalent network was determined by the open circuit voltage of the test fuel cell. The internal resistance of the test cell was determined by a galvanostatic method. The measured fuel cell internal resistance was found to be independent of the fuel cell load current and frequency.
Dissert. Abstr.

N74-10075*# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
MASS TRANSFER IN FUEL CELLS Semiannual Report, 1 Sep. 1972 - 28 Feb. 1973
Robert D. Walker, Jr. 26 Sep. 1973 50 p refs
(Grant NGR-10-005-022)
(NASA-CR-134519; SAR-15)
10A

Results of experiments on electron microscopy of fuel cell components, thermal decomposition of Teflon by thermogravimetry, surface area and pore size distribution measurements, water transport in fuel cells, and surface tension of KOH solutions are described.
Author

N74-10078*# Gould, Inc., Mendota Heights, Minn.
FABRICATION AND TESTING OF NEGATIVE-LIMITED SEALED NICKEL-CADMIUM CELLS Quarterly Report, 1 Jul. - 30 Sep. 1973
E. Luksha and K. C. Kohl 10 Oct. 1973 15 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953680)
(NASA-CR-135981; Rept-732-015-1)

The design, construction, and testing of 100,20Ah and 100,3Ah negative-limited sealed cells are reported. The required physical dimensions of the hardware and components necessary to produce 20 and 3 Ah cells were established. The stainless steel cans and covers have been ordered. The covers contain two ceramic seals. The fabrication of electrodes was started. About 55% (879 electrodes) of the required cadmium electrodes has been prepared. About 44% of the porous nickel substrates (plaques) required for the preparation of the nickel oxide electrodes has been completed.
Author

N74-10080# Army Foreign Science and Technology Center, Charlottesville, Va.
STATE OF DEVELOPMENTS AND RESEARCH PROBLEM ON THE SWITCHING OF SILICON GERMANIUM ALLOY THERMOELECTRIC ELEMENTS
L. L. Silin 30 Jul. 1973 15 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (Moscow), no. 2, 1971 p 116-125
(AD-765845; FSTC-HT-23-2026-72) Avail: NTIS CSCL 10/2

The article reviews the development of thermoelectric generators made with silicon germanium alloy thermoelements.
GRA

N74-10082# Rocketdyne, Canoga Park, Calif.
INVESTIGATION OF CHEMICAL APU APPLICATION FOR SMALL GROUND POWER SOURCES
James N. Ellis and Hartley E. Barber Jun. 1973 95 p refs
(Contract DAAK02-72-C-0424)
(AD-765724; R-9284) Avail: NTIS CSCL 10/2

The Chemical APU (CAPU) turboalternator assembly was tested to determine its suitability for application to advanced Army Ground Power Systems. A major test objective was that of determining the allowable continuous power rating for the alternator as a function of rotative speed. Test speeds up to 120,000 rpm in 30,000 rpm increments were evaluated. A nitrogen test rig was used as a drive which invalidated turbine data. The tests show the alternator to be suitable for use in an advanced ground unit operating on a Brayton cycle to produce 3.5 kw at 140,000 rpm. The turbine should be redesigned for gas turbine flow conditions. A Rankine cycle system could use the turboalternator in its present design at a reduced speed (80,000 rpm) to produce 3.2 kw continuous power.
Author (GRA)

N74-10083# Pratt and Whitney Aircraft, South Windsor, Conn. Engineering Facility.
STUDY OF FUEL CELL SYSTEM FOR POWERED BALLOON Final Report, 5 Feb. - 4 Jun. 1973
Lawrence M. Handley Sep. 1973 54 p
(Contract F19628-73-C-0139; AF Proj. 6665)
(AD-766253; PWA-4792; AFCRL-TR-73-0447) Avail: NTIS CSCL 10/2

A four-month study was conducted to determine the most economical use of these powerplants for a powered balloon system designated POBAL-S. The fuel cell powerplant selected for this application is an existing model, the PC17A-3, tailored to deliver 2.5 kilowatts at 30 volts d.c. continuously for seven days. In

addition to the powerplant itself, the system would contain cryogenic tanks for the 39 pounds of hydrogen and 306 pounds of oxygen used by the fuel cell, a fabric bag for storing the 42 gallons of product water (to maintain constant buoyancy), and a 48-inch-wide-by-88-inch-long aluminum radiator to reject waste heat at 4000 Btu per hour. When loaded with reactants, the power system weighs 707 pounds, equivalent to an energy density of 600 watt-hours per pound. The power system would be mounted on a platform with the payload and the balloon housekeeping equipment to facilitate recovery by parachute. The platform protects everything except the radiator against landing shock, enabling the equipment to be reused for as many as 25 missions. Ground equipment for servicing the reactant tanks is available commercially. (Modified author abstract) GRA

N74-10084# Army Foreign Science and Technology Center, Charlottesville, Va.
POSSIBILITY OF COMMUTATING THERMOELECTRIC BATTERIES WITH THE AID OF MERCURY AMALGAM
Yu. N. Malevskii 9 Dec. 1972 7 p refs Transl. into ENGLISH from Geliotekhnika, Akad. Nauk Uz. SSR (Jashkent), no. 2, 1971 p 22-25
(AD-756068; FSTC-HT-23-1275-72) Avail: NTIS - CSCL 10/2

One of the serious difficulties in the technology of preparation of thermoelectric energy converters is the commutation of thermoelement's branches which would secure a sufficient mechanical strength and low ohmic resistance contacts between current conducting bars and semiconductor materials of the thermoelement. Elimination of the commutation contact resistances is one of the most important problems in the design of thermoelements. Author (GRA)

N74-10085# Energy Research Corp., Bethel, Conn.
ELECTROLYTE FOR HYDROCARBON AIR FUEL CELLS Semiannual Technical Report, 7 Nov. 1972 - 7 Apr. 1973
Ralph N. Camp and Bernard S. Baker Jul. 1973 34 p refs (Contract DAAK02-73-C-0084; DA Proj. 1T0-61102-A-34A) (AD-766313; ERC-00845) Avail: NTIS CSCL 10/2

Several acids were tested for use with direct hydrocarbon fuel cell electrolytes. Complete fuel cells of the matrix and free electrolyte type were used as test vehicles. The performance of cells possessing H3PO4 electrolyte served as a baseline. Only one, tetrafluoroethanedisulfonic acid synthesized at Energy Research Corporation was shown to be superior to phosphoric acid for direct propane oxidation of elevated temperature. Author (GRA)

N74-10086# Energy Research Corp., Bethel, Conn.
MATRICES FOR H3PO4 FUEL CELLS Final Report
Ralph N. Camp and Bernard S. Baker Aug. 1973 49 p refs (Contract DAAK02-72-C-0247; DA Proj. 1T6-62705-A-012) (AD-766312; ERC-0959F) Avail: NTIS CSCL 10/2

Matrices to contain 150C phosphoric acid were perfected. These matrices contain an organic fibre, Kynol, and a thermosetting binder of similar chemical structure, Resinox. In addition Ta2O5 is added to improve the wetting characteristics. The matrices can be produced in uniform, large sheets. Anodes for the oxidation of hydrogen contaminated with carbon monoxide in H3PO4 were also explored. Using supported catalyst techniques, CO tolerant anodes contain .8 mg/sq cm of a mixture of platinum and ruthenium performed at better than .6V at 100mA/sq cm current density for a period in excess of 500 hours. Author (GRA)

N74-10128# Army Foreign Science and Technology Center, Charlottesville, Va.
COMMERICAL PETROLEUM PRODUCTS, PROPERTIES AND APPLICATIONS
N. G. Puchkov 21 Dec. 1972 685 p Transl. into ENGLISH of the publ. "Tovarnye Nefteprodukty, Ih Sovistva i Primenenie" Moscow, Khim., 1971
(AD-754703; FSTC-HT-23-1838-72) Avail: NTIS CSCL 07/1

Replacing an earlier reference work, Tekhnicheskiye Normy na Nefteprodukty (Technical Standards for Petroleum Products), the handbook updates this field by inclusion of additional products and discussion of properties and applications. Covered are fuels, oils, lubricants, and other commercial petroleum products produced by Soviet oil refining enterprises. Standards, technical conditions, component composition, main operating qualities, and uses of these products are discussed. Author (GRA)

N74-10129# Bureau of Mines, Washington, D.C.
THE ASSOCIATION OF AUTOMOTIVE FUEL COMPOSITION WITH EXHAUST REACTIVITY
Basil Dimitriades, B. H. Eccleston, G. P. Sturm, Jr., and C. J. Raible Jul. 1973 57 p refs Prepared for Environ. Protection Agency Research Triangle Park, N. C.
(PB-222609/0; BM-RI-7756) Avail: NTIS HC $3.50 CSCL 07E

The association of automotive fuel composition with exhaust reactivity was studied in an experimental program that involved testing with different automotive engines and with gasolines of varied composition. Results showed clearly the exhaust reactivity to increase with increasing levels of polyalkylbenzenes in the fuel. For the purposes of the study, had it been possible, fuel composition should have been defined and expressed in terms of component groups such that the potential for exhaust reactivity would be the same within each group and different from group to group. Statistical analysis of the mass emissions data showed significant car and fuel effects on hydrocarbon, carbon monoxide, nitric oxide, total aldehydes, and formaldehyde emission levels and on total photochemical reactivity. Correlations were found between mass emission parameters and fuel composition. (Modified author abstract) GRA

N74-10199# National Research Council of Canada, Ottawa (Ontario).
INVESTIGATION OF SILICON PHOTOELECTRIC CELLS AS PRECISION PHOTODETECTORS
N. Muroi and M. Ishino 1973 24 p refs Transl. into ENGLISH from Shomei Gakkai Zasshi (Japan), v. 52, no. 4, 1968 p 20-26
(NRC-TT-1686) Avail: NTIS HC $3.25

The use of silicon photoelectric cells as photodetectors is evaluated. It is found that silicon photoelectric cells offer good, stable photodetectors, but in view of the energy gap there are still more effective photoreceptors than silicon photoelectric cells. For example, there are monocrystal photoelectric cells and multilayer photoelectric cells of the monocrystals GaAs, InP, CdTe and CdSe. Author

N74-10240* Lockheed Missiles and Space Co., Sunnyvale, Calif.
TESTING FOR THERMAL FATIGUE FAILURES IN SOLAR ARRAYS
G. J. Antonides *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 99-104

CSCL 10A

A temperature cycling test facility has been designed and constructed for the study of thermal stress and fatigue in solar arrays. Two bell jar type thermal vacuum chambers and their associated equipment and instrumentation provide close simulation of the space environment, automatic temperature cycling and data acquisition, and economical operation. Author

N74-10391# Ecole Polytechnique Federale de Lausanne (Switzerland). Centre de Recherches en Physique des Plasmas.
ENERGY: COMPILED BIBLIOGRAPHY AND TABLES OF WORLD RESOURCES, CONSUMPTION, AND WASTES [ENERGIE: COMPILATION BIBLIOGRAPHIQUE ET TABULATION DES RESSOURCES, DE LA CONSOMMATION ET DES DECHETS DANS LE MONDE]
M. Roux Jul. 1973 66 p refs In FRENCH; ENGLISH summary Sponsored by Fonds Natl. Suisse de la Rech. Sci.
(LRP-63/73) Avail: NTIS HC $5.50

The available resources of fossil and nuclear fuels, as well as those of solar energy, hydroelectric power and others, are reviewed and compared to global consumption of energy. The

per capita and global consumption, together with its growth rate, are presented with respect to primary energy sources and/or main sectors of use. Attention is focused on the energy required by electrical power generation, and estimates up to 2000 are given. Chemical and radioactive nuclear wastes resulting from either energy consumption or electrical power generation are tabulated and scaled to the energy consumption. Wastes from the nuclear economy are estimated up to 2000. The relative biological hazards pertaining to radioactive inventories and fission reactor wastes are compared to those of a reference reactor.
ESRO

N74-10547*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROPERTIES OF SOLID POLYMER ELECTROLYTE FLUOROCARBON FILM
William B. Alston Washington Nov. 1973 22 p ref
(NASA-TN-D-7482; E-7536) Avail: NTIS HC $2.75 CSCL 11D

The ionic fluorocarbon film used as the solid polymer electrolyte in hydrogen/oxygen fuel cells was found to exhibit delamination failures. Polarized light microscopy of as-received film showed a lined region at the center of the film thickness. It is shown that these lines were not caused by incomplete saponification but probably resulted from the film extrusion process. The film lines could be removed by an annealing process. Chemical, physical, and tensile tests showed that annealing improved or sustained the water contents, spectral properties, thermo-oxidative stability, and tensile properties of the film. The resistivity of the film was significantly decreased by the annealing process.
Author

N74-10681# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MAGNETOHYDRODYNAMIC METHOD OF OBTAINING ELECTRICAL ENERGY (COLLECTED ARTICLES)
V. A. Kirillina and A. E. Sheidlina 27 Apr. 1973 345 p refs Transl. into ENGLISH from the publ. "Magnitogidro Dinamicheskii Metod Polucheniya Elektroenergii" Moscow, Energiya, 1968 273 p
(AF Proj. 3144)
(AD-765933; FTD-MT-24-1737-72) Avail: NTIS CSCL 20/9

The report is a Russian translation which discusses various techniques in magnetohydrodynamics for energy conversion.
GRA

N74-10715# Bureau of Mines, Bartlesville, Okla.
NATURAL GAS AS AN AUTOMOTIVE FUEL, AN EXPERIMENTAL STUDY
R. D. Fleming and J. R. Allsup 1973 29 p refs
(BM-RI-7806) Avail: NTIS HC $3.50

A study was conducted to evaluate natural gas as an automotive fuel and to provide guidelines for optimum engine adjustments for low exhaust emissions. The study was conducted using a single-cylinder engine, a multicylinder engine, and a total of eight vehicles. Results from single-cylinder engine tests showed that the light-load, lean-limit misfire region for natural gas begins at an air-fuel ratio between 150 and 160 pct of stoichiometric. Changes in ignition timing significantly influenced emissions of nitrogen oxides and hydrocarbons, but had little effect on carbon monoxide emission. Low emissions can be achieved with current-design engines by adjustment of engine parameters, but only with heavy penalty to engine performance. Emissions from vehicles fueled with natural gas are virtually unaffected by ambient temperature change within the range 20 to 100 F.
Author

N74-10747# Chandler Evans, Inc., West Hartford, Conn.
VAPOR GENERATOR FEED PUMP FOR RANKINE CYCLE AUTOMOTIVE PROPULSION SYSTEM (CHANDLER EVANS)
R. M. Riordan Dec. 1972 213 p
(Contract EPA-68-01-0430)
(PB-222849/2; R-679-5; APTD-1357) Avail: NTIS HC $5.50 CSCL 21G

A project was undertaken to conduct comprehensive design studies pursuant to the selection of conceptual models of vapor generator feed pumps that will satisfy the performance requirement of each of three Rankine cycle automotive power systems currently under development to reduce air pollution. In pursuing the objective of providing variable output pumps for these applications, investigations were conducted of two selected courses: (1) fixed displacement pumps with variable speed drives, and (2) variable displacement pumps. The report presents a detailed summary of the project, describes the technical results, and gives conclusions.
Author (GRA)

N74-10751# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AVIATION GAS TURBINE ENGINES (SELECTED PORTIONS)
G. S. Zhiritskii, V. I. Lokay, M. K. Maksutova, and V. A. Strunkin Nov. 1972 632 p refs Transl. into ENGLISH from the publ. "Gazovyye Turbiny Dvigateley Letatelnykh Apparatov" Moscow, Mashinostr., 1971 448 p
(AD-756810; FTD-MT-24-287-72) Avail: NTIS CSCL 21/5

The book will acquaint the reader with the working processes in gas turbines, methods of thermodynamic and gas dynamic calculation of turbines in nominal and variable modes, the system for cooling the hot portions of the turbine and its calculation, various structures, and strength calculations for the principal parts of the turbine. In addition the book gives a brief survey of designs of gas turbines. This book is a textbook for students at Aviation Technical Institutions of Higher Learning. It may also be useful to gas-turbine designers.
Author (GRA)

N74-10754*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLAR ENERGY TO MEET THE NATION'S ENERGY NEEDS
Frank E. Rom and Ronald L. Thomas 1973 26 p refs Presented at Energy Facts for Concerned Citizens: A Natl. Forum, Boise, Idaho, 26-27 Apr. 1973
(NASA-TM-X-68290; E-7625) Avail: NTIS HC $3.50 CSCL 10A

Solar energy, being a non-depleting clean source of energy, is shown to be capable of providing energy in all the forms in which it is used today. It can be used to generate electricity, for heating and cooling buildings, and for producing clean renewable gaseous, liquid and solid fuel. There is little question of the technical feasibility for utilizing solar energy. The chief problem is rapidly providing innovative solutions that are economically competititive with other systems.
Author

N74-10874# Army Foreign Science and Technology Center, Charlottesville, Va.
CATALYTIC COMBUSTION OF CARBON MONOXIDE IN GASOLINE ENGINE EXHAUST USING MANGANESE CATALYSTS
V. T. Chagunava 7 Mar. 1973 58 p Transl. into ENGLISH of the mono. "Margantsevye Katalizatory Dlya Nekotoryh Reaktsii" USSR, 1969 p 128-174
(FSTC Proj. t7023012301)
(AD-760395; FSTC-HT-23-1248-72) Avail: NTIS CSCL 07/4

In the last 15 to 20 years, complex research work in the lowering of the toxicity of exhaust gases of the internal combustion engine has been done. Out of the various proposed methods, the broadest dissemination was achieved by the method of the catalytic afterburning of the products of incomplete fuel combustion in neutralizers. In the existing catalytic neutralizers that have been constructed abroad as well as in the Soviet Union, platinum either on various carriers or in alloys with other components was used as the catalyzer. Manganese catalyzers for the afterburning of the carbon monoxide in exhaust gases are being investigated in the Academy of Sciences of the Georgian Soviet Socialist Republic. Preliminary results of these investigations are given.
GRA

N74-10892# Committee on Science and Astronautics (U. S. House).
ENERGY RESEARCH AND DEVELOPMENT AND SPACE TECHNOLOGY
Washington GPO 1973 574 p refs Hearings before Subcomm. on Space Sci. and Appl. and Subcomm. on Energy, 93d Congr., 1st Sess., No. 9, 7, 22, and 24 May 1973
Avail: Comm. on Sci. and Astronaut.

A Congressional hearing on energy research and development was conducted. The circumstances leading to the present energy crisis are discussed. The various methods for obtaining energy from solar, geothermal, wind, and tidal sources are defined. The projects which are expected to produce new methods for obtaining energy are analyzed. Author

N74-10896# Committee on Science and Astronautics (U. S. House).
SOLAR ENERGY FOR THE TERRESTRIAL GENERATION OF ELECTRICITY
Washington GPO 1973 51 p Hearing before Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., No. 12, 5 Jun. 1973
Avail: Subcomm. on Energy

The hearings are presented concerning the concept of terrestrial power stations that convert solar energy into electricity. Solar power farms are discussed, and a solar collector system is described. F.O.S.

N74-10898# Army Foreign Science and Technology Center, Charlottesville, Va.
SIGNIFICANT RESEARCH RESULTS FOR 1971, HIGH TEMPERATURE INSTITUTE, USSR ACADEMY OF SCIENCES
25 Jun. 1973 103 p refs Transl. into ENGLISH of the publ. "Vazhneishie Rezultaty Nauchno-Vysokikh Temperatur, Akademii Nauk SSSR" Moscow, Nauka, 1972
(AD-765753; FSTC-HT 23-1016-73) Avail: NTIS CSCL 07/4

The Institute's work continued in 4 basic directions in 1971: (a) study of thermophysical and electrophysical properties of substances at high temperatures; (b) study of high-temperature heat and mass transfer and gas dynamics processes; (c) development and study of new heat-resistant structural materials; and (d) research toward development of direct conversion of heat into electricity using MHD generators and other new types of energy units. Properties of plasmas, especially of cesium plasmas, at high temperatures (p + or - 500 atm, t + or - 5000K and higher) were studied. Measurements made by the electrical explosion method were made on Fe, Ni, W, Mo and various transition group metals (entropy, enthalpy, heats of fusion, for example). Experimental and theoretical determination of phase diagrams, of e.g. Li-LiH-H2 systems, were prepared, especially at high temperatures and low pressures. Heat and mass transfer and gas dynamics properties of high-temperature heat transfer agents was emphasized. ZrO2-Y2O3-CeO2 based electrodes, as well as LaCrO2-Cr, cermetselectrodes, and high-alumina MgO base cements for insulating materials were studied for MHD applications. The U-25 MHD (magnetohydrodynamics) unit was started up and successfully run in 1971. Power of 75 kW was achieved in MHD generator tests. Various MHD channel configurations were tested extensively. Theoretical studies on the most efficient uses of MHD generators in an electrical power network were made, especially as to their use to carry peak loads on a system. GRA

N74-10944*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE USE OF FEP TEFLON IN SOLAR CELL COVER TECHNOLOGY
Jacob D. Broder and George A. Mazaris 1973 4 p refs Presented at the 10th Photovoltaic Specialists Conf., Palo Alto, Calif., 13-15 Nov. 1973
(NASA-TM-X-71485; E-7813) Avail: NTIS HC $3.00 CSCL 10B

FEP plastic film was used as a cover and as an adhesive to bond cover glasses to silicon solar cells. Various anti-reflective coatings were applied to cells and subsequently covered with FEP. Short circuit currents were measured before and after application of the coating and of the FEP. FEP was bonded to seven of the nine differently coated cells, with no change in the total short circuit current in four cases. Author

N74-10946*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRIC VEHICLE BATTERY RESEARCH AND DEVELOPMENT
Harvey J. Schwartz 1973 18 p refs Presented at the Electrochem. Soc. Meeting, Boston, 7-11 Oct. 1973
(NASA-TM-X-71471; E-7772) Avail: NTIS HC $3.00 CSCL 10C

High energy battery technology for electric vehicles is reviewed. The state-of-the-art in conventional batteries, metal-gas batteries, alkali-metal high temperature batteries, and organic electrolyte batteries is reported. G.G.

N74-10947*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE MULTIPLE JUNCTION EDGE ILLUMINATED SOLAR CELL
B. I. Sater, H. W. Brandhorst, Jr., T. J. Riley, and R. E. Hart, Jr. 1973 8 p refs Presented at 10th Photovoltaic Specialists Conf., Palo Alto, Calif., 13-15 Nov. 1973; Sponsored by IEEE
(NASA-TM-X-71476; E-7795) Avail: NTIS HC $3.00 CSCL 10B

The multiple junction edge illuminated solar cell was devised for high voltage low current applications. Devices to be flight tested in early 1974 with 96 series connected PNN+ junctions in a 2 cm X 2.3 cm size deliver 36 volts at 1 milliampere. Test data of M-J cells fabricated with resistivities of 10, 50, 100, 200, 450, and 1000 ohm cm silicon are presented and problem areas are discussed. An additional potential application of the M-J cell lies in ultilization of its high intensity performance that has been demonstrated at levels in excess of 100 AMO suns. Author

N74-10948*# Linguistic Systems, Inc., Cambridge, Mass.
INFLUENCE OF WIND FREQUENCY ON ROTATIONAL SPEED ADJUSTMENTS OF WINDMILL GENERATORS
Ulrich Hutter Washington NASA Nov. 1973 17 p Transl. into ENGLISH from Z. Elektrotech. (Stuttgart), v. 1, no. 6, 1948 p 117-122
(Contract NASw-2482)
(NASA-TT-F-15184) Avail: NTIS HC $3.00 CSCL 10A

In installing groups of windmill generators to produce electric power from the force of the wind, it is important to locate the units of such a network in such fashion that the so-called two-minute variation of the wind velocity can be overcome. This is done by using at least three windmill generators located an appropriate distance apart. When the wind velocity is insufficiently great to drive the blades of the windmills, a source of power should be available (battery, power from other windmills) to keep the blades turning. Contrary to popular misconception, changing the angle of attack of the windmill blades does not improve the efficiency of their operation or increase the power of the windmill. Author

N74-10949# General Electric Co., Philadelphia, Pa. Space Div.
CLOSED CYCLE MHD FOR CENTRAL STATION POWER WITH FOSSIL OR NUCLEAR FUELS
Bert Zauderer, Charles H. Marston, and Charles S. Cook Aug. 1973 48 p refs
(Contract N00014-73-C-0039; AF Proj. 9800)
(AD-766500; Rept-73SD231; ONR-TR-20) Avail: NTIS CSCL 10/2

A closed cycle MHD generator using a noble gas with alkali metal vapor as the working fluid, when used as a topping unit for a conventional steam plant, can yield cycle efficiencies in excess of 60% at peak stagnation temperature of 3000F. While

high enough for substantial gains in thermodynamic efficiency, this temperature is relatively low for an electrically conducting gas and conductivity is achieved by decoupling electron temperature from gas temperature. A ceramic regenerative heat exchanger supplies thermal energy to the working fluid. The latter can be any clean fossil fuel, preferably low BTU (about 150 BTU/SCF) coal gas. With multi-stage combustion, pulverized coal is also a possible fuel. On a long range basis, closed cycle MHD is ideally suited for high temperature gas cooled fission reactors and probably also to fusion reactors. The closed cycle MHD generator is adaptable to the Brayton cycle, the regenerative Brayton cycle and eventually the Rankine cycle. Author (GRA)

N74-10950# General Electric Co., Philadelphia, Pa. Missile and Space Div.
INVESTIGATION OF A NON-EQUILIBRIUM MHD GENERATOR Annual Report, 1 Aug. 1972 - 31 Jul. 1973
Bert Zauderer Aug. 1973 34 p refs
(Contract N00014-73-C-0039; NR Proj. 9800)
(AD-766493) Avail: NTIS CSCL 10/2

The report presents research results on the following: The ST-40 MHD channel; The 4 Tesla Magnet for the ST-40 MHD channel; MHD generator theoretical analyses; Gas dynamic performance, ST-40 channel; MHD generator performance, ST-40 channel; Electrode conduction studies. GRA

N74-10951# American Univ., Washington, D.C.
RESEARCH ON ELECTROCHEMICAL ENERGY CONVERSION SYSTEMS Interim Technical Report, Oct. 1972 - Apr. 1973
Alayne A. Adams, Robert T. Foley, and Richard M. Goodman Jun. 1973 59 p refs
(Contract DAAK02-72-C-0084; DA Proj. 1T0-61102-A-34A)
(AD-766329; ITR-3) Avail: NTIS CSCL 10/2

The research on electrochemical energy conversion systems has involved work on two tasks: a search for electrolytes alternative to phosphoric acid for direct and indirect hydrocarbon-air fuel cells, and a study of the corrosion characteristics of electrolytes for intermediate-temperature hydrocarbon-air fuel cells. The work during this reporting period was concentrated on the first task. Two alternative electrolytes, trifluoromethanesulfonic acid monohydrate and dichloroacetic acid, representative of two classes of compounds, were studied in some depth. The first compound shows definite promise as an alternative electrolyte. It is physically and electrochemically stable up to 135C for periods of time up to six weeks. The limiting current density for the oxidation of propane at 135C is approximately 15 times that observed in H_3PO_4 at the same temperature. Certain problems associated with the use of dichloroacetic acid were encountered. These were interpreted in terms of the state of the unbound water in the electrolyte. Author (GRA)

N74-10952# Argonne National Lab., Ill.
EXPERIMENTAL TWO-PHASE LIQUID-METAL MAGNETOHYDRODYNAMIC GENERATOR PROGRAM Annual Report, 1 May 1972 - 1 May 1973
W. E. Amend, R. Cole, J. C. Cutting, and L. C. Pittenger Jun. 1973 79 p refs
(Contracts NAonr-19-72; NAonr-16-73; RF0180206; RR0240302)
(AD-766588; ANL-ENG-73-02) Avail: NTIS CSCL 10/2

Extensive data on the contoured generator has been taken which corroborates the very preliminary data reported previously. Detailed experimental parametric studies were completed which mapped generator performance as a function of mixture quality, magnetic field, and generator loading. Turbine efficiencies of 50% have been achieved for the first-generation contoured generator. The experimental data, coupled with theoretical analyses and modeling, however, has shown conclusively that an electrical shunt exists within the generator. Extensive data has also been taken on the generator with constant cross-sectional inserts; similar results were obtained. Several possible causes for the electrical shunt were identified. In order to identify and isolate the principal electrical shunt, the following steps were taken: The generator was redesigned and rebuilt to completely eliminate leakage and thus the shunt behind the insulator wall; a gas-cleaning system and a micropore NaK filter was installed to minimize the amount of gas impurities that could enter the test facility and remove any oxides as soon as they are formed. These steps were successfully carried out and a new series of performance runs are planned. As the testing proceeds, we will be able to separate the effects of the mechanical and fluid boundary-layer-type shunts. Control of the boundary-layer shunt will be accomplished with a gas injection system. (Modified author abstract) GRA

N74-11148*# Texas Instruments, Inc., Dallas. Services Group.
ERTS-1 IMAGERY USE IN RECONNAISSANCE PROSPECTING: EVALUATION OF THE COMMERCIAL UTILITY OF ERTS-1 IMAGERY IN STRUCTURAL RECONNAISSANCE FOR MINERALS AND PETROLEUM Interim Report, 1 Mar. - 31 Aug. 1973
D. F. Saunders, Principal Investigator, G. Thomas, and F. E. Kinsman Sep. 1973 37 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21796)
(E74-10007; NASA-CR-135848; U1-702700-2) Avail: NTIS HC $4.00 CSCL 08G

The author has identified the following significant results. Five areas of North America (North Slope, Alaska; Superior Province, Canada; Williston Basin, Montana; Colorado; and New Mexico-West Texas) are being studied for discernibility of geological evidence on ERTS-1 imagery. Evidence mapped is compared with known mineral/hydrocarbon accumulations to determine the value of the imagery in commercial exploration programs. The conclusion is that there is a great advantage in photogeologic interpretation from the satellite viewpoint to provide a truly synoptic examination of regional geologic features. In addition to detecting lineaments which may be continental in scale, many large circular or curvilinear tonal or dissection patterns not generally detected on conventional aerial photos have been discovered. Preliminary analysis of these lineaments and curvilinear anomalies has established close empirical relationships between these features and both mineral deposits and the structure of sedimentary basins. Details are presented of the Colorado region interpretation.

N74-11159*# State of Ohio Dept. of Development, Columbus.
RELEVANCE OF ERTS TO THE STATE OF OHIO Progress Report, Sep. - Oct. 1973
David C. Sweet, Principal Investigator Oct. 1973 8 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21782)
(E74-10024; NASA-CR-135865) Avail: NTIS HC $3.00 CSCL 08B

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

N74-11182*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
INTERDISCIPLINARY APPLICATIONS AND INTERPRETATIONS OF ERTS DATA WITHIN THE SUSQUEHANNA RIVER BASIN (RESOURCE INVENTORY, LAND USE, AND POLLUTION) Annual Report, 1 Jun. 1972 - 30 May 1973
George J. McMurtry and Gary W. Petersen, Principal Investigators Oct. 1973 260 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-23133)
(E74-10061; NASA-CR-135961 ; ORSER-SSEL-TR-9-73) Avail: NTIS HC $15.00 CSCL 08H

The author has identified the following significant results. An interdisciplinary group at Penn State University is analyzing ERTS-1 data. The geographical area of interest is that of the Susquehanna River Basin in Pennsylvania. The objectives of the work have been to ascertain the usefulness of ERTS-1 data in

the areas of natural resources and land use inventory, geology and hydrology, and environmental quality. Specific results include a study of land use in the Harrisburg area, discrimination between types of forest resources and vegetation, detection of previously unknown geologic faults and correlation of these with known mineral deposits and ground water, mapping of mine spoils in the anthracite region of eastern Pennsylvania, and mapping of strip mines and acid mine drainage in central Pennsylvania. Both photointerpretive techniques and automatic computer processing methods have been developed and used, separately and in a combined approach.

N74-11188*# Geological Survey, Washington, D.C.
SATELLITE GEOLOGICAL AND GEOPHYSICAL REMOTE SENSING OF ICELAND Progress Report, 15 Jan. - 31 Aug. 1973
Richard S. Williams, Jr., Principal Investigator 1 Sep. 1973 28 p refs ERTS
(NASA Order S-70243-AG)
(E74-10073; NASA-CR-135816) Avail: NTIS HC $3.50 CSCL 08G

The author has identified the following significant results. Under a binational, multidisciplinary experiment ERTS-1 imagery is being used to measure and map dynamic natural phenomena in Iceland. A few of the initial results from the project are: (1) a large variety of geological and volcanic features can be studied, particularly on imagery acquired at low sun angle (< 10 deg), which have not been previously recognized; (2) under optimum snow cover conditions, geothermal areas can be discerned by their snowmelt pattern or by warm spring discharge into frozen lakes; (3) a variety of map types at scale of 1:1,000,000 and 1:500,000, can be compiled, made more accurate, or updated (changes in coastline, glaciers, lakes, etc.); (4) the persistence of snow in the highland areas, during the summer months, has important ramifications to rangeland management; (5) false color composites (MSS) permitted the mapping of four types of vegetation; forested, reclaimed, cultivated areas and grasslands, and the mapping of the seasonal change of the vegetation, all of high value to rangeland management when complete, repetitive coverage of Iceland becomes a reality with an operational satellite; and (6) the volcanic eruption on Heimaey was recorded.

N74-11195*# Indiana Geological Survey, Bloomington.
STUDY OF APPLICATION OF ERTS-A IMAGERY TO FRACTURE-RELATED MINE SAFETY HAZARDS IN THE COAL MINING INDUSTRY Progress Report, 1 Sep. - 1 Nov. 1973
Charles E. Wier, Frank J. Wobber, Principal Investigators, Orville R. Russell, Roger V. Amato, and Thomas Leshendok 9 Nov. 1973 9 p Prepared in cooperation with Earth Satellite Corp., Washington, D. C. ERTS
(Contract NAS5-21795)
(E74-10083; NASA-CR-135972) Avail: NTIS HC $3.00 CSCL 08I

The author has identified the following significant results. The Mined Land Inventory map of Pike, Gibson, and Warrick Counties, Indiana, prepared from ERTS-1 imagery, was included in the 1973 Annual Report of the President's Council on Environmental Quality as an example of ERTS applications to mined lands. Increasing numbers of inquiries have been received from coal producing states and coal companies interested in the Indiana Program.

N74-11395 Environmental Protection Agency, Research Triangle Park, N.C. Div. of Meteorology.
APPLICATIONS OF METEOROLOGY TO NATURAL RESOURCE PLANNING
James T. Peterson *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 93-100

Copyright.

The application of meteorology to the planning and management of natural resources is discussed. Weather components - frost, rain, wind, erosion - having an effect on agriculture, forestry, and recreational facilities are reviewed. Energy natural resources are considered, and ways of getting better utilization are discussed. Finally man's effect on natural ecological systems is described.
ESRO

N74-11519# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SELF-CONTAINED LOW POWER ATOMIC PLANTS
A. M. Petrosyants 27 Aug. 1973 12 p Transl. into ENGLISH from the publ. "Ot Nauchnogo Poiska k Stomnoi Promyshlennosti" USSR, 1972 p 198-203
(AD-766969; FTD-HT-23-702-73) Avail: NTIS CSCL 18/5

The report discusses research in the USSR into the direct conversion of thermal (nuclear) energy into electrical, including thermionic, thermoelectrical, and MHD methods. GRA

N74-11592# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
AVIATION TURBINE FUELS, 1972 Petroleum Products Survey No. 79
Ella Mae Shelton Mar. 1973 15 p refs
Avail: NTIS HC $3.00

Properties of aviation turbine fuels produced in the United States during 1972 are reported in accordance with a cooperative agreement between the American Petroleum Institute and the Bureau of Mines of the United States Department of the Interior. By agreement with the American Petroleum Institute, identification of the data by item number is confidential. Analytical data are presented for 117 samples of aviation turbine fuels, representing the products of 16 companies. The data were reported by the manufacturers as typical of their 1972 production. The analyses were made in their laboratories and the results submitted to the Bureau of Mines for compilation. Author

N74-11672* European Space Research and Technology Center, Noordwijk (Netherlands).
CURRENT EUROPEAN DEVELOPMENTS IN SOLAR PADDLE DRIVES
R. H. Bentall *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 49-58 refs

CSCL 22B

The European Space Research and Technology Centre (ESTEC) is sponsoring the development of a number of critical spacecraft hardware items. The hardware under development includes two competing solar paddle drives which are being produced to similar specifications. Three mechanisms of each type are being produced and will undergo thermal vacuum testing. All mechanisms have lead lubricated bearings. Author

N74-11727*# Houston Univ., Tex. Systems Design Inst.
A HYDROGEN ENERGY CARRIER. VOLUME 1: SUMMARY
Robert L. Savage, ed., Lee Blank, ed., Tom Cady, ed., Kenneth Cox, ed., Richard Murray, ed., and Richard Dee Williams, ed. Sep. 1973 27 p
(Grant NGT-44-005-114)
(NASA-CR-135995) Avail: NTIS HC $3.50 CSCL 20M

The production, technology, transportation, and implementation of hydrogen into the energy system are discussed along with the fossil fuel cycle, hydrogen fuel cycle, and the demands for energy. The cost of hydrogen production by coal gasification; electrolysis by nuclear energy, and solar energy are presented. The legal aspects of a hydrogen economy are also discussed.
F.O.S.

N74-11728*# Houston Univ., Tex.
A HYDROGEN ENERGY CARRIER. VOLUME 2: SYSTEMS ANALYSIS

Robert L. Savage, ed., Lee Blank, ed., Tom Cady, ed., Kenneth Cox, ed., Richard Murray, ed., and Richard Dee Williams, ed. Sep. 1973 158 p refs
(Grant NGL-44-005-114)
(NASA-CR-136007) Avail: NTIS HC $10.00 CSCL 20M

A systems analysis of hydrogen as an energy carrier in the United States indicated that it is feasible to use hydrogen in all energy use areas, except some types of transportation. These use areas are industrial, residential and commercial, and electric power generation. Saturation concept and conservation concept forecasts of future total energy demands were made. Projected costs of producing hydrogen from coal or from nuclear heat combined with thermochemical decomposition of water are in the range $1.00 to $1.50 per million Btu of hydrogen produced. Other methods are estimated to be more costly. The use of hydrogen as a fuel will require the development of large-scale transmission and storage systems. A pipeline system similar to the existing natural gas pipeline system appears practical, if design factors are included to avoid hydrogen environment embrittlement of pipeline metals. Conclusions from the examination of the safety, legal, environmental, economic, political and societal aspects of hydrogen fuel are that a hydrogen energy carrier system would be compatible with American values and the existing energy system.

N74-11729* Houston Univ., Tex.
[SUMMARY OF SYSTEMS ANALYSIS OF HYDROGEN AS AN ENERGY CARRIER IN THE UNITED STATES]
In its A Hydrogen Energy Carrier, Vol. 2 Sep. 1973 p 1-3

CSCL 20M

Hydrogen is discussed in terms of meeting the energy demands of the current energy shortage in the U.S. Hydrogen is considered compatible with all fuel needs, except for on-board storage in automotive-type vehicles. Handling and safety factors are considered compatible to other high energy fuel. It is concluded that hydrogen is an environmentally desirable energy source, and is readily acceptable in the American energy system. F.O.S.

N74-11730* Houston Univ., Tex.
[CURRENT ENERGY SHORTAGE IN THE UNITED STATES]
In its A Hydrogen Energy Carrier, Vol. 2 Sep. 1973 p 5-12 refs
CSCL 20M

An overview is presented of the study to use hydrogen as an energy source for meeting the current energy shortage. The fossil fuel cycle, and the hydrogen fuel cycle are discussed along with energy flow patterns. F.O.S.

N74-11731* Houston Univ., Tex.
PRODUCTION OF HYDROGEN
In its A Hydrogen Energy Carrier, Vol. 2 Sep. 1973 p 13-59 refs
CSCL 20M

Methods for producing hydrogen for a hydrogen economy are analyzed. Solar, wind, coal, and nuclear energies are considered as primary sources of energy for the electrolysis of water. Coal gasification processes are discussed along with thermochemical water decomposition by closed cycle processes. F.O.S.

N74-11732* Houston Univ., Tex.
TRANSMISSION AND STORAGE OF HYDROGEN
In its A Hydrogen Energy Carrier, Vol. 2 Sep. 1973 p 61-76 refs
CSCL 20M

Transmission and storage techniques for hydrogen are evaluated. Gaseous hydrogen and natural gas systems are discussed along with liquid hydrogen systems, and solid hydride storage systems are described. It is concluded that hydrogen gas pipeline systems are feasible, but attention must be given to the embrittlement of pipeline metals. F.O.S.

N74-11734* Houston Univ., Tex.
SAFETY, LEGAL, ENVIRONMENTAL, ECONOMIC, POLITICAL AND SOCIAL ASPECTS OF HYDROGEN
In its A Hydrogen Energy Carrier, Vol. 2 Sep. 1973 p 117-146 refs
CSCL 05C

The impact of the hydrogen energy system on society was studied. Areas discussed include: federal and state responsibilities for safety; appliance safety standards; industrial uses and safety; assessment of the danger in the widespread use of hydrogen; legal aspects of the energy system; and the environmental implications. F.O.S.

N74-11735* Houston Univ., Tex.
IMPLEMENTATION OF A HYDROGEN ENERGY CARRIER SYSTEM
In its A Hydrogen Energy Carrier, Vol. 2 Sep. 1973 p 147-151

CSCL 13H

A program for the implementation, by stages, of a hydrogen energy system is proposed based on established methods of production, distribution, and use. The stages for the production of hydrogen progresses from coal gasification, through nuclear power to a hydrogen society. F.O.S.

N74-11736*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FIGURE-OF-MERIT CALCULATION METHODS FOR ORGANIC HEAT-PIPE FLUIDS
James F. Morris Washington Nov. 1973 13 p refs
(NASA-TM-X-2945; E-7632) Avail: NTIS HC $2.75 CSCL 20M

With only chemical formulas and operating temperatures specified, selected correlating equations and tables of chemistry-effect functions allow estimates of figures of merit for organic heat-pipe-fluids. Author

N74-11739# Brown, Boveri und Cie, A.G., Heidelberg (West Germany). Zentrales Forschungslab.
A NOVEL METHOD OF COOLING SEMICONDUCTOR DEVICES FOR POWER ELECTRONICS [NEUARTIGES KUEHLVERFAHREN FUER BAUELEMENTE DER LEISTUNGSELEKTRONIK]
Hermann Bimbreier, Gregor Gammel, Uwe Heidtmann, Mattias Joens, and Peter Pawlowski Bonn Bundesmin. fuer Forsch. und Technol. Apr. 1973 114 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol. (BMFT-FB-T-73-02) Avail: NTIS HC $7.75; ZLDI, Munich 23,55 DM

The development of heat pipe coolers for semiconductors in electric power supplies is discussed. The maximum dimensions were calculated for a given heat flux capability. Technologies necessary for the construction of heat pipes were developed, such as the manufacturing of capillary structures as well as the filling and sealing of heat pipes. Various samples of different design were built, and the influence of heat throughput, heat pipe position, and cooling air velocity on the heat resistance and temperature distribution were experimentally determined. The startup behavior of a heat pipe cooler was examined at room temperature and at temperatures below the freezing point of the working fluid. Corrosion tests performed so far have shown that the material combination copper-water is suitable for heat pipe coolers within the desired temperature range and that prospective lifetimes can be reached. ESRO

N74-11743*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering.
THE ENERGY DILEMMA AND ITS IMPACT ON AIR TRANSPORTATION
Calvin R. Dyer, ed., Michael Z. Sincoff, ed., and Paul D. Cribbins, ed. 1973 171 p refs
(Grant NGT-47-003-028)
(NASA-CR-135993) Avail: NTIS HC $10.75 CSCL 05A

The dimensions of the energy situation are discussed in

relation to air travel. Energy conservation, fuel consumption, and combustion efficiency are examined, as well as the proposal for subsonic aircraft using hydrogen fuel.

N74-11744* Old Dominion Univ., Norfolk, Va.
THE ENERGY SITUATION
In its The Energy Dilemma and Its Impact on Air Transportation 1973 p 1-48 refs
CSCL 05A

Energy reserves from the principal energy sources other than petroleum and natural gas are summarized. It was found that energy sources are being consumed at rates which exceed the ability to replace them through new discoveries and technology improvements. The costs and implications to environment for using coal and nuclear energy are discussed. Tables are presented on energy consumption, cost of reclamation, and water power capacity. J.A.M.

N74-11745* Old Dominion Univ., Norfolk, Va.
THE AIR TRANSPORTATION/ENERGY SYSTEM
In its The Energy Dilemma and Its Impact on Air Transportation 1973 p 49-70 refs
CSCL 05A

The changing pattern of transportation is discussed, and the energy intensiveness of various modes of transportation is also analyzed. Sociopsychological data affecting why people travel by air are presented, along with governmental regulation and air transportation economics. The aviation user tax structure is shown in tabular form. J.A.M.

N74-11746* Old Dominion Univ., Norfolk, Va.
ENERGY CONSERVATION AND AIR TRANSPORTATION
In its The Energy Dilemma and Its Impact on Air Transportation 1973 p 71-94 refs
CSCL 05A

Air transportation demand and passenger energy demand are discussed, in relation to energy conservation. Alternatives to air travel are reviewed, along with airline advertising and ticket pricing. Cargo energy demand and airline systems efficiency are also examined, as well as fuel conservation techniques. Maximum efficiency of passenger aircraft, from B-747 to V/STOL to British Concorde, is compared. J.A.M.

N74-11747* Old Dominion Univ., Norfolk, Va.
AN INITIAL STEP: A DEMONSTRATION PROJECT
In its The Energy Dilemma and Its Impact on Air Transportation 1973 p 95-117 refs
CSCL 05A

To initiate the transition into a clean and diverse energy environment independent of fossil-based fuels, the rapid development of a subsonic, hydrogen-fueled aircraft is recommended. Tables are presented on characteristics of synthetic fuels, comparisions with JP-4 and gasoline, comparison of nitric oxide emissions from hydrocarbon and hydrogen fuels vs. final flame temperature, and sensitivity limits of LH2 detectors. J.A.M.

N74-11748* Old Dominion Univ., Norfolk, Va.
CONCLUSIONS AND RECOMMENDATIONS
In its The Energy Dilemma and Its Impact on Air Transportation 1973 p 119-173 refs
CSCL 05A

Conclusions and recommendations are presented for an analysis of the total energy situation; the effect of the energy problem on air transportation; and hydrogen fuel for aircraft. Properties and production costs of fuels, future prediction for energy and transportation, and economic aspects of hydrogen production are appended. J.A.M.

N74-11759 Joint Publications Research Service, Arlington, Va.
TRENDS IN THE MECHANIZATION OF THE COAL INDUSTRY AND GUARANTEE OF PATENT-ABILITY OF DESIGNS THAT ARE COMPETITIVE ON THE WORLD TECHNOLOGICAL LEVEL
V. L. Shteynbuk *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 105-112 ref Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 106-113

An analysis of the historical trends in the development of mechanized hydraulic supports for the USSR coal industry is given; the relationships to problems of legal protection, patenting, patent purity, and future requirements in worldwide competition are discussed. It is proposed that computerized analysis of historical and technical experience is included in the processing of technological inventions pertaining to mechanized hydraulic supports. G.G.

N74-11760 Joint Publications Research Service, Arlington, Va.
THE HISTORY OF TECHNOLOGY AND ENGINEERING SOLUTIONS
O. F. Schukin *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 113-114 Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 114-115

Mathematical methods and computer processing of accumulated technological and engineering data are essential in forecasting the development and operation of modern coal mines. The blueprint for construction of a modern coal mine should include considerations of technological progress and economic aspects in planning and design organization. G.G.

N74-11765 Joint Publications Research Service, Arlington, Va.
FORECASTING OF TECHNOLOGICAL PROGRESS FOR LONG-RANGE PLANNING OF MINING OPERATIONS AT COAL MINES
A. M. Arabadzhev, G. M. Dobrov, N. I. Ivanov, and L. P. Smirnov *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 141-148 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 141-148

Ideas, principles, and decisions that result from scientific-technical research are included in forecasting the development of coal field reserves and planning for coal mine operations. The process of mine development planning is represented as a multistage industrial process, distributed in time and space, where specific loads are increased by improved technology and operational organization to yield practical conclusions. An algorithm is developed that solves the feasibility problem of converting from one qualitative state (old equipment) to a new one, corresponding to the decision to replace the old equipment which has exhausted its technical and economic capabilities. G.G.

N74-11787# Committee on Science and Astronautics (U. S. House).
SOLAR-ENERGY FOR HEATING AND COOLING
Washington GPO 1973 295 p refs Hearings before Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., No. 13, 7 and 12 Jun. 1973
Avail: Subcomm. on Energy

A Congressional hearing was conducted to examine the use of solar energy for heating and cooling. Examples of various solar energy conversion systems are illustrated and described. The subjects discussed are: (1) the status of solar energy technology, (2) market factors, (3) technology transfer, and (4) the benefits of using solar energy for heating and cooling buildings. P.N.F.

N74-11788# Committee on Science and Astronautics (U. S. House).
ENERGY RESEARCH AND DEVELOPMENT: AN OVERVIEW OF OUR NATIONAL EFFORT
Washington GPO 1973 51 p Hearing before Comm. on Sci.

and Astronaut., 93d Congr., 1st Sess., No. 10, 15 May 1973 Avail: Subcomm. on Energy

A Congressional hearing was conducted to discuss the research and development efforts directed toward providing sources of energy. The funds available for research and development by government and private agencies are presented. The various alternate sources of energy are described to show the level of effort for each source. The long range priorities which involve the development of new energy sources and the conservation of energy are analyzed. Examples of alternate energy sources are included to show specific techniques for energy conversion. P.N.F.

N74-11790# RAND Corp., Santa Monica, Calif.
ENERGY DEMAND AND ITS EFFECT ON THE ENVIRONMENT
D. N. Morris Jul. 1973 28 p
(P-5048) Avail: NTIS HC $3.50

An analysis of the current energy crisis and the possible environmental factors involved in the use of alternate sources of energy to reduce the consumption of fossile fuels is presented. Graphs are developed to show: (1) energy use in the United States, (2) total U.S. crude oil production from 1860 to 2060, (2) consumption of electricity in California, and (4) commercial, residential, and industrial electrical use in California. Measures for conserving electricity are proposed. The estimated national air pollution emission by source in 1969 is shown in table form. Author

N74-11791# RAND Corp., Santa Monica, Calif.
ENERGY TRENDS AND THEIR FUTURE EFFECTS UPON TRANSPORTATION
W. E. Mooz Jul. 1973 27 p refs
(P-5046) Avail: NTIS HC $3.50

The impact of fuel shortages on the transportation energy is discussed. The areas investigated are: (1) the demand for energy for transportation purposes, (2) the supply of energy for transportation purposes, and (3) the espected price of energy. Graphs are included to show the overall energy requirements, comparative energy intensiveness values for different methods of transportation, recent trends in automobile fuel use, a history of rail, truck, and air cargo development, and an analysis of annual energy consumed by all transport modes in the United States. P.N.F.

N74-11795# InterTechnology Corp., Warrenton, Va.
THE U.S. ENERGY PROBLEM. VOLUME 2: APPENDICES, PART A Final Report, Dec. 1970 - Nov. 1971
G. C. Szego 1971 745 p refs 2 Vol.
(Grant NSF C-645)
(PB-207518; NSF-RANN-71-1-2) Avail: NTIS HC $12.50 CSCL 10B

The energy status and outlook for the United States and the World are analyzed. A simulation model of fossil fuel steam electric generating plants is developed. The model includes the following features: (1) cost tradeoff analysis, (2) influence coefficients, (3) cost reduction versus technology, (4) cost of fossile fuels, (5) magnetohydrodynamic topping, (6) nuclear energy, (7) residential energy analysis, and (8) solar energy. Author

N74-11796# InterTechnology Corp., Warrenton, Va.
THE U.S. ENERGY PROBLEM. VOLUME 2: APPENDICES, PART B Final Report, Dec. 1970 - Nov. 1971
G. C. Szego Nov. 1971 686 p refs 2 Vol.
(Grant NSF C-645)
(PB-207519; NSF-RANN-71-1-3) Avail: NTIS HC $12.50 CSCL 10B

An analysis of the energy requirements and energy sources for the United States is presented. The subjects discussed are: (1) off-peak storage, (2) state of electrochemical research and development of fuel cells, (3) alternate energy conversion cycles, (3) effects of failures of cryogenic superconductivity on electrical transmission lines, (4) transportation requirements, (5) environmental factors, (6) future investment capital for public utilities, (7) supply and demand analysis for energy related minerals, (8) econometric model for primary industries, (9) technology of alternate fuels, (10) a petroleum refinery model, and (11) the current state of thermionic energy conversion technology. Author

N74-11828# National Aviation Facilities Experimental Center, Atlantic City, N.J.
AIRCRAFT FUEL SYSTEM TESTS WITH GELLED FUEL-FLOWMETER CALIBRATION, FUEL BOOST PUMP AND JETTISON TESTS Final Report, Dec. 1971 - Nov. 1972
Joseph A. Avbel Nov. 1973 29 p refs
(FAA Proj. 181-520-020)
(FAA-NA-73-43; FAA-RD-73-138) Avail: NTIS HC $3.00

The feasibility of using gelled fuel (nominal 250 centipoise viscosity) with full scale aircraft fuel system components was investigated. Tests indicated that turbine-type flowmeters are suitable for measuring flow rates with accuracies of 1 percent. Jettison and fuel feed operations were conducted using a B-57 wing fuel tank. Approximately 3 percent more gelled fuel than JP-5R remained in the tank after emptying the tank in both boost pump and jettison tests. Flow rates and times to empty the tank were significantly poorer with the gelled fuel when compared to the results obtained with the JP-5R fuel. The gelled fuel tested is considered unsatisfactory because of its instability in storage, causing wide variations in viscosity. Author

N74-11849# Atomic Energy Commission, Washington, D.C.
ENERGY R AND D INVENTORY DATA BASE. BIBLIOGRAPHY, 1973
1973 439 p refs
Avail: NTIS HC $24.00

The bibliography provides separate listings which include: (1) index on authors, (2)simple index on corporate authors, (3) permuted index on titles, (3) energy sources (arranged according to the various types), (4) electric power generation (subdivided by type), and (5) energy demand and uses. D.L.G.

N74-11851# Dartmouth Coll., Hanover, N.H. Thayer School of Engineering.
Si-Au SCHOTTKY BARRIER NUCLEAR BATTERY Ph.D. Thesis
A. N. Tse Nov. 1972 168 p refs Sponsored by AEC
(TID-26342) Avail: NTIS HC $7.60

A long life, high power density, high reliability, compact microwatt battery is needed in many applications. In the field of medicine, for example, such a battery could power an artificial pacemaker which would greatly extend the residence time of the device. Various alternatives are analyzed and discussed. Betavoltaic conversion systems with Si-Au Schottky barrier cells coupled with Pm 147 metal foil were selected for investigation. Characterization experiments were performed to obtain optimized silicon resistivity and promethium metal foil thickness. Radiation dose rates were measured and the safety aspects of the battery were analyzed. A prototype battery was assembled and tested. The economics of the battery were demonstrated for special applications. It is concluded that a microwatt nuclear battery can be built with a conversion efficiency of 1 to 2%, a power density of 60 to 300 microwatts/cu cm depending on the power level, and a useful life of 5 to 10 years. Further research areas are recommended. Author (NSA)

N74-11852# ARO, Inc., Arnold Air Force Station, Tenn.
DEVELOPMENT OF DESIGN CRITERIA, COST ESTIMATES, AND SCHEDULES FOR AN MHD HIGH PERFORMANCE DEMONSTRATION EXPERIMENT Final Report, Apr. 1972 - Apr. 1973
G. W. Garrison, T. R. Brogan, H. J. Schmidt, and J. J. Nolan AEDC Aug. 1973 119 p refs Sponsored by Office of Coal Res.
(ARO Proj. PF226)
(AD-766232; ARO-PWT-TR-73-75; AEDC-TR-73-115) Avail: NTIS CSCL 10/2

The successful application of magnetohydrodynamics (MHD) for commercial, coal-fired, base-load power generation requires that the generator have an energy extraction ratio of approximately 0.20 with a turbine efficiency of 70 percent. There is a significant gap between this required performance and the generator performance which has been achieved to date. The commercial MHD concept is critically dependent upon the generator achieving this required performance, and it is therefore essential that a demonstration of this generator performance have the highest priority. Of equal importance, the generator channel configuration and operating conditions which are necessary in order to achieve the required performance will be determined while accomplishing the performance demonstration. Thus other Office of Coal Research (OCR) sponsored MHD research efforts can be directed toward the real problems and configurations as determined by solid experiments. (Modified author abstract) GRA

N74-11941# National Academy of Sciences - National Research Council, Washington, D.C.
SUBSTITUTE CATALYSTS FOR PLATINUM IN AUTOMOBILE EMISSION CONTROL DEVICES AND PETROLEUM REFINING Final Report
Mar. 1973 110 p
(Contract GS-00-DS-(P)-94008)
(PB-222167/9; NMAB-297) Avail: NTIS HC $5.45 CSCL 07A

The technological potential is reported of catalysts other than platinum as economic and efficient substitutes for platinum in petroleum refining and automobile emission devices for control of atmospheric pollution. Much research is being done to develop base-metal catalysts but at present they are only one percent as active as platinum per unit amount of metal under practical conditions in an exhaust environment. More research is necessary in many areas, especially hydrocarbon and carbon monoxide oxidation by oxides and salts with promise of high thermal stability, and nitrogen oxide removal by base metals and their alloys. The report should be read in the context of newer information that will be released. Author (GRA)

N74-12016*# Xerox, Rochester, N.Y.
REFURBISHMENT OF SOLAR SIMULATION OPTICAL TRAIN MIRROR ASSEMBLIES Final Report
W. R. Leverton Sep. 1973 29 p
(Contract NAS9-11461)
(NASA-CR-134123; EOS-1155) Avail: NTIS HC $3.50 CSCL 14B

Mirror refurbishment processing is described, and the results of processing 251 mirror assemblies are reported. The mirror replica bonding, optical tests, electrical discharge machining, and vacuum coating are discussed. F.O.S.

N74-12119*# Eason Oil Co., Oklahoma City, Okla.
AN EVALUATION OF THE SUITABILITY OF ERTS DATA FOR THE PURPOSES OF PETROLEUM EXPLORATION Progress Report, Aug. - Sep. 1973
Robert J. Collins, Principal Investigator 28 Nov. 1973 6 p ERTS
(Contract NAS5-21735)
(E74-10029; NASA-CR-135870) Avail: NTIS HC $3.00 CSCL 08G

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

N74-12159# Bureau of Mines, Morgantown, W.Va. Energy Research Center.
DIRECTIONAL PROPERTIES OF COAL AND THEIR UTILIZATION IN UNDERGROUND GASIFICATION EXPERIMENTS Technical Progress Report
C. A. Komar, W. K. Overbey, Jr., and J. Pasini, III Nov. 1973 14 p refs
(BM-TPR-73) Avail: NTIS HC $3.00

Renewed interest in the underground gasification of coal evolves from comprehensive studies of earth fracture systems that indicate that the movement of fluids can be controlled in the coalbed. In particular, directional property studies of natural microfissure occurrence, permeability, ultrasonic velocity, tensile strength, and orientation of intervals of inherent rock weakness, together with geologic structure setting and fracture trace analysis, can predict the gaseous flow paths in the coalbed. Having this information, the dominant direction in which gases generated and/or liberated by heat can be determined so that appropriate well patterns can be developed. Together with advances made in drilling technology that permit long horizontal holes to be drilled through the coal seams, tests can be conducted to determine whether directional control will permit devolatilization of the coalbed low-Btu gas suited for the generation of electricity. Author

N74-12183# Southern Methodist Univ., Dallas, Tex. Geophysical Lab.
DEVELOPMENT OF GEOTHERMAL RESERVOIRS FROM OVER-PRESSURED AREAS BENEATH THE GULF COASTAL PLAIN OF TEXAS. A FEASIBILITY STUDY OF POWER PRODUCTION FROM OVERPRESSURED RESERVOIRS Final Report
Eugene Herrin Mar. 1973 149 p refs
(ARPA Order 2184)
(AD-766855; AFOSR-73-1344TR) Avail: NTIS CSCL 08/7

It is the purpose of the present study to determine the feasibility of locating a pilot project in the Texas Gulf Coast area for the purpose of tapping the overpressured aquifers and transforming the thermal and mechanical energy into electrical power. Three areas in south Texas were given particular attention for their feasibility of being the site of the pilot project. These are the Sebastian area in northwest Cameron County, the Port Mansfield area in eastern Willacy County, and the Corpus Christi area. GRA

N74-12321# Kanner (Leo) Associates, Redwood City, Calif.
PRESENT AIR POLLUTION SITUATION IN KAWASAKI CITY AND FUTURE COUNTERMEASURES
Motoji Terabe Apr. 1973 22 p Transl. into ENGLISH from Kuki Seijo (Tokyo) v. 10, no. 5, Oct. 1972 p 66-71 Sponsored by Environ. Protection Agency
(KS-27; APTIC-47644) Avail: NTIS HC $3.25

The concentration of air pollutants and their effects are reported for Japan from 1965 through 1971. The present situation, in regards to sulfurous acid gas pollution, is discussed along with the future countermeasures. The air pollutants include: combustable products, leads, nitrogen oxides, ozones, organic peroxides, carbon monoxide, and hydrocarbons. The smoke producing facilities are listed along with the amounts of fuels used and the amounts of sulfurous gas acids produced. The occurrences of photochemical smog, dust fall, automobile gas exhausts, and the illnesses caused by these pollutants are also discussed. T.M.R.

N74-12445*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EMISSION CALCULATIONS FOR A SCRAMJET POWERED HYPERSONIC TRANSPORT
Erwin A. Lezberg Nov. 1973 32 p
(NASA-TM-X-71464; E-7760) Avail: NTIS HC $3.75 CSCL 21E

Calculations of exhaust emissions from a scramjet powered hypersonic transport burning hydrogen fuel were performed over a range of Mach numbers of 5 to 12 to provide input data for wake mixing calculations and forecasts of future levels of pollutants in the stratosphere. The calculations were performed utilizing a one-dimensional chemical kinetics computer program for the combustor and exhaust nozzle of a fixed geometry dual-mode scramjet engine. Inlet conditions to the combustor and engine size was based on a vehicle of 227,000 kg (500,000 lb) gross take of weight with engines sized for Mach 8 cruise. Nitric oxide emissions were very high for stoichiometric engine operation but for Mach 6 cruise at reduced equivalence ratio are in the range predicted for an advanced supersonic transport. Combustor

designs which utilize fuel staging and rapid expansion to minimize residence time at high combustion temperatures were found to be effective in preventing nitric oxide formation from reaching equilibrium concentrations. Author

N74-12447*# Owens-Illinois, Inc., Toledo, Ohio.
EXPLORATORY DEVELOPMENT OF A GLASS CERAMIC AUTOMOBILE THERMAL REACTOR
R. E. Gould and R. W. Petticrew Sep. 1973 33 p refs
(Contract NAS3-14334)
(NASA-CR-134531) Avail: NTIS HC $3.75 CSCL 21A

This report summarizes the design, fabrication and test results obtained for glass-ceramic (CER-VIT) automotive thermal reactors. Several reactor designs were evaluated using both engine-dynamometer and vehicle road tests. A maximum reactor life of about 330 hours was achieved in engine-dynamometer tests with peak gas temperatures of about 1065 C (1950 F). Reactor failures were mechanically induced. No evidence of chemical degradation was observed. It was concluded that to be useful for longer times, the CER-VIT parts would require a mounting system that was an improvement over those tested in this program. A reactor employing such a system was designed and fabricated. Author

N74-12448*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESIGN CONSIDERATIONS FOR THE AIRFRAME-INTEGRATED SCRAMJET
John R. Henry and Griffin Y. Anderson Washington Dec. 1973 38 p refs Presented at 1st Intern. Symp. on Air Breathing Engines, Marseille, France, Jun. 1972
(NASA-TM-X-2895; L-8152) Avail: NTIS HC $3.00 CSCL 21E

Research programs at the NASA Langley Research Center on the development of airframe-integrated scramjet concepts (supersonic combustion ramjet) are reviewed briefly. The design and performance of a specific scramjet configuration are examined analytically by use of recently developed and substantiated techniques on boundary-layer development, heat transfer, fuel-air mixing, heat-release rates, and engine-cycle analysis. These studies indicate that the fixed-geometry scramjet module will provide practical levels of thrust performance with low cooling requirements. Areas which need particular emphasis in further development work are the combustor design for low speeds and the integrated nozzle design. Author

N74-12462*# Maryland Univ., College Park. Dept. of Mechanical Engineering.
AN ASSESSMENT OF SOLAR ENERGY AS A NATIONAL ENERGY RESOURCE
Dec. 1972 88 p refs Sponsored by NASA
(Grant NSF GI-32488)
(NASA-CR-136191; PB-221659; NSF/RA/N-73-001) Avail: NTIS HC $6.50 CSCL 03B

The findings of a panel on the development and application of solar energy to reduce the need for fossil fuels are presented. The applications which are considered most promising from technical, economic, and energy quantity standpoints are: (1) heating and cooling of residential and commercial buildings, (2) chemical and biological conversion of organic materials to liquid, solid, and gaseous fuels, and (3) generation of electricity. Tables are presented to show the solar utilization techniques, major technical problems, and the impact of solar energy applications on the reference energy system. Author

N74-12577# Oak Ridge National Lab., Tenn.
SECOND ITERATION ANALYSIS OF A FOSSIL FUEL-FIRED GAS TURBINE-POTASSIUM-STEAM COMBINED CYCLE
M. E. Lackey Jul. 1973 32 p refs
(Contract W-7405-eng-26)
(ORNL-NSF-EP-39) Avail: NTIS HC $3.75

The operating conditions and heat balance of the fossil fuel-fired potassium vapor topping cycle as proposed in an initial ORNL study carried out under the NSF-RANN program have been reexamined in considerable detail. It appears desirable to reduce the peak temperature in the steam system as well as make a number of modifications in the feed heating system. Gas turbine operating experience has been reviewed to provide a firm basis for choosing the turbine inlet temperature and component efficiency for the gas turbine cycle. On the basis of these analyses the operating conditions of the initial study were modified and a new flow sheet and heat balance were prepared using the supercritical pressure steam cycle of the TVA Bull Run steam plant as the point of departure. This gave an overall combined cycle efficiency of 52% and a net heat rate of 6580 Btu/kW-hr. Author (NSA)

N74-12635 Parente (Robert B.), Los Angeles, Calif.
POWER SOURCE QUALITY
Robert B. Parente *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 3 p
03-34)
Copyright.

The various source deficiencies which can occur in the quality of ac electric power serivce, their potential consequences upon the performance of electronic equipment, and their cures are surveyed. These deficiencies include blackouts, brownouts, and waveform distortion. The information is considered to have particular application in plant siting, operations, or the preparation of specifications for new electronic equipment. Author

N74-12636 Federal Aviation Administration, Washington, D.C.
POWER CONDITIONING SYSTEM FOR FAA AIR ROUTE TRAFFIC CONTROL CENTERS
Anthony J. Froehlich and Alexander Kusko (Kusko (Alexander), Inc., Needham Heights, Mass.) *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p refs

Copyright.

The FAA is presently installing 18,000 kVA of solid state UPS equipment to supply power at high reliability to critical electronic loads at 20 air route traffic control centers (ARTCC's) in the U.S. The requirements for a power conditioning system for ARTCC's are given, and two approaches to meet these requirements are discussed. D.L.G.

N74-12664 Pennsylvania Univ., Philadelphia.
SOLAR HEAT UTILIZATION IN RESIDENTIAL HEATING SYSTEMS Ph.D. Thesis
Abdullah Ostad-Hosseini 1972 216 p
Avail: Univ. Microfilms Order No. 73-13447

A performance model of a solar collector was created in order to determine the useful heat which may be obtained from a flat plate solar collector. The model permits the calculation of the efficiency of a flat plate solar collector as a function of interplate spacing, incident solar radiation, number of plates, emissivity and absorptivity of the absorber, angle of incidence and other engineering variables. The model was used to compare different collector designs. The results are presented in graphical form suitable for system performance determination. A series of experiments yielded results within 5% of the analytical predictions. The computer program can predict the efficiency of solar collector as a function of date, time, location, and orientation of the collectors, the thermal and optical properties of glass and absorber plates, and the temperatures of the outside glass plate and the absorber plate. Weather data can be fed into the computer along with this program to obtain the yearly yield of solar heat.
Dissert. Abstr.

N74-12668# Committee on Science and Astronautics (U. S. House)
UNIVERSITY ENERGY RESEARCH CENTERS
Washington GPO 1973 52 p refs Hearing on H.R. 8348 and H.R. 9133 before Comm. on Sci. and Astronaut., 93d Congr. 1st Sess., No. 11, 23 Jul. 1973
Avail: NTIS Avail Subcomm. on Energy

A Congressional hearing is presented concerning the enactment of bills for enlisting the aid of academic researchers in carrying out energy R and D programs. Previous bills and past efforts are cited. The relationship between national laboratories to universities and the relation of either or both to private industry and the Federal Government, and to mission oriented projects associated with power engineering research are discussed. The designation of certain leading institutions and universities in certain fields is also considered. T.M.R.

N74-12669# Boeing Commercial Airplane Co., Seattle, Wash.
WHERE ARE WE HEADED IN AIR TRANSPORT?
L. T. Goodmanson 17 Oct. 1973 19 p Presented at Airport Operators Council Intern. Ann. Conf., Dallas, 17 Oct. 1973
Avail. NTIS HC $3.00

Certain trends are indicated for the future of air transport and a discussion on both cargo and passenger aircraft design options are given. An example from today's fleet of passenger airplanes is used to illustrate design improvement possibilities for current aircraft. This is followed by a discussion of new airplanes for both the near and far term. The passenger aircraft section includes a discussion on terminal area compatibility. The future cargo aircraft section covers a broad spectrum of designs, from conventional types of air freighters to new, dedicated intermodal systems. Some long range thinking about energy conservation and its effect on aircraft design is included. Author

N74-12672# Committee on Science and Astronautics (U. S. House).
ENERGY FACTS
Washington GPO Nov. 1973 458 p refs Presented to Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., 29 Nov. 1973 Prepared by Library of Congr.
Avail: Subcomm. on Energy

A congressional report on United States and foreign energy statistics is presented. Tables on the most common and some unconventional energy sources are developed. The statistical tables and graphs are grouped by resources, production, consumption and demand, energy and gross national products, and research and development. An inventory of world wide nonrenewable energy sources in the forms of natural gas, natural gas liquids, crude oil, shale oil, and coal is developed. Author

N74-12674*# Auburn Univ., Ala. School of Engineering.
TERRASTAR: TERRESTRIAL APPLICATION OF SOLAR TECHNOLOGY AND RESEARCH Final Report
Sep. 1973 344 p refs
(Contract NGT-01-003-044)
(NASA-CR-129012) Avail: NTIS HC $19.25 CSCL 05A

The application of solar energy to the energy crisis of the 70's and beyond is discussed in the context of energy consumption in the U.S., energy resources in the U.S., and the state-of-the-art of solar energy applications. Solar energy application concepts, such as solar farms (a term used to describe vast fields of concentrators collecting solar energy for the generation of steam to drive power turbines), an orbiting solar power station, and the conversion of solar energy into solar power for heating and cooling of individual buildings on the earth, are discussed. The report emphasizes the application of solar energy to the heating and cooling of buildings since this application seems to be more promising in the near term as far as research and development are concerned. The importance of initiating research and development on all solar application concepts is stressed as an important step in pursuing the use of solar energy. Immediate steps leading to the application of solar energy to heating and cooling of buildings are outlined to insure appreciable energy displacement through the use of solar energy by the year 2020.

N74-12675* Auburn Univ., Ala.
ENERGY CONSUMPTION: PAST, PRESENT, FUTURE
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 27 p refs
CSCL 20M

The energy consumption history of the United States and the changes which could occur in consumption characteristics in the next 50 years are presented. The various sources of energy are analyzed to show the limitations involved in development and utilization as a function of time available. Several scenarios were prepared to show the consumption and supply of energy under varying conditions. Author

N74-12676* Auburn Univ., Ala.
ENERGY AND RESOURCE CONSUMPTION
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 10 p refs
CSCL 20M

The present and projected energy requirements for the United States are discussed. The energy consumption and demand sectors are divided into the categories: residential and commercial, transportation, and industrial and electrical generation (utilities). All sectors except electrical generation use varying amounts of fossile fuel resources for non-energy purposes. The highest percentage of non-energy use by sector is industrial with 71.3 percent. The household and commercial sector uses 28.4 percent, and transportation about 0.3 percent. Graphs are developed to project fossil fuel demands for non-energy purposes and the percentage of the total fossil fuel used for non-energy needs. Author

N74-12677* Auburn Univ., Ala.
ENERGY RESOURCES
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 34 p refs
CSCL 20M

A statistical analysis of the availability of fossil fuels for energy and non-energy production is presented. The cumulative requirements for petroleum, natural gas, and coal are discussed. Alternate forms of energy are described and the advantages and limitations are analyzed. Emphasis is placed on solar energy availability and methods for conversion. The Federal energy research and development funding for energy sources is tabulated. Author

N74-12678* Auburn Univ., Ala.
COMPONENTS FOR SOLAR ENERGY
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 14 p refs
CSCL 20M

A requirement for the direct technological utilization of solar energy is a device for capturing and absorbing the available sunlight. These devices are commonly termed collectors. Because of the highly variable nature of sunlight, a facility for storing the collected energy is often essential. A device for direct conversion of light into electricity, which depends for operation on incident sunlight, is the photovoltaic cell. These components for solar energy systems are considered. Author

N74-12679* Auburn Univ., Ala.
SOLAR HEATING AND COOLING BUILDINGS
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 28 p refs
CSCL 20M

Sunshine is available in differing amounts everywhere in the world and the easiest method of capturing it is by absorption in the form of thermal energy (heat). Therefore, it is logical to utilize it directly in the heating and cooling of buildings and avoid losses that would occur by conversion to some other form. It may be emphasized that of the total energy consumed annually in the U.S., about 25% is used for heating and cooling in buildings. It is generally agreed that of all the possible widespread uses of solar energy, this application has the highest probability of success in the near term. Although there are significant uncertainties associated with some technological and economic aspects, they do not loom as large as those associated with

other potentially significant applications, such as electrical power generation. It may, however, be noted that solar electrical power generation at the building site, or at a centralized station is an excellent long term prospect. Approximately 25 experimental solar heated structures have been built in various parts of the world. Author

N74-12680* Auburn Univ., Ala.
SOLAR POWER GENERATION AND DISTRIBUTION
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 11 p refs
CSCL 20M

The production of electricity from solar energy is discussed. The economics of the proposed generation and distribution systems are analyzed. The use of photovoltaics for converting solar energy to home heating is proposed. The problems of energy distribution are analyzed from the standpoint of equipment costs and complexity. Author

N74-12681* Auburn Univ., Ala.
NATIONAL ENERGY POLICY
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 12 p refs
CSCL 05A

The efforts of the U.S. government to cope with the national energy crisis are discussed. The provisions of several legislative actions to implement the actions for energy conservation are examined. Immediate conservation measures and the long range planning for energy resources are reported. Author

N74-12682* Auburn Univ., Ala.
SOLAR ENERGY POTENTIAL
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 9 P ref
CSCL 20M

The potential of solar energy as a national resource is discussed. Research and development programs for the development of eleven concepts are described to show the proposed funding for each year over a fifteen year period. The estimated energy contributions by period for each of the solar concepts are analyzed. The estimated impact of the solar concepts to the year 2020 are tabulated. Author

N74-12683* Auburn Univ., Ala.
IMPACTS OF SOLAR ENERGY UTILIZATION
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 25 p refs
CSCL 20M

Various methods of conducting surveys and analyses to determine the attitude of the public toward the energy crisis are discussed. Models to determine the impact of the energy crisis and proposed alternative sources of energy on the social structure are analyzed. The various interest groups which are concerned with energy and the nature of their interest are identified. The government structure for controlling resource production and allocation is defined. Author

N74-12684* Auburn Univ., Ala.
MARKET POTENTIAL FOR SOLAR HEATING AND COOLING IN BUILDINGS
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 13 p refs
CSCL 20M

The use of solar heating and cooling for buildings as a method of conserving fossil fuels is discussed. The residential and commercial end use consumption of energy is tabulated. A survey to project the energy requirements for home and industry heating and cooling is developed. The survey indicates that there is a market potential for solar heating and cooling of buildings. A prediction of three to five billion dollars per year as the potential for solar heating and cooling is made. Author

N74-12685* Auburn Univ., Ala.
STRATEGY FOR SOLAR HEATING AND COOLING IN BUILDINGS
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 159 p refs
CSCL 20M

The types of solar energy heating and cooling equipment for use with buildings are discussed. The steps from manufacturing to equipment installation are identified. A feasibility study for the use of solar energy was conducted. The study determined the technical, environmental, economic, sociological, political, and strategic aspects of solar heating and cooling. Author

N74-12687# Committee on Science and Astronautics (U. S. House).
THE FEDERAL GOVERNMENT AND ENERGY: R AND D HISTORICAL BACKGROUND
Washington GPO Mar. 1973 111 p refs Presented to Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., 20 Mar. 1973 Prepared by Library of Congr.
Avail: Subcomm. on Energy

Energy source R and D is traced for the Navy, the National Bureau of Standards, Federal Power Commission, Tennessee Valley Authority, Atomic Energy Commission, National Science Foundation, National Aeronautics and Space Administration, and Advisory boards and committees. A historical look at aviation technology is given along with research in the Dept. of Interior including geological surveys for the Bureau of Mines, and Offices of Oil, Gas, and Coal. T.M.R.

N74-12688# Committee on Science and Astronautics (U. S. House).
AN INVENTORY OF ENERGY RESEARCH, VOLUME 1
Washington GPO Mar. 1972 1111 p refs Presented to Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., 20 Feb. 1972 Prepared by ORNL for Task Force on Energy Sponsored by NSF 2 Vol.
Avail: Subcomm. on Sci., Res., and Develop.

An inventory of energy research was prepared for the subcommittee on science, research, and development of the U.S. House of Representatives. An overview of the research being conducted on most aspects of energy production and use is provided. The survey was prompted by the concern for the limitation in the sources of energy and the impact of the production and use of energy on the environment. Within fourteen categories of energy sources 4,400 research projects have been identified. Author

N74-12689# Committee on Science and Astronautics (U. S. House).
AN INVENTORY OF ENERGY RESEARCH, VOLUME 2
Washington GPO Mar. 1972 631 p refs Presented to Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., 20 Feb. 1972 Prepared by ORNL for Task Force on Energy Sponsored by NSF 2 Vol.
Avail: Subcomm. on Sci., Res., and Develop.

A permuted index of research projects involving energy sources was prepared for the subcommittee on science, research, and development of the U.S. House of Representatives. The index identifies fourteen categories of energy sources and 4,400 research projects within the categories. Author

N74-12690# Committee on Science and Astronautics (U. S. House).
SHORT TERM ENERGY SHORTAGES
Washington GPO 1973 927 p refs Hearings before Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., No. 7, 3, 8, and 17 May 1973
Avail: Subcomm. on Energy

The hearings are reported concerning the causes and implications of the impending shortages of gasoline, heating oil, fuel oil, jet fuel, and electricity. Short term fuel shortages and their effects on electric utilities are analyzed. Other topics discussed include: natural gas supply, electric energy supply; R and D considerations, and convertibility of oil-fired electric utility plants to coal. F.O.S.

N74-12691# Committee on Science and Astronautics (U. S. House).
ENERGY RESEARCH AND DEVELOPMENT AND SPACE TECHNOLOGY
Washington GPO 1973 573 p refs Hearings before Subcomm. on Space Sci. and Appl. and Subcomm. on Energy of the Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., No. 9, 7, 22, and 24 May 1973
Avail: Comm. on Sci. and Astronaut.

The hearings concerning the energy R and D for developing long-term fuel supplies are reported. Topics discussed include: role of the Federal Laboratories in energy R and D; energy crisis and consumer costs, university programs, nuclear energy, and the relay of energy from power satellites by microwave beams. F.O.S.

N74-12693# Joint Publications Research Service, Arlington, Va.
MATHEMATICAL METHODS OF OPTIMAL PLANNING DEVELOPMENT AND USE OF ENERGY SYSTEMS
L. P. Padalko 15 Nov. 1973 209 p refs Transl. into ENGLISH of the book "Matematicheskiye Metody Optimal'nogo Planirovaniya Razvitiya i Ekspluatatsii Energosistem" Minsk, Izdatel' stvo Vysheyshaya Shkola, 1973 199 p
(JPRS-60546) Avail: NTIS HC $12.50

A discussion is given of the bases of mathematical methods of optimal planning and their use for selecting optical solutions in the planning, development, and operation of power supply systems. Author

N74-12695# Oak Ridge National Lab., Tenn.
ENERGY RESEARCH AND DEVELOPMENT: A SELECTED READING LIST
M. P. Guthrie, ed., E. E. Huber, ed., and G. A. Norwood, ed. (AEC, Washington, D. C.) Nov. 1973 107 p Revised
(Contract W-7405-eng-26; NSF-IA-AAA-R-479)
(ORNL-EIS-73-65-Rev-1) Avail: NTIS HC $7.50

A selected list of readings designed to aid policymakers in the identification of promising areas for energy research and development is presented. The document is also designed to assist the informed layman who wishes to orient himself in this overall field. The genesis of the reading list was a need to gain a perspective on what has already been done in energy research and development. This perspective was required to support the development of a report to the President from the Chairman of the Atomic Energy Commission on long-range energy research and development needs and policy as requested in the President's June 29, 1973, statement on Energy and National Resources. A basic aim was to include monographs and reports on technology assessment for each of the many energy technologies. The bibliography emphasizes general publications on energy sources, electric power, generation, and energy uses. Detailed technical reports and scientific papers are included only to a limited extent. A special effort was made to include Congressional publications relating to energy. Author

N74-12696# Los Alamos Scientific Lab., N.Mex.
SOME INTERFACES IN RESOURCE UTILIZATION
L. P. Reinig [1973] 16 p refs Presented at Symp. on Econ. Develop. vs. Environ. Quality in the Southwest, Lubbock, Tex., 19-20 Apr. 1973; sponsored by Comm. on Desert and Arid Zone Res. of the Am. Assoc. For the Advan. of Sci.
(Contract W-7405-eng-36)
(LA-UR-73-570; Conf-730440-1) Avail: NTIS HC $3.00

Los Alamos Scientific Laboratory is engaged in programs to explore the ways of extracting useful power from the heat of the earth's crust; to demonstrate the feasibility of superconducting transmission lines; and to develop a rock-melting penetrator, or subterrene, expected to be capable of creating long tunnels in rock. The tunnels, lined with the glass-like melted rock created by passage of the subterrene, might form excellent conduits for underground transmission lines, as well as serving in the exploitation of geothermal energy. A project to exploit the vast underground reservoir of saline water in New Mexico is described. The project TRG is based on desalination by means of geothermal or nuclear energy to furnish New Mexico with water and electric power. NSA

N74-12742# Pratt and Whitney Aircraft, East Hartford, Conn.
AIR MOBILITY FUEL CELL STUDY Technical Report, 9 May 1972 - 9 Jan. 1973
Jeffrey H. Arnold Kirtland AFB, N. Mex. AFWL Jul. 1973 96 p refs
(Contract F29601-72-C-0083; AF Proj. 683M)
(AD-766757; PWA-4635; AFWL-TR-73-26) Avail: NTIS CSCL 10/2

An analytical and test program was conducted to evaluate the fuel cell power concept for the Bare Base mission which was selected as an example of an air mobility application. A life cycle cost model was developed and the life cycle costs of candidate fuel cell power systems were compared to the present Bare Base centralized power system. A study and test program was conducted to determine the feasibility of desulfurizing military JP-4 fuel and a powerplant test program was also conducted to evaluate operation on JP-4 fuel to meet typical air mobility loads. Study results verified that dispersed fuel cell power systems offer potential operational advantages in system installation, operation, and maintenance and are economically competitive with existing centralized power systems. The desulfurizer test program demonstrated the feasibility of desulfurizing JP-4 fuel. Powerplant tests demonstrated the capability to operate on JP-4 fuel and the ability to provide power compatible with air mobility loads. A comprehensive field experiment was planned as a logical next step to confirm the economic and operational conclusions of the study and provided detailed design information for an air mobility fuel cell system. Author (GRA)

N74-12744# Pratt and Whitney Aircraft, East Hartford, Conn.
THE 1.5-kW FUEL CELL POWERPLANT Final Report, 1 Jul. 1971 - 31 Dec. 1972
Anthony J. DeCasperis and H. Leigh Ferguson 2 Apr. 1973 119 p refs
(DA Proj. 1G6-63702-DG-10; Contract DAAK02-70-C-0518)
(AD-767302; PWA-4704) Avail: NTIS CSCL 10/2

Four advanced development model 1.5kW fuel cell power plants were delivered to the Army for evaluation. The delivery configuration power plant weighs 292 lbs. and has a volume of 9.7 cubic feet. Startup and Operation are fully automatic and the power plant operates on JP-4 fuel with a specific fuel consumption of less than 2.2 lbs/kWh. Output voltage is adjustable from 26 to 34 volts at any output from 0 to 1.5kW. The power plant consists of four subsystems, a regenerative thermal cracker, which converts logistic fuel to hydrogen, an acid fuel cell power section which generates dc power from hydrogen and air, a voltage regulator and an automatic control system. A core technology program was conducted to develop the cracker voltage regulator and automatic control unit. Limited development of the power section, which is based on commercial technology fuel cells, to tailor the design to Army requirements was also conducted. The program culminated with development testing of a complete power plant and delivery of four power plants to the Army. Author (GRA)

N74-12824# Research Inst. of National Defence, Sundbyberg (Sweden).
COMBUSTION OF THE GASES METHANE, LP GAS AND AMMONIA IN A MIXING REACTOR [FOERBRAENNING AV GASERNA METAN, GASOL OCH AMMONIAK I EN FOERBLANDAD REAKTOR]
Henry Kanebaeck and Ivar Lill Mar. 1972 31 p In SWEDISH
(FOA-1-C-1442-H3) Avail: NTIS HC $3.75

The burning of sulfurous compounds in a test reactor for removing contaminants in the air is considered. The reactor is a flow tube with a stage for mixing, and combustion is obtained without catalysts at as high a temperature as possible. Previous

good results using sulfurous compounds have been verified with LP gas and ammonia whilst as expected, methane is needed for difficult reactions. From the point of view of preserving the environment it is also interesting to see whether, in addition to questions of the economics of heating, selective combustion in mixtures of ammonia and sulfurous compounds, e.g. H2S and RSH, are acceptable. Author.

N74-13051*# Alabama Univ., University. Bureau of Engineering Research.
INVESTIGATIONS USING DATA IN ALABAMA FROM ERTS-A Bimonthly Progress Report, 7 Oct. - 6 Dec. 1973
Harold R. Henry and George P. Whittle, Principal Investigators 6 Dec. 1973 66 p ref ERTS
(Contract NAS5-21876)
(E74-10124; NASA-CR-136169; BMPR-7) Avail: NTIS HC $5.50 CSCL 08B

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

N74-13428# Joint Publications Research Service, Arlington, Va.
FROM SCIENTIFIC RESEARCH TO THE ATOMIC INDUSTRY
A. M. Petrosyants 19 Nov. 1973 222 p refs Transl. into ENGLISH from the book "Ot Nauchnogo Poiska k Atomnoy Promyshlennosti" Moscow, Atomizdat, 1972 231 p
(JPRS-60584) Avail: NTIS HC $13.25

Excerpts from a book tracing the evolution of the nuclear power industry from the research stage to its present day development are presented. Topics discussed include high-energy physics, thermonuclear fusion, electric power engineering, small and low power nuclear power plants, prospects of nuclear power engineering, radioactive waste disposal, and nuclear centers. Author

N74-13466*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIQUID METAL MAGNETOHYDRODYNAMICS (LMMHD) TECHNOLOGY TRANSFER FEASIBILITY STUDY. VOLUME 1: SUMMARY
R. L. Phen, Lance G. Hays, and M. E. Alper 18 May 1973 60 p Sponsored by NASA 2 Vol.
(NASA-CR-136197; JPL-1200-59-Vol-1) Avail. NTIS HC $5.00 CSCL 20I

The potential application of liquid metal magnetohydrodynamics (LMMHD) to central station utility power generation through the period to 1990 is examined. Included are: (1) a description of LMMHD and a review of its development status, (2) LMMHD preliminary design for application to central station utility power generation, (3) evaluation of LMMHD in comparison with conventional and other advanced power generation systems and (4) a technology development plan. One of the major conclusions found is that the most economic and technically feasible application of LMMHD is a topping cycle to a steam plant, taking advantage of high temperatures available but not usable by the steam cycle. Author

N74-13467*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIQUID METAL MAGNETOHYDRODYNAMICS (LMMHD) TECHNOLOGY TRANSFER FEASIBILITY STUDY. VOLUME 2: APPENDIXES
R. L. Phen, Lance G. Hays, and M. E. Alper 18 May 1973 198 p refs Sponsored by NASA 2 Vol.
(NASA-CR-136198; JPL-1200-59-Vol-2) Avail: NTIS HC $12.00 CSCL 20I

The potential application of liquid metal magnetohydrodynamics (LMMHD) to central station utility power generation through the period to 1990 is examined. Included are: (1) a description of LMMHD and a review of its development status, (2) LMMHD preliminary design for application to central station utility power generation, (3) evaluation of LMMHD in comparison with conventional and other advanced power generation systems and (4) a technology development plan. One of the major conclusions found is that the most economic and technically feasible application of LMMHD is a topping cycle to a steam plant, taking advantage of high temperatures available but not usable by the steam cycle. Author

N74-13537# California Univ., Livermore. Lawrence Livermore Lab.
SOLAR PONDS EXTENDED
A. F. Clark 27 Jul. 1973 12 p refs
(Contract W-7405-eng-48)
(UCID-16317) Avail: NTIS HC $3.00

An effort was made to find and develop a system to produce electrical power from solar energy. The largest item of cost in a solar energy system is the collector, and a solar pond can be made very cheaply compared to mirrors or metal collection or multilayered glass systems. The heat can be transported by, stored in, and extracted from water very readily and relatively inexpensively. The present concepts feature a shallow pond that is quickly and readily heated and can be emptied at night, cutting down on the thermal losses. The pond would be filled only when the solar radiation is strong enough to heat the water. The rest of the time the water would be stored in a large insulated reservior, thus providing as much heat energy storage as desired and certainly enough to last more than a day or so. Calculations indicate that a thermodynamic cycle using some fluid other than water could be more efficient in extracting power. A Freon 11 liquid-vapor system could be the appropriate fluid to run the turbine and generate electricity. Waste heat could be disposed of in a water cooling tower. NSA

N74-13538# California Univ., Berkeley. Lawrence Berkeley Lab.
CALCULATIONS ON A SOLAR ENERGY SYSTEM
R. M. Graven 8 Mar. 1973 33 p refs Presented at the Intern. Meeting on the Solar Energy Soc., Cleveland, 3 Oct. 1973
(Contract W-7405-eng-48)
(LBL-1773; Conf-731002-1) Avail: NTIS HC $3.75

A computer program has been used to calculate the amount of energy which can be extracted from a flat plate solar collector. The computations consider latitude, heat loss, daily temperature range, percent cloud cover, sun angle, etc. to determine the feasibility of home heating for an angularly adjustable solar collector in the Northern Hemisphere. The program also calculates the energy available from a solar-earth heat pump. The influence of design parameters and the feasibility of using solar energy to generate heat and electricity for a small single family residence have been considered. Author (NSA)

N74-13673# National Research Council of Canada, Ottawa (Ontario).
QUARTERLY BULLETIN OF THE DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT, 1 JULY - 30 SEPTEMBER 1973
30 Sep. 1973 82 p refs
(DME/NAE-1973(3)) Avail: NTIS HC $6.25

A review of current activities of Canadian mechanical engineering and national aeronautical establishments is presented. The topics discussed are: (1) effects of Reynolds number at low speeds on the maximum lift of two dimensional aerofoil sections equipped with mechanical high lift devices; (2) energy in transportation; and (3) a wave buoy accelerometer unit. A list of current projects and publications is included.

N74-13675 National Research Council of Canada, Ottawa (Ontario). Engine Lab.
ENERGY IN TRANSPORTATION

E. P. Cockshutt *In its* Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab. 30 Sep. 1973 p 25-32 refs

The energy requirements of a variety of transportation systems are reviewed in the context of the current concern over diminishing reserves of hydrocarbon fuels. The energy costs of current passenger and cargo transportation systems are presented. The energy cost components - thermo-propulsive efficiency, frictional resistance, and structural efficiency-are assembled as a ratio for low energy cost. Charts and graphs are included. K.M.M.

N74-13697# Stanford Research Inst., Arlington, Va. Strategic Studies Center.

LEGAL CONSIDERATIONS AND CONSTRAINTS ON US NUCLEAR POLICY Final Report

Albert Ferri, Jr. Dec. 1972 48 p refs

(Contract DAHC19-71-C-0001; SRI Proj. 8974)

(AD-754641; SSC-TN-8974-68) Avail: NTIS CSCL 05/4

A review of the major pre-SALT treaties and laws affecting U.S. nuclear policy is reported. The major items of the paper are presented mainly in chronological order. The last section of the work discusses recent trends in U. S. domestic law and their significance for U. S. nuclear policy. This research is part of a larger effort which utilizes this material in force posture analysis. This compilation is considered a handy and useful summary of constraints on nuclear policy which may have wider utility for other elements of the defense establishment. This research paper does not cover the SALTIABM Treaty nor the interim agreements on the limitation of strategic offensive weapons. GRA

N74-12759 McGill Univ., Montreal (Quebec).

THE EFFECT OF FRONTAL EYE FIELD STIMULATION OF UNIT RESPONSES IN THE SUPERIOR COLLICULUS OF THE CAT

D. Guitton and G. Mandl *In its* DRB Aviation Med. Res. Unit Rept., Vol. 3, 1971 - 1973 Oct. 1973 p 124-131 refs Submitted for publication

(AMRU-R.73:7)

Effects of excited units in the frontal eye field on visually evoked responses of movement sensitive cells in the superior colliculus of the cat are studied. Results show that units unresponsive to visual stimulation can be influenced at short latency by frontal eye field stimulation; they are located 2-3 mm below the superior colliculus surface. Units that respond to both visual and electrical front field stimulation are generally situated more superficially. The influence of electrical front field stimulation on visual responses depends on the relative timing between the two modes of stimulation. It is concluded that a neural discharge originating in the frontal eye field and arriving at the superior colliculus after an eye movement, cannot operate as a corollary discharge. G.G.

N74-12766 McGill Univ., Montreal (Quebec).

DO MUSCLE AFFERENTS CONTRIBUTE TO LONG-LOOP REFLEXES IN MAN?

C. W. Y. Chan, G. Melvill Jones, and R. F. H. Catchlove *In its* DRB Aviation Med. Res. Unit Rept., Vol. 3, 1971 - 1973 Oct. 1973 p 223-231 refs

(AMRU-R.73:5)

Muscular response to stretch has been termed the Functional Stretch Reflex (FSR). Experiments were undertaken to investigate the relative contributions of muscle and other afferents to the FSR. In each of ten subjects, complete anesthesia of the ankle and foot was obtained by intravenous regional anesthesia. The MSR to a sharp tap on the Achilles' tendon and the FSR to a suddenly applied and maintained dorsiflexing force to the sole of the foot were recorded by surface emg from the gastrocnemius before, during and after full recovery from regional anesthesia. The results showed no significant change in mean latency of the MSR; the respective mean latencies of the FSR were indistinguishable from one another, as were their response amplitudes. It is therefore concluded that the observed FSR probably originated predominantly from muscle afferents. In conjunction with other current results, it is inferred that these muscle afferent signals mediate their influence at least in part through long loop central pathways. Author

N74-14028*# Wolf Research and Development Corp., Pocomoke City, Md.

APPLICABILITY OF SKYLAB REMOTE SENSING FOR DETECTION AND MONITORING OF SURFACE MINING ACTIVITIES Quarterly Progress Report, 8 Sep. - 31 Dec. 1973

R. L. Brooks, Principal Investigator and J. D. Pennewell 28 Dec. 1973 6 p EREP

(Contract NAS9-13310)

(E74-10160; NASA-CR-136287; QPR-3) Avail: NTIS HC $3.00 CSCL 08I

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

N74-14093*# Kansas Univ. Center for Research, Inc., Lawrence.

RESEARCH ON THE APPLICATION OF SATELLITE REMOTE SENSING TO LOCAL, STATE, REGIONAL, AND NATIONAL PROGRAMS INVOLVED WITH RESOURCE MANAGEMENT AND ENVIRONMENTAL QUALITY Semiannual Progress Report, Apr. Sep. 1973

Robert L. Walters, Robert J. Eastmond, and B. G. Barr Sep. 1973 69 p refs

(Grant NGL-17-004-024)

(NASA-CR-136472) Avail: NTIS HC $5.50 CSCL 08F

Project summaries and project reports are presented in the area of satellite remote sensing as applied to local, regional, and national environmental programs. Projects reports include: (1) Douglas County applications program; (2) vegetation damage and heavy metal concentration in new lead belt; (3) evaluating reclamation of strip-mined land; (4) remote sensing applied to land use planning at Clinton Reservoir; and (5) detailed land use mapping in Kansas City, Kansas. K.M.M.

N74-14094# Citizens Advisory Committee on Environmental Quality, Washington, D.C.

REPORT TO THE PRESIDENT AND TO THE COUNCIL ON ENVIRONMENTAL QUALITY

Oct. 1973 48 p refs

Avail: SOD HC $1.05

A report on the effectiveness of environmental protection methods is presented. The report was prepared for the President by the Citizens' Advisory Committee on Environmental Quality. The subjects discussed include: (1) actions taken to improve waste disposal, (2) land use action legislation, (3) environmental impact statements, (4) protection of agricultural lands, (5) center city improvement efforts, (6) urban transportation systems, (7) preservation of historic features, and (8) energy conservation measures. Author

N74-14097# Sydney Univ. (Australia). Dept. of Mechanical Engineering.

ALTERNATIVE ENERGY SOURCES: A RESEARCH CHALLENGE

D. W. George 1973 21 p refs Presented at Symp. on the Energy Crisis: Implications for Secondary Ind., Sydney, 23 May 1973

(Conf-730560-1) Avail: AEC Depository Libraries HC $3.25

Methods of obtaining energy such as controlled thermonuclear fusion, direct solar conversion, or deep geothermal resources of energy are considered alternative energy sources in a global sense. In Australia, nuclear fission and natural gas are considered alternative or unconventional energy sources. One significant area of alternative energy source discussed is the energy currently dissipated to the environment in a nonproductive manner through the limitations of conventional conversion technology and which in overall terms often exceeds that actually used by a factor of two or three. Research into improved methods

of conversion includes areas such as MHD power generation and fuel cells. It also includes the concept of total industrial energy. Other alternative energy sources discussed include the natural sources of primary energy, namely, solar energy, tidal energy, wind, and geothermal energy. NSA

N74-14105# Tennessee Univ., Knoxville. Water Resources Research Center.
STRIP-MINED WATERSHED HYDROLOGIC DATA ACQUISITION STUDY
Bruce A. Tschantz 27 Aug. 1973 24 p refs
(Contract DI-14-31-0001-3843)
(PB-223558/8GA; OWRR-A-030-TENN(1); W73-14368; RR-35) Avail: NTIS HC $2.75 CSCL 08H

Remotely sensed aerial photography of two small strip mined East Tennessee watersheds was used as a means for obtaining land use information essential to econometric and hydrologic studies and for reclamation practice surveillance. 1:12,000 scale maps were produced for both watersheds from three color IR photographic flights. Other available high altitude photography and thermal imagery data were used to help map strip mine disturbed areas. The study demonstrated the usefulness of using low altitude IR photography for identifying, mapping, and measuring strip mine disturbance areas. (Modified author abstract) GRA

N74-14251# National Commission on Materials Policy, Washington, D.C.
COMPENDIUM OF UNIVERSITY FORUMS OF THE NATIONAL COMMISSION ON MATERIALS POLICY, MAY - JUNE 1972. A BACKGROUND DOCUMENT. NCMP FORUM ON TECHNOLOGICAL INNOVATION IN THE PRODUCTION AND UTILIZATION OF MATERIALS AT PENNSYLVANIA STATE UNIVERSITY, ON 19-21 JUNE 1972
Allen F. Agnew Aug. 1973 223 p refs
(PB-223679/2GA; NCMP-UF-6) Avail: NTIS HC $13.25 CSCL 05C

The Pennsylvania State University Forum discussed, under the general thrust of technological innovation, iron and steel, nonferrous production metallurgy, economics of substitution, polymeric and ceramic materials, coal and synthetic pipeline gas, and the state of the U. S. mineral position. GRA

N74-14377# Oak Ridge National Lab., Tenn.
ISOTOPE KILOWATT PROGRAM Quarterly Progress Report, period ending 31 Mar. 1973
A. P. Fraas and G. Samuels Sep. 1973 28 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4243) Avail: NTIS HC $3.50

Work in progress on developing a 1 to 10 kW radioisotopefueled energy conversion system for terrestrial and undersea use is described. Information is included on: facilities for decomposition testing of materials being evaluated as a working fluid for an organic Rankine cycle conversion system; decomposition test results which indicated that the gas volume evolved in capsules loaded with Dowtherm A was much higher than for capsules containing material produced by the Eastman Kodak Co.; performance testing of fusible insulation; and thermal and impact testing of fuel capsules. NSA

N74-14408# Office of Naval Research, London (England).
MHD FOR POWER GENERATION: THE VIEW OF A CHOSEN FEW
David F. Dyer 20 Apr. 1973 11 p
(AD-760342; ONRL-C-10-73) Avail: NTIS CSCL 20/9

A report of the ninth meeting of the international liaison group on magnetohydrodynamics power generation and the MHD closed cycle specialist meeting held in Geneva is given. The following topics are discussed various concepts proposed for MHD power generation the role of programs in various countries technology problems to be overcome in producing viable MHD power generation systems meetings and publications concerned with MHD for power generation. Author (GRA)

N74-14496*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLAR ENERGY POWER SYSTEM Patent Application
Billy K. Davis, inventor (to NASA) Filed 4 Dec. 1973 18 p
(NASA-Case-MFS-21628-1; US-Patent-Appl-SN-421702) Avail: NTIS HC $3.00 CSCL 20M

A solar energy vapor (freon) powered system is described for generating electrical energy in which a portion of the heat absorbed from the sun in daylight is stored for use during darkness by a thermal capacitor. A mass of Pyrone, having a high thermal capacity, liquifies when heat is applied to it and goes through a solidification process to provide a heat output. A highly efficient solar boiler is constructed, utilizing an anodized titanium surface and a particular combination of shaped boiler tubes and complementary reflectors. The overall efficiency of the system is further improved by an arrangement of heat recovery devices. NASA

N74-14499# Maryland Univ., College Park. Dept. of Mechanical Engineering.
PROCEEDINGS OF THE SOLAR HEATING AND COOLING FOR BUILDINGS WORKSHOP. PART 1: TECHNICAL SESSIONS, MARCH 21 AND 22
Redfield Allen Jul. 1973 231 p refs Workshop held Washington, D. C., 21-23 Mar. 1973
(Grant NSF GI-32488)
(PB-223536/4GA; NSF-RA/N-73-004) Avail: NTIS HC $3.00 CSCL 13A

The proceedings contain thirty-six technical papers on solar energy for U.S. building applications areas; namely, solar collectors, energy storage, domestic hot water heating, energy conservation and insulation, solar air-conditioning, and systems for solar heating and cooling. Some foreign activities are also reviewed. Each technical paper is a report on: proposed reseach, on-going research, proposed systems, or operating systems. Questions and answers from the discussion periods are included, as is an agenda and list of attendees. GRA

N74-14533*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FEASIBILITY OF SPACE DISPOSAL OF RADIOACTIVE NUCLEAR WASTE. 1: EXECUTIVE SUMMARY
Washington Dec. 1973 21 p
(NASA-TM-X-2911; E-7679) Avail: NTIS HC $2.75 CSCL 18G

This NASA study, performed at the request of the AEC, concludes that transporting radioactive waste (primarily long-lived isotopes) into space is feasible. Tentative solutions are presented for technical problems involving safe packaging. Launch systems (existing and planned), trajectories, potential hazards, and various destinations were evaluated. Solar system escape is possible and would have the advantage of ultimate removal of the radioactive waste from man's environment. Transportation costs would be low (comparable to less than a 5 percent increase in the cost of electricity) even though more than 100 space shuttle launches per year would be required by the year 2000. Author

N74-14651*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF WATER INJECTION ON NITRIC OXIDE EMISSIONS OF A GAS TURBINE COMBUSTOR BURNING NATURAL GAS FUEL
Nicholas R. Marchionna, Larry A. Diehl, and Arthur M. Trout Washington Dec. 1973 26 p refs
(NASA-TM-X-2959; E-7565) Avail: NTIS HC $3.00 CSCL 20M

The effect of direct water injection on the exhaust gas emissions of a turbojet combustor burning natural gas fuel was investigated. The results are compared with the results from similar tests using ASTM Jet-A fuel. Increasing water injection decreased the emissions of oxides of nitrogen (NOX) and increased the emissions of carbon monoxide and unburned hydrocarbons. The greatest percentage decrease in NOX with increasing water injection was at the lowest inlet-air temperature tested. The

effect of increasing inlet-air temperature was to decrease the effect of the water injection. The reduction in NOX due to water injection was almost identical to the results obtained with Jet-A fuel. However, the emission indices of unburned hydrocarbons, carbon monoxide, and percentage nitric oxide in NOX were not. Author

N74-14665 Oklahoma Univ., Norman.
MANERGY: AN ENERGY MANAGEMENT MODEL OF THE UNITED STATES FOR THE PREDICTION OF ENERGY DEMAND, RESOURCE CONSUMPTION, ENVIRONMENTAL EFFECTS, THE ASSESSMENT OF NEW TECHNOLOGY, AND ENERGY RESOURCE ALTERNATIVES Ph.D. Thesis
William Woodrow Talley, II 1973 723 p
Avail: Univ. Microfilms Order No. 73-23921

A computerized, systems-analysis model of the United States energy system has been developed and presented in code form. The model was designed for use as a management tool for assessing the consequences of resources and fuel alternatives, environmental controls, and technological advances. The assessment guidelines are presented as resource consumptions, environmental impacts, and balance of payment deficits to the year 2100. The model's capabilities and its inherent flexibility have been demonstrated for a baseline case and several alternatives. The base case was based on current energy use patterns, diversified resource development, projected fuel splits, population and gross national product projections, and reasonable advances in technology. The model has sufficient flexibility to include the results of the many existing and future studies on energy supply and demand. It quantifies the impacts of energy policy decisions into acceptable indices. As such, it has the capability to provide energy management guidelines necessary to make decisions on research and development priorities, legislation and regulations. Dissert. Abstr.

N74-14666 Institute of Gas Technology, Chicago, Ill.
REVIEW OF WORLD ENERGY SUPPLIES
Henry R. Linden London Intern. Gas Union 1973 40 p refs Presented at the 12th World Gas Conf., Nice, 1973
(IGU/A-1-73) Copyright. Avail: Issuing Activity

On the basis of currently definable technology and economics, world energy resources are insufficient to support historical rates of growth much beyond the middle of the 21st century. Further, conventional energy supply systems appear to be inadequate to support these growth rates under the expected limitations of the use of investment capital, raw materials, and air, water and land resources. New energy supply systems are discussed, including those for conversion of the lower grades of fossil fuels to nonpolluting fluid fuels and those employing hydrogen as the energy form. The state of technological development of the most promising fossil fuel conversion processes, and their thermal efficiencies, operating characteristics, investment costs, and prospects for industrial use are reviewed. Particular reference is made to the major commercialization effort already underway in the United States. The advantages of a hydrogen-based economy over complete electrification are discussed in detail. Although major emphasis is placed on the adequacy of fossil fuel and uranium resources in meeting future requirements and on delivery systems for these energy sources which are compatible with investment cost and environmental limitations, the major renewable energy resources are also reviewed briefly. Author

N74-14671 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
SECTION 4: PROPULSION AND ENERGY [FACHGEBIET 4: ANTRIEBE UND ENERGETIK]
In its DFVLR Annual Review, 1972 1972 p 199-281 refs

Problems of turbojet engines include engine noise and propulsion systems. Investigations on cascades in the trisonic regime, on problems of compressor stages, and on combustion with emission of pollutants are considered. Work on energy transfer and electrical propulsion for space vehicles, technological applications of plasma flows, as well as chemical and physical studies on rocket propulsion systems and their lubricants, is also included. Transl. by G.G.

N74-14682*# Techtran Corp., Glen Burnie, Md.
ECONOMICS OF AIR TRANSPORT
M. C. Alvarez Washington NASA Jan. 1974 20 p Transl. into ENGLISH from Rev. Aeron. Astron. (Spain), no. 388, Mar. 1973 p 173-183
(Contract NASw-2485)
(NASA-TT-F-15249) Avail: NTIS HC $3.00 CSCL 05C

The costs of air transportation are analyzed, giving attention to direct and indirect costs. Systems of cost analysis are considered together with the effect of individual parameters on the costs of operation. Attention is given to cruising speed, flight time, total operational time, aircraft design, and aircraft manufacture. A first estimation of operational costs has to take into account the weight of the aircraft, the weight of the fuel needed during the flight, the fuel reserve, and questions of the selection of one of three operational approaches in conducting the flight. Direct costs of the flight operation are discussed in detail together with expenses for maintenance, inspection, depreciation, and fuel costs. Indirect expenses include costs of administration, publicity, and airport charges. Author

N74-14684# RAND Corp., Santa Monica, Calif.
ENERGY POLICY RESEARCH AND THE STATE OF FLORIDA
William E. Mooz Aug. 1973 17 p Sponsored by NSF and the State of Calif.
(P-5078) Avail: NTIS HC $3.00

A discussion of state energy problems and the research required to support the selection of policies designed to solve them. The example chosen is the State of Florida, in which future energy demands may be in conflict with its unique environment, and the basis for the discussion is Rand's past and present energy work for the National Science Foundation and the State of California. Author

N74-14686# Interior Dept., Washington, D.C. Office of Energy Conservation.
FEDERAL AGENCY ENERGY CONSERVATION Quarterly Report, Jul. - Sep. 1973
Dec. 1973 13 p *ref*
(QR-1) Avail: NTIS HC $3.00

On June 29, 1973, the President ordered the Federal government to achieve a 7 percent reduction in its anticipated energy consumption over the succeeding 12 months. While there are more than 80 departments and agencies within the Federal government, nearly all of the energy is consumed by the 11 cabinet departments and five large agencies. The focus of the effort has been in these 16 units. In all, a total of 20.8 percent savings in energy was made when compared to anticipated use during FY 1974. Monetary savings amounted to about $160 million. The Department of Defense is the largest user of energy in the government (86 percent), and it effected the greatest savings, mostly in its diminished use of automotive and aviation fuels. Seven other agencies met or exceeded the goal. Author

N74-14687# Interior Dept., Washington, D.C. Office of Energy Conservation.
FEDERAL ENERGY CONSERVATION Interim Report
Oct. 1973 33 p
Avail: NTIS HC $3.75

This interim report estimates total energy use in the sixteen major Federal agencies during Fiscal Year 1973. It will provide a baseline against which to measure progress in succeeding years. The sixteen largest agencies consumed 2.26 quadrillion British thermal units of energy in Fiscal Year 1973, of which about 60 percent was for vehicle and equipment operations and about 40 percent for building and facility lighting, heating and cooling. Specific actions being taken to achieve the targeted reduction in energy use during the current fiscal year are described. As expected, all agencies will seek to reduce lighting, heating and cooling, as these are the easiest to put into motion, monitor, and adjust as experiences dictate. A host of other ideas have also surfaced, however, including reduced travel and shifts to more energy-conservative ways to travel, employee participation through use of public transport, bicycles, and the like. Author

N74-14688# National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.
ENERGY CONSERVATION THROUGH EFFECTIVE UTILIZATION
Charles A. Berg Feb. 1973 55 p refs
(NBSIR-73-102) Avail: NTIS HC $4.75

In two major sectors of the economy (building services and industrial processes), accounting for approximately 75 percent of the total national energy consumption, energy utilization was found to be inefficient. It is estimated that in these two sectors, as much as 25 percent of the energy consumed annually by the nation as a whole may be lost through ineffective practices. Possible reasons for the existence of ineffective utilization are considered, and possible means of improving effectiveness of ultilization are discussed. The levels of effort to promote effective utilization of energy are identified as: (1) the effective use of present fuels in present processes, (2) utilization of presently unused energy sources, and (3) more effective investment of energy in durable and maintainable products. Author

N74-14690# Committee on Banking and Currency (U.S. House).
EPA POLLUTION REGULATIONS AND FUEL SHORTAGE: THE IMPACT ON MASS TRANSIT
Washington GPO 1973 689 p refs Hearings before Comm. on Banking and Currency, 93d Congr., 1st Sess., 26, 30, and 31 Jul. 1973
Avail: Subcomm. on Urban Mass Transportation

A hearing was held before the Subcommittee on Urban Mass Transportation of the Committee on Banking and Currency of the House of Representatives to discuss the Environmental Protection Agency pollution regulations and the fuel shortage. Specific emphasis was placed on the impact of the fuel shortage on mass transportation and recommendations for improving mass transportation as an energy saving measure. Testimony from representatives of various petroleum companies was presented to show the causes for the current fuel shortages and steps being taken to improve the situation. The effects of the proposals for reducing fuel shortages on the quality of the environment are emphasized. Author

N74-14691# Select Committee on Small Business (U. S. House).
ENERGY CRISIS AND SMALL BUSINESS
GPO Washington 1973 65 p refs Presented to Select Comm. on Small Business, 93d Congr., 1st Sess., 13 Jul. 1973
Avail: Select Comm. on Small Business

Results are presented of an investigation of the petroleum industry made by the Federal Trade Commission. The investigation looks into the growing shortage of gasoline and its effects on small businesses, especially the independent gas station operator. The origins and nature of the present gasoline shortage can only be understood with reference to the structure, conduct and performance of the entire industry. The focus of the discussion includes: background and methodology of the current petroleum investigation; structure, conduct, and performance of the petroleum industry; and Committee staff conclusions. A.L.

N74-14692# Committee on Commerce (U. S. Senate).
ENERGY RESEARCH AND DEVELOPMENT, 2
Washington GPO 1973 166 p Hearing on S. 357 before Comm. on Com., 93d Congr., 1st Sess., 1 Mar. 1973
Avail: Comm. on Com

A Congressional hearing was conducted to establish a Federal power research and development program to increase efficiencies of electric energy production and utilization, reduce environmental impacts, develop new sources of clean energy, and reduce the use of fossil fuels. The various features of the energy bill are: (1) establishment of a Federal Power Research and Development Board, (2) establishment of a trust fund, (3) authorization of a research program, and (4) definition of penalties for failure to comply with the provisions of the act. The report consists primarily of testimony by witnesses concerning the utilization of energy and new energy sources. Author

N74-14693# Committee on Commerce (U. S. Senate).
NATIONAL FUELS AND ENERGY CONSERVATION ACT OF 1973
Washington GPO 1973 177 p refs Rept. on S.2176 presented by Comm. on Com. at the 93d Congr., 1st Sess., 16 Nov. 1973
(S-Rept-93-526) Avail: US Capitol, Senate Document Room

The National Fuels and Energy Conservation Act of 1973 is reported. The purpose of the bill is to declare a national policy of conserving energy resources through more efficient conversion and use, to make energy conservation an integral part of all programs of the Federal Government, and to encourage an energy conservation ethic among American industry and the consuming public. The methods by which these goals are to be achieved are specified. Examples of energy consumption by various components of the national economy are provided. Author

N74-14695# Oak Ridge National Lab., Tenn.
ELECTRIC ENERGY REQUIREMENTS FOR ENVIRONMENTAL PROTECTION
E. Hirst and T. Healy 1973 20 p refs Presented at Conf. on Energy, Demand, Conserv., and Inst. Probl., Cambridge, Mass., 12 Feb. 1973 Sponsored in part by AEC and NSF Prepared in cooperation with Santa Clara Univ., Calif.
(Conf-730205-4) Avail: NTIS HC $3.00

The amount of electricity needed for (or saved by) operation of several environmental quality strategies is examined. These strategies include: electric mass transit, waste water treatment, solid waste disposal, air pollution control, waste heat dissipation, and electricity conservation. Energy requirements of existing electric mass transit systems are compared with the new BART system, buses, and autos. Electric energy costs, as a function of plant size, are examined for primary/secondary sewage plants. Electricity costs and savings are computed for solid waste disposal, recycle, and use as fuel. Electricity needs for air pollution control at stationary sources and from motor vehicles are evaluated. Electricity needs for use of cooling towers at power plants are reviewed. Finally, potential energy savings which reduce air and thermal pollution levels are examined. The electricity required to meet the needs discussed here-based on the assumptions in this study-are small relative to total kilowatt-hour consumption. Author (NSA)

N74-14749# Institute of Transport Aviation, Paris (France).
AVIATION NEEDS AND PUBLIC CONCERNS
Emile VanLenner 29 Oct. 1973 22 p Presented at 7th Dr. Albert Plesman Mem. Lecture, Delft, Netherlands, 29 Oct. 1973
Avail: NTIS HC $3.25

Economic profits in the continuous growth of civil aviation are weighed against the social impact on human life in the building of Europe's transportation network. Problems of aircraft noise, demands on energy resources, airport congestion, and consequently of environmental control are considered. G.G.

N74-14784* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF MAKING SILICON SOLAR CELL ARRAY
Patent
Americo F. Forestieri, Jacob D. Broder, and Daniel T. Bernatowicz, inventors (to NASA) Issued 25 Dec. 1973 4 p Filed 26 Oct. 1970 Supersedes N71-29048 (09 - 16, p 2541)
(NASA-Case-LEW-11069-1; US-Patent-3,780,424; US-Patent-Appl-SN-83816; US-Patent-Class-29-572; US-Patent-Class-136-89; US-Patent-Class-29-588) Avail: US Patent Office CSCL 10C

A heat sealable transparent plastic film, such as a flourinated ethylene propylene copolymer, is used both as a cover material and as an adhesive for mounting a solar cell array to a flexible substrate. Official Gazette of the U.S. Patent Office

N74-14785*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPINGING JET SEPARATORS FOR LIQUID METAL

MAGNETOHYDRODYNAMIC POWER CYCLES
David W. Bogdanoff 1 Dec. 1973 155 p refs Sponsored in part by NAS-NRC
(Contract NAS7-100)
(NASA-CR-136552; JPL-TM-33-621) Avail: NTIS HC $9.75 CSCL 10A

In many liquid metal MHD power cycles, it is necessary to separate the phases of a high-speed liquid-gas flow. The usual method is to impinge the jet at a glancing angle against a solid surface. These surface separators achieve good separation of the two phases at a cost of a large velocity loss due to friction at the separator surface. This report deals with attempts to greatly reduce the friction loss by impinging two jets against each other. In the crude impinging jet separators tested to date, friction losses were greatly reduced, but the separation of the two phases was found to be much poorer than that achievable with surface separators. Analyses are presented which show many lines of attack (mainly changes in separator geometry which should yield much better separation for impinging jet separators).
Author

N74-14788*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE NASA-LEWIS TERRESTRIAL PHOTOVOLTAICS PROGRAM
Daniel T. Bernatowicz 1973 8 p refs Presented at 10th Photovoltaics Specialists Conf., Palo Alto, Calif., 13-15 Nov. 1973; sponsored by IEEE
(NASA-TM-X-71491; E-7828) Avail: NTIS HC $3.00 CSCL 10A

Research and technology efforts on solar cells and arrays having relevance to terrestrial uses are outline. These include raising cell efficiency, developing the FEP-covered module concept, and exploring low cost cell concepts. Solar cell-battery power systems for remote weather stations have been built to demonstrate the capabilities of solar cells for terrestrial applications.
Author

N74-14791# Council on Environmental Quality, Washington, D.C.
ENERGY AND THE ENVIRONMENT: ELECTRIC POWER
Aug. 1973 66 p refs
(PB-223326/0GA) Avail: NTIS SOD HC $0.85 as 4111-00019 CSCL 13B

The conflict between energy needs and the environment poses a problem that must be solved by understanding the factors that influence demands for energy and by developing energy systems that meet these demands with minimal damage to the environment. This report considers the elements underlying our growing demand for energy and the environmental implications of the complex energy systems for meeting this demand. It focuses on electric energy because of the particularly rapid growth in this sector.
GRA

N74-15020*# Servicio Geologico de Bolivia, La Paz.
PETROLEUM EXPLORATION SUBPROGRAM: GEOLOGICAL INTERPRETATION OF PROPORTIONAL IMAGERY FROM ERTS-A SATELLITE [SUB PROGRAMA EXPLORACION PETROLERA: INTERPRETACION GEOLOGICA DE IMAGENES PROPORCIO NADAS POR EL SATELITE ERTS-A]
C. E. Brockmann, Principal Investigator and Carlos Vargas Flores 30 Nov. 1973 14 p In SPANISH Sponsored by NASA ERTS
(E74-10213; NASA-CR-136476) Avail: NTIS HC $3.00 CSCL 08G

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

N74-15070*# Scientific Translation Service, Santa Barbara, Calif.
OIL EXPLORATION SUBPROGRAM GEOLOGICAL INTERPRETATION OF IMAGES PROVIDED BY THE ERTS-A SATELLITE
C. Vargas F. Washington NASA Jan. 1974 10 p Transl. into ENGLISH of "Sub Program a Exploracion Petrolera, Interpretacion Geologica de Imagenes Proporcio Nadas por el Satelite ERTS-A", Servicio Geol. de Bolivia, Programa del Satelite Technol. de Resursos Nat., La Paz, report, 1973 9 p
(Contract NASw-2483)
(NASA-TT-F-15265) Avail: NTIS HC $3.00 CSCL 08G

Geological interpretation of three black and white images provided by the ERTS-A satellite is discussed. The study was to determine to what extent these images may be used to compile geological survey maps, using conventional photointerpretation techniques in the process.
Author

N74-15226 Geological Survey, Washington, D.C.
BITUMEN-BEARING ROCKS
W. B. Cashion *In its* US Mineral Resources 1973 p 99-104 refs

Bitumen bearing rocks occur in many areas in the United States, but few deposits have been exploited or evaluated for their total energy potential. The evaluated deposits are a relatively small part of North American resources of bitumen bearing rocks and probably will not contribute to U.S. energy needs before 1985. Studies of known but unappraised deposits, especially extensive subsurface tar sands, will greatly increase total resource estimates. Technological advancements are needed in tar sand processing, especially for in situ recovery methods.
Author

N74-15230 Geological Survey, Washington, D.C.
COAL
Paul Averitt *In its* US Mineral Resources 1973 p 133-142 refs

World coal resources are estimated to total 16,830 billion tons, of which 9,500 billion tons is classed as identified, and 7,330 billion tons is classed as hypothetical. The United States contains about one-fifth of estimated total world resources. On a uniform Btu basis, U.S. coal resources are larger than the combined domestic resources of petroleum, natural gas, oil shale, and bituminous sandstone. The prolonged future need for energy in ever increasing quantities, and the prospect of decreasing availability of and increased prices for petroleum and natural gas, have focused very sharp attention on coal as an alternative source of synthetic gas, liquid fuels, and lubricants.
Author

N74-15240 Geological Survey, Washington, D.C.
GEOTHERMAL RESOURCES
L. J. P. Muffler *In its* US Mineral Resources 1973 p 251-261 refs

The geothermal resource base is defined as all the heat above 15 C in the earth's crust, but only a small part of this resource base can properly be considered as a resource. The magnitude of the geothermal resource depends on the evaluation of many physical, technological, economic, environmental, and governmental factors. The physical factors that control the distribution of heat at depth can be evaluated, at least rudely. More tenuous are the assumptions of technology, economics, and governmental policy. These assumptions are critical to geothermal resource estimation.
Author

N74-15257 Geological Survey, Washington, D.C.
NUCLEAR FUELS: URANIUM
Warren I. Finch, Arthur P. Butler, Jr., Frank C. Armstong, and Albert E. Weissenborn *In its* US Mineral Resources 1973 p 456-468 refs

Uranium is an important energy resource, and even though the demand for its use in nuclear-powered electrical generators was only moderate in 1972, near-future needs are expected to be very great. In the United States, large exploitable deposits are found chiefly in sandstone and associated rocks. In other parts of the world, large deposits are mainly in quartz-pebble conglomerate of early Precambrian age and in veins. Domestic resources recoverable at present prices totaled about 273,000

tons of U3O8 at the end of 1971, and the total for all countries reporting resources is about 1.6 million tons of U3O8. These supplies are sufficient to last into the 1980's. Needs beyond 1980 are so great that tremendous efforts in exploration, and research in ore-finding techniques, will be required to discover new recoverable resources. Author

N74-15258 Geological Survey, Washington, D.C.
NUCLEAR FUELS: THORIUM
Mortimer H. Staatz and Jerry C Olson *In its* US Mineral Resources 1973 p 468-476 refs

Although the current demand for thorium is small, future needs may be large as a fuel for nuclear generators. The occurrence of thorium is widespread, and large deposits are found in beach and fluviatile placers, veins, sedimentary rocks, alkalic igneous rocks, and carbonatities. Thorium has been produced principally from monazite from beach and fluviatile placers, although in the 1950's and early 1960's monazite from a unique vein in South Africa was the chief source. In the early 1970's monazite was recovered principally as a byproduct of titanium or tin mining in India, Brazil, Australia, and Malaysia. A large thorium resource in the conglomerates at the Elliot Lake uranium mines, Canada, could become an important byproduct if demand increases. Thorium resources are not well known because of the small demand, but are sufficient for many years in the future. The development of a variable domestic thorium mining industry is dependent on a large enough increase in demand to exceed the amount obtainable as byproducts from other types of deposits. Author

N74-15259 Geological Survey, Washington, D.C.
OIL AND GAS
T. H. McCulloh *In its* US Mineral Resources 1973 p 477-496 refs

The oil and gas resources of the United States are examined. Organic carbon, hydrocarbons, and producible hydrocarbon accumulations are discussed from the standpoint of distribution and accessibility. All estimates of petroleum and natural gas resources depend upon prior exploration results and are considered unreliable. Changing economic incentives, technologic advances, enlarged prospecting areas, and creative thinking all increase exploration effectiveness. Data are presented to show variations in produced and proven reserves of oil for the U.S. and the world. Author

N74-15260 Geological Survey, Washington, D.C.
OIL SHALE
William C. Culbertson and Janet K. Pitman *In its* US Mineral Resources 1973 p 497-503 refs

Oil shale is a fine-grained sedimentary rock containing organic matter that has the property of yielding substantial amounts of oil when heated in a closed retort (destructive distillation) but that is mostly insoluble in ordinary petroleum solvents. The United States has tremendous quantities of oil shale, principally in the Green River Formation in Colorado, Utah, and Wyoming. These three States contain identified resources of about 1.8 trillion barrels of oil in oil shale that yields an average of 15 or more gallons per ton. However, no oil-shale venture has been a commercial success in the United States in the last 100 years, despite the fact that other countries of the world have for many years burned oil shale as a fuel, or have produced oil or combustible gas from the shale. Author

N74-15261 Geological Survey, Washington, D.C.
PEAT
Cornelia C. Cameron *In its* US Mineral Resources 1973 p 505-513 refs

The physical characteristics of peat that are important to modern uses are related to the geologic and physiographic settings of the deposits. Research on methods of prospecting for peat focuses on establishing geologic controls for the types of peat defined in the classification adopted by the American Society for Testing and Materials in 1969. This new classification is designed principally to characterize different types of peat by means of such physical properties as amount, kind, and size of fibers and quantity of ash. One or more types of peat occur in all but about 8 of the 50 States in magnitudes ranging from hundreds of thousands to tens of billions of tons. The demand for specific physical qualities in peat related to modern uses and to standards for sales is largely responsible for national consumption of more peat than is produced domestically. Author

N74-15290# National Commission on Materials Policy, Washington, D.C.
COMPENDIUM OF UNIVERSITY FORUMS OF THE NATIONAL COMMISSION ON MATERIALS POLICY, MAY - JUNE 1972. A BACKGROUND DOCUMENT: UNIVERSITY FORUM ON NATIONAL MATERIALS POLICY, MASSACHUSETTS INSTITUTE OF TECHNOLOGY ON 30 MAY - 2 JUNE 1972
Allen F. Agnew Aug. 1973 733 p refs
(PB-223678/4GA; NCMP-UF-3) Avail: NTIS HC $38.75 CSCL 05C

The Massachusetts Institute of Technology Forum covered six subjects: materials problems in energy conversion, research in advanced materials; national policy on resources, waste recycling, and education and a national materials policy. Specialty metals, coal conversion, electronic materials, aerospace structural materials, biomaterials, and polymeric materials were all considered in depth as were recycling of solid refuse and the effect of recycling on materials supply. Relationships to man were examined via the topic human ecology and compatible technology. GRA

N74-15291# National Bureau of Standards, Washington, D.C. Inorganic Materials Div.
INVESTIGATION OF VISCOUS FLOW IN GLASS DURING PHASE SEPARATION Annual Report, Nov. 1972 Jun. 1973
J. H. Simmons, S. A. Mills, A. Napolitano, D. H. Blackburn, and W. K. Haller Sep. 1973 44 p refs
(Contract NAonr-12-73; NR Proj. 032-536; NBS Proj. 31304) (AD-767920; NBS-TN-792; AR-1) Avail: NTIS MF $1.45; SOD HC $0.65 as C13.46:792 CSCL 11/2

The isothermal viscosity of two borosilicate glasses, of which one is a commercial glass widely used for chemical glassware, shows a large increase (4 to 5 orders of magnitude) with heat-treatment time (ranging up to 100,000 min) near the annealing point. The two glasses have similar compositions, but differ greatly in their phase separation characteristics. Electron micrographs are used to analyze the development of microstructure during the suspected phase separation. In both glasses, it is found that the structure development is primarily responsible for the viscosity increase. An analysis of the data, and a theoretical interpretation of the effect are presented. Author (GRA)

N74-15447 Wyoming Univ., Laramie.
LOW ENERGY GAS UTILIZATION IN COMBUSTION GAS TURBINE Ph.D. Thesis
John M. Cegielski, Jr. 1973 335 p
Avail: Univ. Microfilms Order No. 73-25541

Gases having a net heat of combustion less than 150 Btu per standard cubic foot were successfully used to partially fuel a modified 11.2 kilowatt combustion gas turbine generator set. A modification to the combustion gas turbine engine enabled the low energy gases to be substituted for a portion of the compressed air normally supplied to the combustion chamber. Two sets of field tests were conducted. The first test set used the exhaust gas (Sloss gas) from a secondary oil recovery operation. The second set used the stack gas from an experimental oil-shale retort. Twelve stack gas combustion efficiency tests were conducted. An average of 70.3% of the stack gas net heat of combustion which ranged from 28.9 to 51.5 Btu per standard foot was utilized by the combustion gas turbine engine. Thirty-six Sloss gas combustion efficiency tests were

conducted. An average of 70.1% of the Sloss gas net heat of combustion which was 147 Btu per standard cubic foot was utilized by the combustion gas turbine engine. Dissert. Abstr.

N74-15448# Oak Ridge National Lab., Tenn.
STORAGE AND TRANSPORTATION OF SYNTHETIC FUELS. A REPORT TO THE SYNTHETIC FUELS PANEL
J. E. Johnson Sep. 1972 20 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4307) Avail: NTIS HC $3.00

A review of the problems associated with the storage and transportation of energy by the major candidate synthetic fuel systems hydrogen and hydrogen-derived fuels, such as ammonia and methanol is presented. Particular emphasis has been placed on the identification of limiting technologies and on areas in which research and development efforts should be undertaken to contribute solutions to the nation's growing problems of energy resources, transmission and conversion. Author (NSA)

N74-15449# Oak Ridge National Lab., Tenn.
PROSPECTS FOR HYDROGEN AS A FUEL FOR TRANSPORTATION SYSTEMS AND FOR ELECTRICAL POWER GENERATION
W. J. D. Escher Sep. 1973 56 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4305) Avail: NTIS HC $5.00

The potential application of hydrogen, produced from non-fossil domestic sources, is examined for applicability to the transportation and electrical generation sectors. The characteristics of hydrogen as a gas and as a cryogenic liquid are noted; cost trends are presented. Ground, water, and air transportation modes and systems are individually examined with respect to a potential conversion to hydrogen fuel. Electrical generation systems, both conventional and unconventional, are assessed similarly. Hydrogen's potential for transmission and storage of electrical energy is cited. From these findings, a detailed list of recommended study, research and development, and demonstration system topics is given toward implementing an eventual conversion of transportation and the electrical utilities to hydrogen fuel. Author (NSA)

N74-15661# Interior Dept., Washington, D.C.
ASSESSMENT OF GEOTHERMAL ENERGY RESOURCES
Dallas L. Peck 25 Sep. 1972 86 p refs
Avail: NTIS HC $6.50 CSCL 20M

A study was conducted to develop and assessment of the state of the art and to recommend a research program to provide the basis for establishing the proper role of geothermal resources. It is expected that geothermal resources can accomplish the following: (1) provide additional energy to alleviate the Nation's impending storage, (2) water to supplement present supplies, and (3) mineral resources. It was recommended that an expanded program be conducted to assess the magnitude, type, and location of the Nation's geothermal resources and to spur the development of improved technology for discovering, evaluating, and utilizing the resources. The significant accomplishments to be realized by such a program are defined. Author

N74-15667 California Inst. of Tech., Pasadena. Environmental Quality Lab.
TIME FACTORS IN SLOWING DOWN THE RATE OF GROWTH OF DEMAND FOR PRIMARY ENERGY IN THE UNITED STATES
Lester Lees and Mingin Philip Lo 1 Jun. 1973 35 p refs
(Grant NSF GI-29726)
(EQL-7) Copyright. Avail: Issuing Activity

The time scales involved in slowing down the rate of growth of primary energy consumption in the U.S., as one component of an overall energy/environment strategy designed to limit the required volume of energy imports from overseas are discussed. Two important energy-consuming sectors of the economy are chosen as illustrative examples: (1) the automobile as a total system (25%); (2) space heating, air conditioning and water heating in the residential sector (22%). These two components of an energy-conserving policy taken together would bring the growth rate in U.S. primary energy demand down from its present rate of 4.2% per year to about 2.8% per year by 1985. Reductions in the annual growth rate of the remaining 50% of U.S. primary energy consumption that seem quite feasible would bring the overall growth rate down to about 2.5% per year by 1985. If reductions in growth rate of this magnitude could in fact be achieved, energy imports would peak in the mid-1980s at a level no higher than about 60% above the present (1973) volume of imports. Incentives and disincentives designed to bring about this slowdown in the rate of U.S. energy consumption are discussed. Author

N74-15679# Commission of the European Communities, Brussels (Belgium).
THE ENERGY SITUATION IN THE COMMUNITY, SITUATION 1972, FORECASTS 1973
9 Feb. 1973 55 p
Avail: NTIS HC $4.75

An analysis of the world energy situation in 1972 and the outlook for 1973 are presented. The development of an energy policy which would improve the quality of information available concerning energy requirements and problems is discussed. The market situation in 1972 and its consequences are examined for the specific cases of petroleum, coal, gas, electricity, and nuclear energy. Tables, charts, and graphs are included to show consumption rates and predicted consumption of the significant natural resources used for energy conversion. Author

N74-15680# Committee on Science and Astronautics (U. S. House).
INDIVIDUAL ACTION FOR ENERGY CONSERVATION
Washington GPO Jun. 1973 8 p Presented to Comm. on Sci. and Astronaut., 93d Congr., 1 st Sess., 31 May 1973
Avail: Subcomm. on Energy

Prompted by a concern for conserving the limited energy supplies, suggestions are given for saving money and using less energy. Ideas are presented for: driving and purchasing automobiles; cooling and heating residential homes; using home appliances; and vacationing. K.M.M.

N74-15681# National Economic Research Associates, Inc., New York.
ENERGY CONSUMPTION AND GROSS NATIONAL PRODUCT IN THE UNITED STATES: AN EXAMINATION OF A RECENT CHANGE IN THE RELATIONSHIP
1971 29 p refs
Copyright. Avail: NTIS HC $3.50

The ratio of aggregate energy consumption to Gross National Product (the energy/GNP ratio) underwent a long-term secular decline during the period 1947-1966, following a trend that began in the 1920s. Since 1966, however, the trend has reversed and the ratio has shown an uninterrupted increase. If the trend prior to 1966 had persisted, energy consumption in 1970 would have been lower by an amount greater than the total electric utility consumption of coal in that year. An analysis of the possible reasons for this trend reversal indicates that it cannot be ascribed to any single cause but that a major part of it is apparently the result of: (1) the increasing relative importance of nonenergy uses of the fuels, (2) a tapering off in the year-to-year improvement in thermal efficiency at central power stations, and (3) the increasing relative importance of air conditioning and electric heating. The net result of these factors is a tendency toward a sustained high growth rate in aggregate energy consumption and a consequent increase in the energy/GNP ratio except in years of high GNP growth rate. Author

N74-15682# Committee on Government Operations (U. S. House).
CONSERVATION AND EFFICIENT USE OF ENERGY, PART 1
Washington GPO 1973 469 p refs Hearings before Comm. on Govt. Operations and Comm. on Sci. and Astronaut., 93d

Congr., 1st Sess., No. 14, 19 Jun. 1973 Prepared in cooperation with Comm. on Sci. and Astronaut.
Avail: SOD HC $3.05

A Congressional hearing on the conservation and efficient use of energy resources is presented. The organization and functions of the Office of Energy Conservation are described. Current research and development projects being conducted by the government to conserve energy resources by increasing the efficiency of converting heat energy to electricity are explained. Improvements and developments in surface transportation systems for increased efficiency are reported. Specific research and development projects are defined to show the scope of the effort, the FY 1973 funding, and the proposed FY 1974 funding. P.N.F.

N74-15684# Committee on Interior and Insular Affairs (U. S. Senate).
FACTORS AFFECTING THE USE OF COAL IN PRESENT AND FUTURE ENERGY MAKERS
Washington GPO 1973 46 p refs Presented to Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 1973 Prepared by Library of Congr.
Avail: Comm. on Interior and Insular Affairs

A bakground paper to inform members of Congress on the factors affecting the use of coal in present and future energy markets is presented. The subjects discussed are: (1) coal reserves, (3) mining regulations, (4) air pollution control for coal burning utilities, and (5) the policy issues which must be considered in the Federal government for adequate exploitation of coal supplies. Tables are included to show yearly consumption, forecasts of 1980 demand, potential domestic supply available, and coal characteristis by states. P.N.F.

N74-15685# Geological Survey, Washington, D.C.
ENERGY RESOURCES OF THE UNITED STATES
P. K. Theobald, S. P. Schweinfurth, and D. C. Duncan 1972 30 p refs
(CIRC-650) Avail: NTIS MF $1.45; USGS HC no charge

The accompanying diagrams present the U.S. Geological Survey estimates of the United States resources of coal, petroleum liquids, natural gas, uranium, geothermal energy, and oil from oil shale. The estimates have been complied by a group of specialists familiar with each of the energy sources, each using techniques he considers most useful for estimating his particular energy source. The short text accompanying each diagram outlines the method of estimation or the source of the estimate and defines the characteristics of each estimate. Where appropriate, comparisons with other estimates are also given. Resources, as used here, include all rocks and minerals (including their contained heat for geothermal sources) potentially usable by man. Author

N74-15686# Committee on Interior and Insular Affairs (U. S. Senate).
LEGISLATIVE AUTHORITY OF FEDERAL AGENCIES WITH RESPECT TO FUELS AND ENERGY: A STAFF ANALYSIS
Washington GPO 1973 240 p refs Presented to Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 1973
Avail: SOD HC $1.65

A Congressional committee report on the authority of Federal agencies with respect to fuels and energy emergency management is presented. It is stated that more than forty Federal departments, agencies, and regulatory commissions affect energy matters. The reorganization and restructuring of these Federal energy activities is a principal concern of the Committee involved in the energy study. A staff analysis is developed to show the statutory authority of Federal agencies and the implementation of that authority in the energy field. The staff analysis is based on a questionnaire which requested the following information: (1) goals and objectives of the energy and (2) a summary of their respective roles within the overall body of Federal fuels and energy policy formulation and implementation. The term Energy Policy is define as all basic legal authority which authorized programs or policies designed to assist, to promote, to regulate, or to impose constraints on the range of alternatives which local, State, Federal, or private descision makers may consider in their effort to meet existing and future energy demands. Author

N74-15687# Committee on Interior and Insular Affairs (U. S. Senate).
THE PRESIDENT'S ENERGY MESSAGE AND S. 1570
Washington GPO 1973 869 p refs Hearing pursuant to S. Res. 45 before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 1 May 1973
Avail: Comm. on Interior and Insular Affairs

The message of the President of the United States concerning energy recources which was delivered to the Committee on Interior and Insular Affairs on 1 May, 1973 is presented. The subjects discussed are: (1) the National energy policy, (2) developing domestic energy resources, (3) importing fuels to meet demands, (4) conserving energy, (5) research and development projects for energy sources, and (6) international cooperation. The message prepared the development of legislation to authorize the President to allocate energy and fuels when he determines and declares that extraordinary shortages or dislocations in the distribution of energy and fuels exist or are imminent. The legislation provides for the delegation of authority to the Secretary of the Interior to carry out the provisions of the bill. Author

N74-15688# Committee on Interior and Insular Affairs (U. S. Senate).
SUMMARY OF THE ENERGY CONSERVATION AND DEVELOPMENT RECOMMENDATIONS CONTAINED IN THE FINAL REPORT OF THE NATIONAL COMMISSION ON MATERIALS POLICY, JUNE 1973: A BACKGROUND PAPER
Washington GPO 1973 35 p refs Presented to Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., Jun. 1973 Prepared by Library of Congr.
Avail: SOD HC $0.35 Domestic Post Paid or $0.20 GPO Bookstore

A summary of the energy conservation and development recommendations was presented to the U.S. Congress pursuant to Senate Resolution 45. The summary was based on the final report of the National Commission on Materials Policy. The seven functions which are to be served by the national materials policy are defined. The major theme of the report is the need to strike a balance between producing goods and protecting the environment. A second theme is the need for a balance between the supply of materials and the demand for their use by increasing primary materials production. Specific recommendations are submitted for the following: (1) disposition of wastes, (2) development of energy sources, (3) land use, (4) water use, and (5) international aspects of the materials policy. The requirements for science and technology, research and development, and inventories of materials are included. P.N.F.

N74-15689# Westinghouse Electric Corp., East Pittsburgh, Pa. Fuels and Energy Systems.
THE EFFECT OF FUEL AVAILABILITY ON FUTURE R AND D PROGRAMS IN POWER GENERATION
L. G. Hauser, W. H. Comtois, and R. R. Boyle Apr. 1972 20 p refs Presented at Am. Power Conf., Chicago, 18-20 Apr. 1972
Avail: NTIS HC $3.00

An analysis of the energy requirements of various sectors of the U.S. economy is presented. Charts are developed to show trends in energy consumption and predictions of energy availability. The use of the load duration curve as a method for analyzing future electrical energy production is explained. Graphs are included to show the distribution of energy generated by capacity factor of the generating plants. Future research and development programs with emphasis on nuclear fuels and breeder reactors as a solution to the energy shortage are proposed. The creation and utilization of new methods for exploiting coal reserves are stressed. Author

N74-15690# Committee on Interior and Insular Affairs (U. S. Senate).
ENERGY CONSERVATION, PART 1
Washington GPO 1973 482 p refs Hearings pursuant to S. Res. 45 before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 22-23 Mar. 1973

Avail: Comm. on Interior and Insular Affairs

A Congressional hearing on the role of energy conservation in the National energy policy was conducted. The hearing assisted members of Congress and other interested parties in their understanding of the issues inherent in the formulation of a long-term National Energy Policy which assures the continued welfare of the Nation including balance growth safeguarding and enhancing the quality of the environment, and national security. The questions addressed in the hearings were directed toward: (1) the general issue of energy conservation, (2) detailed questions and policy issues, (3) requirements of the transportation sector, (4) requirements of the residential/commercial sector, (5) requirements of the industrial sector, and (6) requirements of the electric utilities. P.N.F.

N74-15691# Bureau of Mines, Bartlesville, Okla. Energy Research Center.

SELECTED LIST OF BUREAU OF MINES PUBLICATIONS ON PETROLEUM AND NATURAL GAS, 1961-1970

V. Vern Hutchinson [1972] 165 p refs Supplement to BM-IC-8240

(BM-IC-8534; BM-IC-8240-Suppl) Avail: SOD HC $1.75

This selected list contains 829 entries with citations to publications related to petroleum and natural gas, which were released during the 1961-1970 period. Some entries are multiple in nature, resulting in a total of 881 citations. The purpose of this bibliography is to provide a selective review of publications related to petroleum and natural gas during the 1961-1970 period. The publications are grouped under broad headings as shown in the contents section. Indexes, placed at the end of the list, identify publications by author with short title, detailed subject approaches, and report numbers. As the title indicates, the publications included have, for the most part, a direct and specific relationship to petroleum and natural gas. In some selections, however, the reports included are applicable to other energy fuels as well. Author

N74-15695# Mitre Corp., McLean, Va.

ENERGY, RESOURCES AND THE ENVIRONMENT

Charles A. Zraket 24 Oct. 1972 38 p Revised

(M72-180-Rev-1) Avail: NTIS HC $4.00

The proceedings of eight symposia on the subject of energy resources and requirements are summarized. The subjects discussed include the following: (1) the long term energy situation, (2) the future outlook for energy and resources, (3) the international context, (4) the intermediate situation or energy crisis, (5) options for the long term situation, (6) transportation requirements, (7) current problems with the environment, and (8) long term environment impact factors. Author

N74-15697# Chase Manhattan Bank, New York. Energy Economics Div.

OUTLOOK FOR ENERGY IN THE UNITED STATES TO 1985

John G. Winger, Gerald D. Gunning, John D. Emerson, Richard C. Sparling, and Arthur J. Zraly Jun. 1972 56 p

Avail: NTIS HC $5.00

The energy requirements of various sectors of the U.S. economy are analyzed. Graphs and charts are developed to show previous energy consumption levels and predictions are made for future requirements to 1985. A comparison is made for the amounts of energy in the form of oil, natural gas, coal, water, and nuclear used by various geographical areas of the United States. Tables of data are prepared to show the potential sources of energy, both foreign and domestic. The economic impact of depending on foreign sources for resources is analyzed. Author

N74-15698# RAND Corp., Santa Monica, Calif.

RESIDENTIAL ENERGY USE: AN ECONOMETRIC ANALYSIS

Kent P. Anderson Oct. 1973 89 p refs

(Grant NSF GI-44)

(R-1297-NSF) Avail: NTIS HC $6.50

The demands of the residential sector of the U.S. economy for energy resources in the form of gas and electricity are discussed. Tables of data are presented to show the various predictions concerning the future price of electricity and natural gas to the consumer. Methods for predicting the future cost of energy resources are explained. The energy requirements for residential use are expressed in mathematical models and the results are tabulated for type of fuel, type of home, and specific use within the home. Author

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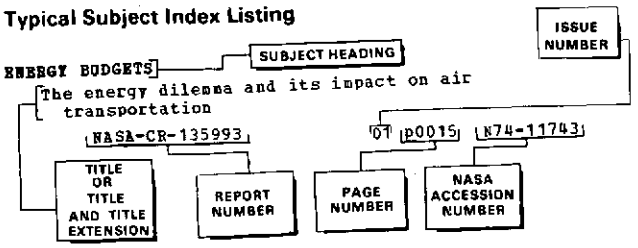

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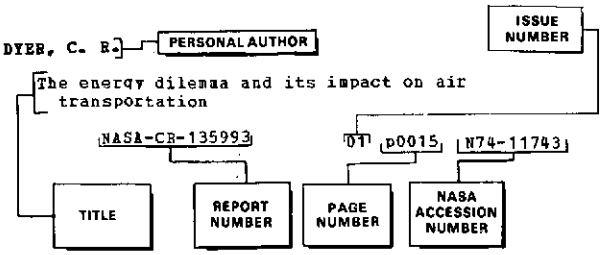

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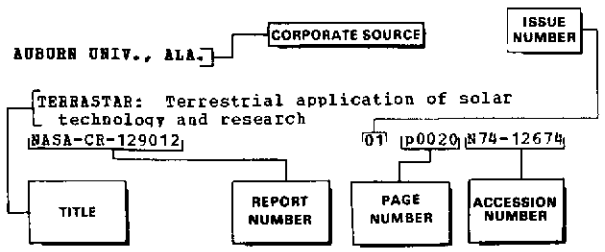
CORPORATE SOURCE INDEX

Typical Corporate Source Index Listing



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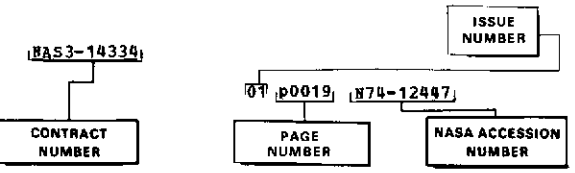
Typical Contract Number Index Listing



Listings in this index are arranged alphanumerically by contract number. Under each contract number, the accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order with the IAA accession numbers appearing first. The accession number denotes the number by which the citation is identified in either the *IAA* or *STAR* section. Preceding the accession number are the issue and page number in the particular supplement in which the citation may be found.

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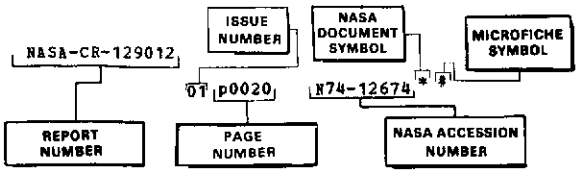

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